# *Stormwater Drainage Report*

**for**

## North Street Condominiums

**Northampton, MA**

~~November 11, 2008~~
*Revised 02/19/09*

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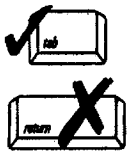
**Massachusetts Department of Environmental Protection**
Bureau of Resource Protection - Wetlands Program

# Checklist for Stormwater Report

## A. Introduction

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



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

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

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

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

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

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

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

**Massachusetts Department of Environmental Protection**
Bureau of Resource Protection - Wetlands Program

# Checklist for Stormwater Report

## B. Stormwater Checklist and Certification

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

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

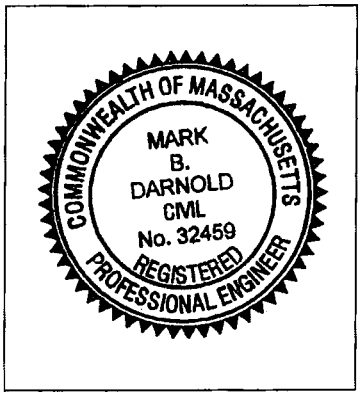
A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

## Registered Professional Engineer's Certification

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

↑ TO THE BEST OF MY KNOWLEDGE

Registered Professional Engineer Block and Signature




Signature and Date 2/11/09

## Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

# Checklist for Stormwater Report

## Checklist (continued)

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

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

**Standard 1: No New Untreated Discharges**

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

# Checklist for Stormwater Report

## Checklist (continued)

**Standard 2: Peak Rate Attenuation**

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

**Standard 3: Recharge**

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume **for its respective drainage area.**

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

☒ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☒ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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

# Checklist for Stormwater Report

## Checklist (continued)

**Standard 3: Recharge** (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

**Standard 4: Water Quality**

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

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

# Checklist for Stormwater Report

## Checklist (continued)

**Standard 4: Water Quality** (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

**Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs) Not Applicable – Proposed project site is not expected to yield high potential pollutant loads.**

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

**Standard 6: Critical Areas Not Applicable – The project site does not discharge to a critical area.**

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

# Checklist for Stormwater Report

## Checklist (continued)

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

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:**site with only "Hydrologic Group C" Soils**

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☒ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

# Checklist for Stormwater Report

## Checklist (continued)

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

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☒ The project is covered by a NPDES Construction General Permit and a copy of the **DRAFT** SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

**Standard 9: Operation and Maintenance Plan**

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

**Standard 10: Prohibition of Illicit Discharges**

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

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## Figures



## Appendices

## I. Introduction

The following report presents an analysis of the stormwater management system for the proposed development of 23 housing units located off of Northern Avenue in zoning district URB in Northampton, Massachusetts. The proposed development includes 23 new housing units and associated parking areas, driveways (approximately 1087 LF), and sidewalks, utilities, landscape features and stormwater management system. The total site area is approximately 6 acres of which approximately 2.44 acres will be disturbed by construction activities. The impervious area on site will increase by approximately 1.10 acres due to the new development and the stormwater management system has been designed to minimize proposed peak flows to reduce or match existing flows off the site. Mechanisms to reduce runoff and treat water quality include a rain garden, a proprietary treatment chamber, infiltration trench, dry wells, deep sump hooded catch basins, and a detention basin.

## II. Site Terrain and Soils

The project site is comprised of gradual sloping terrain, which generally drains toward the wetlands on the west part of the site.

The USDA Soil Survey of Hampshire County, Massachusetts, Central Part report classifies the site soils as (see attached soil map):

- **(Ra) Raynham Silt Loam**

  Hydrologic Group: C
  Flood Risk: None
  Depth to Water Table: 0.5'-2.0'
  Depth to Bedrock: >60"

- **(Au) Amostown-Windsor Silty Substratum**

  Hydrologic Group: C
  Flood Risk: None
  Depth to Water Table: 1.5'-3.0'
  Depth to Bedrock: >60"

- **(Ud) Udorthents Smooth**

  Soil formed by cutting or filling developed area.
  Reference pedon not given.
  *Assumed* Hydrologic Group: C

A series of test pits were conducted on site to determine subsurface conditions. The purpose of the test pits was to evaluate the site for the existence of ledge, the ability of the site to support stormwater drainage components, and for groundwater information. In general, the test pits confirmed the USDA Soil Survey findings for the site as ground water is generally very high throughout the site, thereby reducing the potential areas where infiltration would be feasible. The test pit logs are attached in Appendix B.

*Note: Additional test pits will be performed on 3/9/09 within all proposed infiltration and detention structures to confirm the soils and groundwater at the exact location of the proposed BMPs.*

## III. Existing Conditions

The existing site includes one drainage area: E-1. The existing drainage area boundary is depicted on the Pre-Development Drainage Area Plan (Figure 1). The overall curve number (CN) in existing conditions is 74. The control point to determine peak flow in existing conditions is the stream located on the property line west of the site shown on Figure 1 as E-CP. The following is a brief description of the drainage area:

E-1
E-1 is approximately 7.84 acres in size (approximately 0.115 acres of impervious area) and contains existing houses, pavement, grass, wooded areas, and a large wetland area on the west part of the site. Runoff flows overland in a southwestern direction through the wetlands and to the stream located southwest of the site.

## IV. Proposed Conditions

The stormwater management system in proposed conditions has been designed to treat and reduce runoff on site. The proposed site contains five drainage areas: P-1, P-2, P-3, P-4, and P-5 (See Figure 2) and the overall curve number (CN) in proposed conditions is 79. The control point to determine peak flow in proposed conditions is the stream located on the property line located west of the site shown on Figure 2 as P-CP. The following is a brief description of each drainage area:

P-1
P-1 is approximately 5.85 acres in size and contains the northwestern area of the site consisting of all of the wetland area, grass and wooded areas, and new roof and pavement. The drainage follows a similar pattern as in existing conditions. It flows overland in a southwestern direction through the wetlands and to the stream located southwest of the site. The runoff from the back of the new roof areas located within P-1 is directed to dry wells where the water is infiltrated into the ground. These dry wells are designed to be very shallow (approximately one foot

in depth) due to high groundwater throughout the site. The dry wells are designed with an overflow outlet that allows roof water to sheet flow overland toward the wetlands as it does in existing conditions in larger storms.

P-2
P-2 is approximately 0.27 acres in size and is located in the central eastern portion of the site. It contains the front portion of the roof areas from units 15-20 as well as a portion of the new road and grassed areas. The runoff from this area is directed to a rain garden which has been sized to clean and remove pollutants from the stormwater runoff prior to discharging toward the wetlands.

P-3
P-3 is approximately 0.40 acres in size and is located in the eastern part of the site. It contains new pavement, grass, and existing wooded areas. Runoff from this area is directed to an infiltration trench which allows water to be recharged into the ground in smaller storms. In larger storms the infiltration trench is designed to overflow into the downstream pipe network which discharges into the detention basin at the south area of the site.

P-4
P-4 is approximately 1.02 acres in size and is located in the southern part of the site. It contains the majority of the new pavement and the front roof areas from units 1-5 and 11-14. It also contains existing grass and wooded areas along the property line. Runoff is directed into deep sump hooded catch basins, which flow into a stormwater treatment chamber (STC 1200) which removes pollutants prior to discharging into the detention basin located behind units 9 and 10.

P-5
P-5 is approximately 0.30 acres in size and is located in the southwest corner of the site. It contains roof areas from units 4-10, grass and the detention basin. Runoff from the roof areas flow into dry wells designed to infiltrate the water into the ground prior to entering the detention basin as the runoff from the other areas do.

## V. Calculations and Design

Drainage calculations were performed on Hydrocad Stormwater Modeling System version 8.0 using Soil Conservation Service (SCS) TR-20 methodology. The SCS method is based on rainfall observations, which were used to develop the Intensity-Duration-Frequency relationship, or IDF curve. The mass curve is a dimensionless distribution of rainfall over time, which indicates the fraction of the rainfall event that occurs at a given time within a 24-hour precipitation event. This synthetic distribution develops peak rates for storms of varying duration and intensities. The SCS distribution provides a cumulative rainfall at any point in

time and allows volume dependent routing runoff calculations to occur. These calculations are included in the appendices.

The watershed boundaries for calculation purposes are divided according to the proposed site grading and the natural limits of the drainage areas. The curve numbers (CNs) and times of concentration for the existing and proposed subcatchment areas are based on the soil type and the existing and proposed cover conditions at the site. The soil hydrologic group assumed for the site is noted in Figure 3. Watershed subcatchment areas, runoff coefficients and watercourse slopes are based on survey information.

Calculations were performed for the 2-, 10-, and 100-year frequency storms under existing and proposed conditions. The results of the calculations are presented in Table 1 on the following page. Appendix A presents the Hydrocad calculations.

Flow Rates & Water Quantity

In the post development conditions the runoff from the proposed site will be routed to a detention basin located in the south area of the site. The proposed detention basin is composed of both surface and underground storage. There is a pipe and header system connected to the surface detention basin which provides additional storage. The basin will attenuate peak flows up to the 100-Year Storm in proposed conditions through the use of an outlet control structure. Stormwater will be discharged to the wetlands as runoff does in existing conditions. In addition to the detention basin, 9 infiltration systems are proposed (1 infiltration trench and 8 dry wells) which will provide significant stormwater attenuation (through exfiltration); however these systems were not included in the hydrocad calculations in order to provide a more conservative runoff quantity calculation. Table 1 on the following page presents the comparison of flow rates and water quantity at both existing and proposed control points based solely on the detention basin's attenuation capacity.

**Table 1 Peak Flow and Volume Summary**

| Condition & Point of Analysis | 2-Year Storm 3.00" | | 10-Year Storm 4.50" | | 100-Year Storm 6.50" | |
|---|---|---|---|---|---|---|
| | Peak Flow Rate(cfs) | Volume (acre-ft) | Peak Flow Rate(cfs) | Volume (acre-ft) | Peak Flow Rate(cfs) | Volume (acre-ft) |
| Existing – Control Pt. (E-CP)* | *4.71* | *0.569* | *11.07* | *1.256* | *21.00* | *2.346* |
| Proposed – Control Pt. (P-CP)* | *4.67* | *0.667* | *11.01* | *1.408* | *20.97* | *2.552* |

**Names in parentheses refer to HydroCad model and calculations.*

## VI. MADEP Stormwater Standards Compliance

The following section details how the project will meet DEP Stormwater Management Policy's ten stormwater management standards.

Standard 1 - Untreated Stormwater
The proposed stormwater system is designed to treat the new point source discharge prior to flowing to the resource area. All new outlets are outfitted with flared ends and erosion protection to prevent any erosion from occurring in the area. See Appendix C for TSS removal summary.

Standard 2 - Post-Development Peak Discharge Rates
The stormwater system is designed so that post-development peak discharge rates *are less than* pre-development peak discharge rates leaving the site. In order to reduce runoff rates in proposed conditions a detention basin with an outlet control structures is proposed. Note that although 9 infiltration systems are proposed, none are not included in the runoff calculations in order to maintain a more conservative peak discharge rate. Refer to Table 1 Peak Flow and Volume Summary and Appendix A for HydroCAD calculations.

Standard 3 - Recharge to Groundwater
The proposed site has designed to recharge groundwater to the maximum extent practicable in proposed conditions. The entire site consists of hydrologic group "C" soils and there is very high groundwater throughout most of the site (see Appendix B for test pit logs). The soil conditions caused limitations for infiltration on many areas of the site because the required 2 feet separation from groundwater could not be met. Wherever possible, infiltration has been proposed. The proposed infiltration trench located on the east side of the site has been designed to recharge the impervious runoff located within drainage area P-3. All of the new unit's roofs are connected to a shallow dry well system designed to recharge roof runoff into the ground. Due to restrictions of the site terrain and soil conditions, not all of the impervious area could be directed to an infiltration system, therefore all 8 of the dry well systems are oversized to maximize the amount of infiltration on site. They are designed to hold at least twice the required recharge volume and still drawdown within 72 hours in order to meet Standard 3 to the maximum extent practicable (see Appendix D for recharge calculations).

Standard 4 – Water Quality
The proposed stormwater management system has been designed to remove the average annual Total Suspended Solids (TSS) load equal to or in excess of 80% for the proposed site conditions (see Appendix C for calculations). There are 3 treatment chains proposed:

*Treatment Train 1(total of 90% TSS removed)*
The first treatment chain contains the roof areas and paved impervious areas within P-2. The runoff is directed through a pre-treatment system consisting of a stone diaphragm and grassed area which discharges into a rain garden which achieves a total annual TSS removal rate of approximately 90%. The water quality basin has been designed to hold a larger volume of water (369cf) than the water quality volume required (354cf) for the impervious area directed to it.

*Treatment Train 2(total of 83% TSS removed)*
The second treatment chain contains the impervious areas from P-3 and P-4 which is approximately 0.58 acres. The runoff is directed into deep sump hooded catch basins (25% TSS removal) and then to a proprietary treatment chamber (*Stormceptor STC 1200, 77% TSS removal) which achieves a total TSS removal rate of approximately 83%.

**Note: The stormwater treatment chamber has been sized based on MASTEP test evaluations. The attached table in appendix C displays MASTEP evaluated TSS removal rates based on the impervious area directed to the system.*

*Treatment Train 3(total of 80% TSS removed)*
The third treatment chain contains a portion or all of the roof areas from all of the units. Where possible, the roof area is directed into a shallow dry well sized to hold the water quality volume and achieve a total annual TSS removal rate of approximately 80%. Although each of roof areas are not hydraulically connected, they are considered to be within the same treatment chain as they all utilize the same BMP (dry well). See Appendix C for water quality and BMP sizing calculations.

In addition to removal of TSS, a Long Term Pollution Prevention Plan has been created to maintain a clean site and ensure that all BMPs are functioning to their maximum potential. See Appendix F for Long Term Pollution Prevention Plan.

Standard 5 - Higher Potential Pollutant Loads
The proposed project is not expected to yield high potential pollutant loads.

Standard 6 - Protection of Critical Areas
The project site does not discharge to critical areas as defined in MA DEP Stormwater Policy Handbook.

Standard 7 - Redevelopment Projects
The redevelopment of previously developed site standard is not applicable for this project.

Standard 8 - Erosion/Sediment Control
Erosion and sediment controls have been incorporated into the project design to prevent erosion, control sediments, and stabilized exposed soils during construction and land disturbance. See Appendix G for Construction Period Pollution Prevention and Erosion Sedimentation Control.

Standard 9 - Operation/Maintenance Plan
An Operation and Maintenance Plan for the proposed project is included in Appendix E. It includes general controls for construction and long term maintenance of the stormwater management system.

Standard 10 – Prohibition of Illicit Discharges
No Illicit Discharge Compliance Statement is included with this report however one will be submitted prior to the discharge of any stormwater to post-construction BMPs.

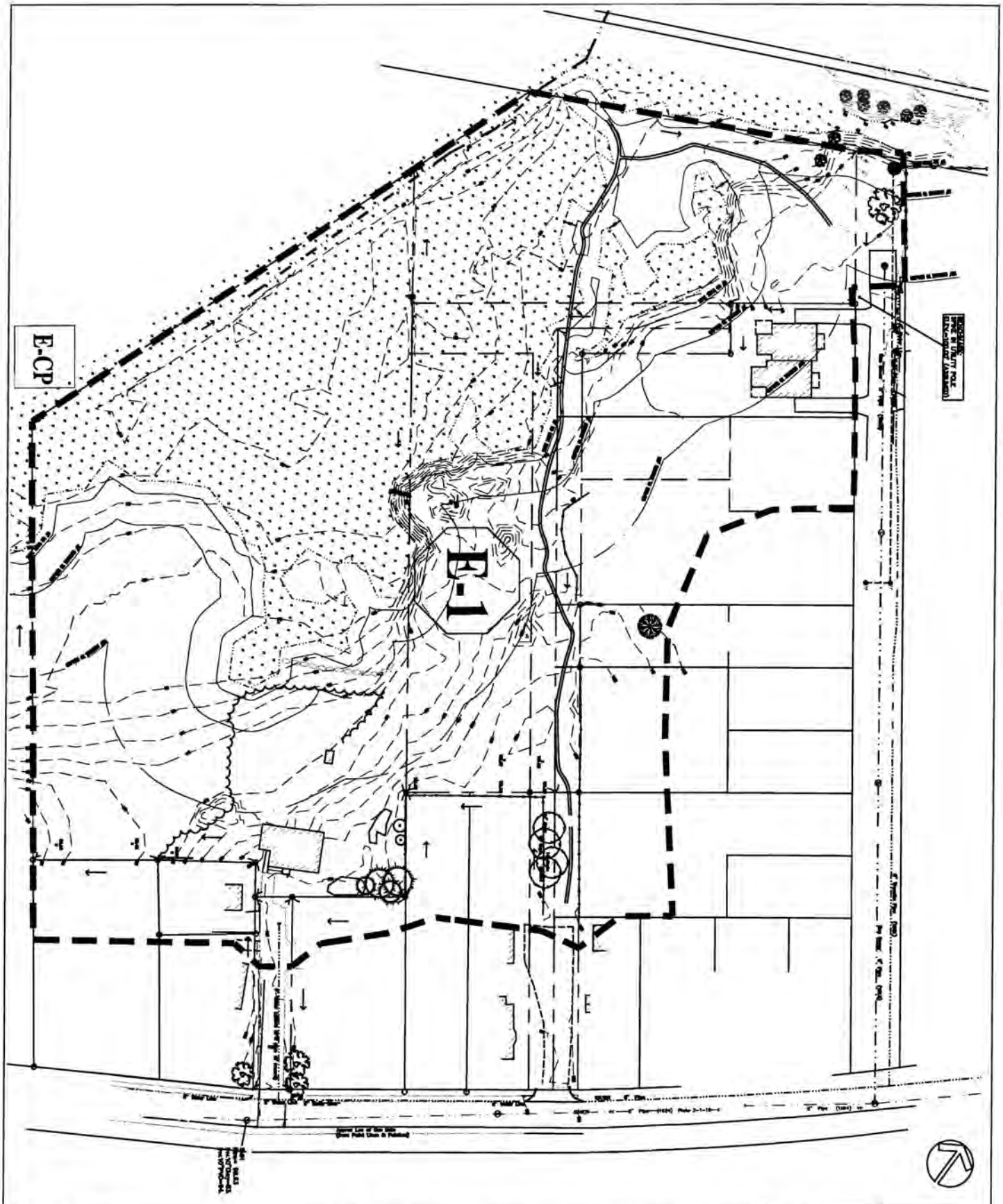
## VII. Summary

The impervious area from existing to proposed conditions will increase by approximately 1.10 acres from the new roadway and housing units. The proposed stormwater management system is designed to maintain or reduce the peak flow rates in proposed conditions for the 2-, 10-, and 100-year storm frequencies. Special care has been taken to treat runoff with a series of best management practices to ensure water quality and annual TSS removal rates equal to or in excess of 80%. These methods include deep sump hooded catch basins, a rain garden, dry wells, and a stormwater treatment chamber.

## VIII. References

United States Department of Agriculture. 1998. Soil Survey of Hampshire County (Central Part), Massachusetts.

# Figures




The Berkshire Design Group, Inc.
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Figure Title:
Pre-Developement Drainage Area Map

North Street Condominiums
NORTHAMPTON MASSACHUSETTS

Reference:

Date: 02/19/09
Scale: 1"=100'

Figure Number:
1

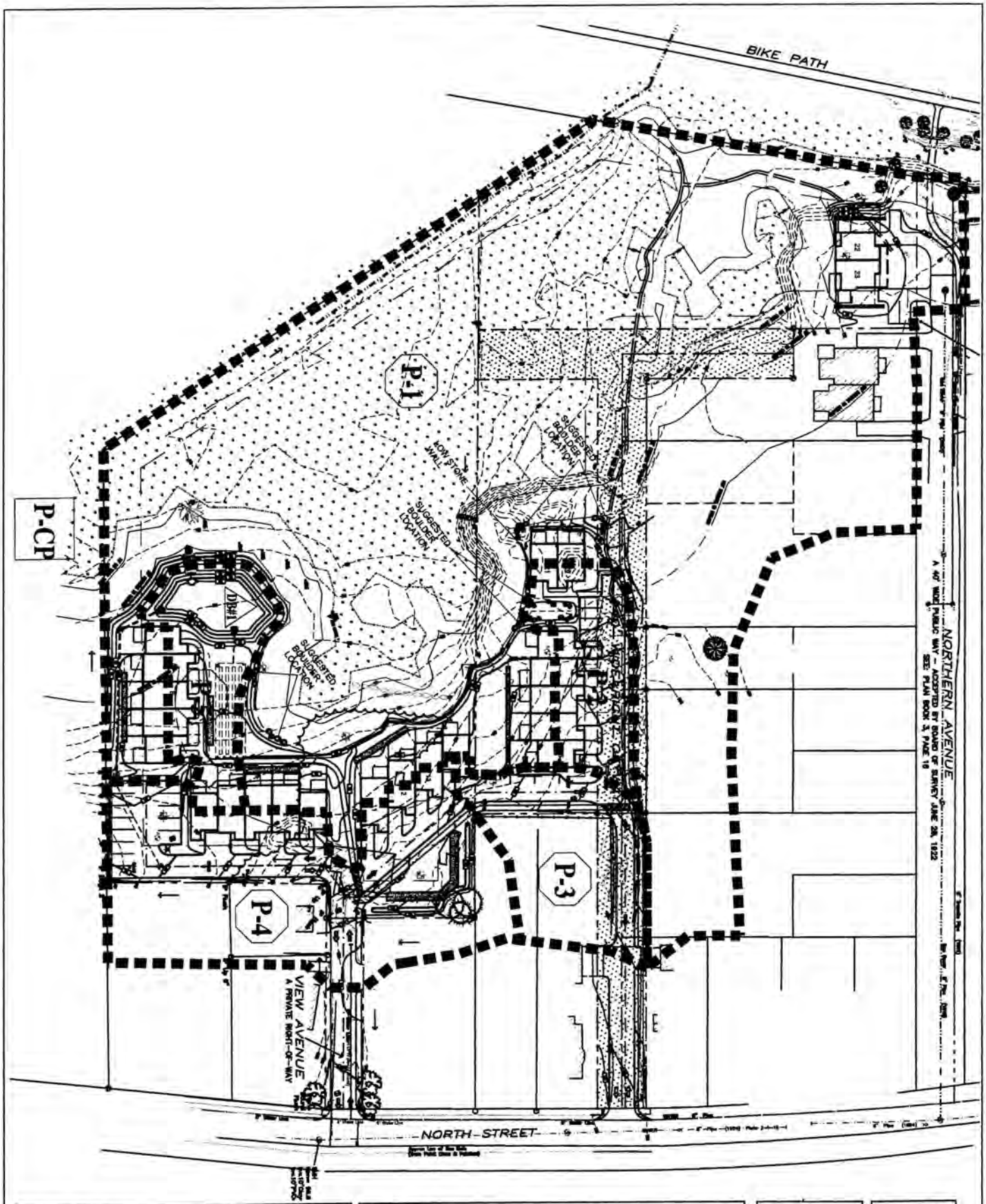


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Figure Title:
Post-Developement Drainage Area Map

North Street Condominiums
NORTHAMPTON MASSACHUSETTS

Reference:

Date: 02/19/09

Scale: 1"=100'

Figure Number: 2

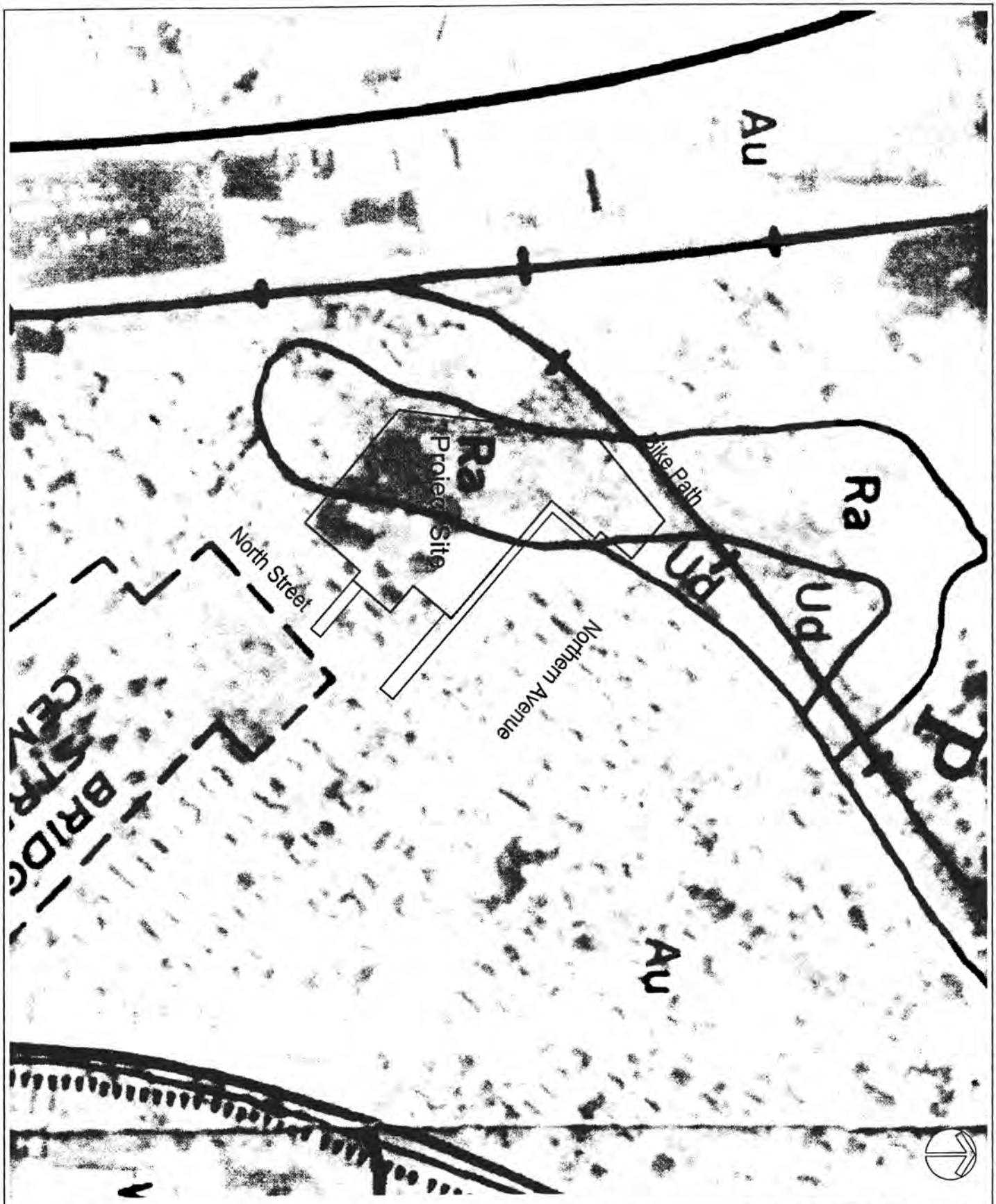


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Figure Title:
USDA Soils Map

North Street Condominiums
NORTHAMPTON MASSACHUSETTS

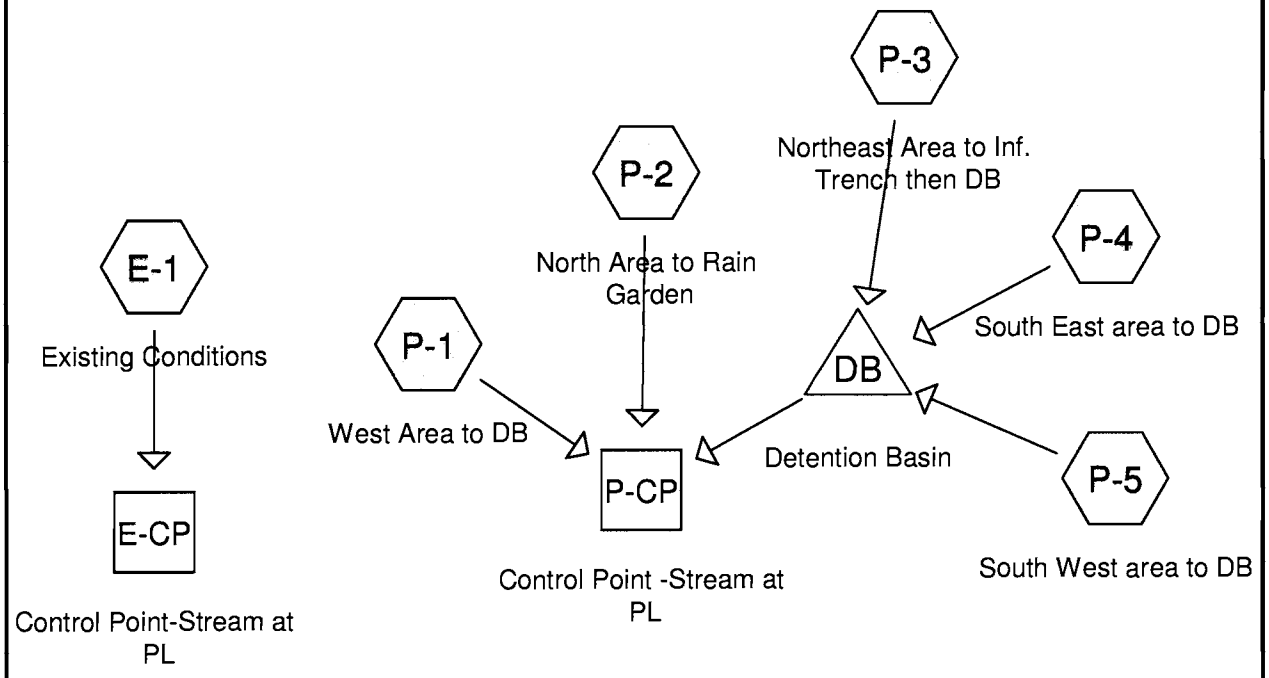
Reference:

Date: 02/19/09

Scale: 1"=300'

Figure Number:
3

# Appendix A – Pre- and Post Development Hydrologic Calculations




Subcat Reach Pond Link

**Drainage Diagram for Northern Avenue Housing-Active**
Prepared by The Berkshire Design Group 3/5/2009

## Area Listing (selected nodes)

| Area (acres) | CN | Description (subcats) |
|---|---|---|
| 5.720 | 70 | Woods, Good, HSG C (E-1,P-1,P-3,P-4) |
| 3.961 | 74 | >75% Grass cover, Good, HSG C (E-1,P-1,P-2,P-3,P-4,P-5) |
| 4.416 | 78 | Wetlands (E-1,P-1) |
| 0.058 | 90 | Patio (P-1,P-5) |
| 0.125 | 98 | Basin (P-2,P-5) |
| 1.390 | 98 | Paved parking & roofs (E-1,P-1,P-2,P-3,P-4,P-5) |
| 15.671 | | |

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E-1: Existing Conditions** Runoff Area=341,304 sf Runoff Depth>0.87"
Flow Length=570' Tc=23.1 min CN=74 Runoff=4.71 cfs 0.569 af

**Subcatchment P-1: West Area to DB** Runoff Area=254,932 sf Runoff Depth>0.98"
Flow Length=351' Tc=19.8 min CN=76 Runoff=4.30 cfs 0.476 af

**Subcatchment P-2: North Area to Rain Garden** Runoff Area=11,802 sf Runoff Depth>2.21"
Tc=5.0 min CN=93 Runoff=0.69 cfs 0.050 af

**Subcatchment P-3: Northeast Area to Inf. Trench then DB** Runoff Area=17,233 sf Runoff Depth>1.34"
Tc=5.0 min CN=82 Runoff=0.62 cfs 0.044 af

**Subcatchment P-4: South East area to DB** Runoff Area=44,439 sf Runoff Depth>1.47"
Flow Length=160' Tc=15.0 min CN=84 Runoff=1.33 cfs 0.125 af

**Subcatchment P-5: South West area to DB** Runoff Area=12,898 sf Runoff Depth>1.94"
Tc=5.0 min CN=90 Runoff=0.67 cfs 0.048 af

**Reach E-CP: Control Point-Stream at PL** Inflow=4.71 cfs 0.569 af
Outflow=4.71 cfs 0.569 af

**Reach P-CP: Control Point -Stream at PL** Inflow=4.67 cfs 0.667 af
Outflow=4.67 cfs 0.667 af

**Pond DB: Detention Basin** Peak Elev=90.37' Storage=5,145 cf Inflow=2.22 cfs 0.217 af
Outflow=0.23 cfs 0.141 af

**Total Runoff Area = 15.671 ac Runoff Volume = 1.312 af Average Runoff Depth = 1.00"**
**90.33% Pervious Area = 14.155 ac 9.67% Impervious Area = 1.516 ac**

## Subcatchment E-1: Existing Conditions

Runoff = 4.71 cfs @ 12.36 hrs, Volume= 0.569 af, Depth> 0.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.95"

| Area (sf) | CN | Description |
|---|---|---|
| 96,180 | 78 | Wetlands |
| 93,521 | 74 | >75% Grass cover, Good, HSG C |
| 6,300 | 98 | Paved parking & roofs |
| 145,303 | 70 | Woods, Good, HSG C |
| 341,304 | 74 | Weighted Average |
| 335,004 | | Pervious Area |
| 6,300 | | Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.7 | 60 | 0.0200 | 0.15 | | **Sheet Flow,** Grass: Short n= 0.150 P2= 3.00" |
| 4.8 | 280 | 0.0375 | 0.97 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 11.6 | 230 | 0.0174 | 0.33 | | **Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps |
| 23.1 | 570 | Total | | | |

## Subcatchment P-1: West Area to DB

Runoff = 4.30 cfs @ 12.30 hrs, Volume= 0.476 af, Depth> 0.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.95"

| Area (sf) | CN | Description |
|---|---|---|
| 96,180 | 78 | Wetlands |
| 49,740 | 74 | >75% Grass cover, Good, HSG C |
| 16,732 | 98 | Paved parking & roofs |
| 90,000 | 70 | Woods, Good, HSG C |
| 2,280 | 90 | Patio |
| 254,932 | 76 | Weighted Average |
| 238,200 | | Pervious Area |
| 16,732 | | Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.4 | 89 | 0.0250 | 0.18 | | **Sheet Flow,** Grass: Short n= 0.150 P2= 3.00" |
| 1.5 | 62 | 0.0200 | 0.71 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 9.9 | 200 | 0.0180 | 0.34 | | **Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps |
| 19.8 | 351 | Total | | | |

## Subcatchment P-2: North Area to Rain Garden

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

Runoff = 0.69 cfs @ 12.07 hrs, Volume= 0.050 af, Depth> 2.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.95"

| Area (sf) | CN | Description |
|---|---|---|
| 2,650 | 74 | >75% Grass cover, Good, HSG C |
| 8,494 | 98 | Paved parking & roofs |
| 658 | 98 | Basin |
| 11,802 | 93 | Weighted Average |
| 2,650 | | Pervious Area |
| 9,152 | | Impervious Area |

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

## Subcatchment P-3: Northeast Area to Inf. Trench then DB

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

Runoff = 0.62 cfs @ 12.08 hrs, Volume= 0.044 af, Depth> 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.95"

| Area (sf) | CN | Description |
|---|---|---|
| 8,865 | 74 | >75% Grass cover, Good, HSG C |
| 5,824 | 98 | Paved parking & roofs |
| 2,544 | 70 | Woods, Good, HSG C |
| 17,233 | 82 | Weighted Average |
| 11,409 | | Pervious Area |
| 5,824 | | Impervious Area |

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

## Subcatchment P-4: South East area to DB

Runoff = 1.33 cfs @ 12.21 hrs, Volume= 0.125 af, Depth> 1.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.95"

| Area (sf) | CN | Description |
|---|---|---|
| 13,348 | 74 | >75% Grass cover, Good, HSG C |
| 19,769 | 98 | Paved parking & roofs |
| 11,322 | 70 | Woods, Good, HSG C |
| 44,439 | 84 | Weighted Average |
| 24,670 | | Pervious Area |
| 19,769 | | Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.7 | 100 | 0.0200 | 0.11 | | **Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00" |
| 0.3 | 60 | 0.0233 | 3.10 | | **Shallow Concentrated Flow,** Paved Kv= 20.3 fps |
| 15.0 | 160 | Total | | | |

## Subcatchment P-5: South West area to DB

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

Runoff = 0.67 cfs @ 12.07 hrs, Volume= 0.048 af, Depth> 1.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=2.95"

| Area (sf) | CN | Description |
|---|---|---|
| 4,418 | 74 | >75% Grass cover, Good, HSG C |
| 3,440 | 98 | Paved parking & roofs |
| 4,800 | 98 | Basin |
| 240 | 90 | Patio |
| 12,898 | 90 | Weighted Average |
| 4,658 | | Pervious Area |
| 8,240 | | Impervious Area |

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

## Reach E-CP: Control Point-Stream at PL

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

Inflow Area = 7.835 ac, Inflow Depth > 0.87" for 2-Year event
Inflow = 4.71 cfs @ 12.36 hrs, Volume= 0.569 af
Outflow = 4.71 cfs @ 12.36 hrs, Volume= 0.569 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

## Reach P-CP: Control Point -Stream at PL

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

Inflow Area = 7.835 ac, Inflow Depth > 1.02" for 2-Year event
Inflow = 4.67 cfs @ 12.29 hrs, Volume= 0.667 af
Outflow = 4.67 cfs @ 12.29 hrs, Volume= 0.667 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

## Pond DB: Detention Basin

Inflow Area = 1.712 ac, Inflow Depth > 1.52" for 2-Year event
Inflow = 2.22 cfs @ 12.12 hrs, Volume= 0.217 af
Outflow = 0.23 cfs @ 13.74 hrs, Volume= 0.141 af, Atten= 90%, Lag= 97.2 min
Primary = 0.23 cfs @ 13.74 hrs, Volume= 0.141 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 90.37' @ 13.74 hrs Surf.Area= 4,607 sf Storage= 5,145 cf

Plug-Flow detention time= 293.6 min calculated for 0.141 af (65% of inflow)
Center-of-Mass det. time= 190.0 min ( 1,022.9 - 832.8 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 89.00' | 11,271 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |
| #2 | 89.00' | 94 cf | **24.0"D x 30.00'L 24" Inlet Pipe (from DMH to Basin) S= 0.0066 '/'** |
| #3 | 89.20' | 352 cf | **24.0"D x 112.00'L 24" Pipe (from SWTC to DMH) S= 0.0050 '/'** |
| #4 | 89.00' | 2,474 cf | **36.0"D x 70.00'L 36" Lateral Pipe x 5** x 5 |
| #5 | 89.00' | 339 cf | **36.0"D x 24.00'L 36" Header Pipe x 2** x 2 |
| | | 14,531 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 89.00 | 2,243 | 0 | 0 |
| 90.00 | 2,885 | 2,564 | 2,564 |
| 91.00 | 3,575 | 3,230 | 5,794 |
| 92.00 | 4,391 | 3,983 | 9,777 |
| 92.33 | 4,666 | 1,494 | 11,271 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 88.90' | **12.0" x 18.0' long Culvert** CPP, square edge headwall, Ke= 0.500<br>Outlet Invert= 88.75' S= 0.0083 '/' Cc= 0.900<br>n= 0.010 PVC, smooth interior |
| #2 | Device 1 | 90.20' | **10.0" Vert. Orifice/Grate** C= 0.600 |
| #3 | Device 1 | 89.00' | **2.0" Vert. Orifice/Grate** C= 0.600 |
| #4 | Primary | 91.67' | **6.0' long x 2.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50<br>Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32 |

**Primary OutFlow** Max=0.23 cfs @ 13.74 hrs HW=90.37' (Free Discharge)
- **1=Culvert** (Passes 0.23 cfs of 3.66 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.11 cfs @ 1.40 fps)
  - **3=Orifice/Grate** (Orifice Controls 0.12 cfs @ 5.46 fps)
- **4=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E-1: Existing Conditions** Runoff Area=341,304 sf Runoff Depth>1.92"
Flow Length=570' Tc=23.1 min CN=74 Runoff=11.07 cfs 1.256 af

**Subcatchment P-1: West Area to DB** Runoff Area=254,932 sf Runoff Depth>2.08"
Flow Length=351' Tc=19.8 min CN=76 Runoff=9.59 cfs 1.015 af

**Subcatchment P-2: North Area to Rain Garden** Runoff Area=11,802 sf Runoff Depth>3.66"
Tc=5.0 min CN=93 Runoff=1.11 cfs 0.083 af

**Subcatchment P-3: Northeast Area to Inf. Trench then DB** Runoff Area=17,233 sf Runoff Depth>2.59"
Tc=5.0 min CN=82 Runoff=1.20 cfs 0.085 af

**Subcatchment P-4: South East area to DB** Runoff Area=44,439 sf Runoff Depth>2.76"
Flow Length=160' Tc=15.0 min CN=84 Runoff=2.49 cfs 0.235 af

**Subcatchment P-5: South West area to DB** Runoff Area=12,898 sf Runoff Depth>3.35"
Tc=5.0 min CN=90 Runoff=1.14 cfs 0.083 af

**Reach E-CP: Control Point-Stream at PL** Inflow=11.07 cfs 1.256 af
Outflow=11.07 cfs 1.256 af

**Reach P-CP: Control Point -Stream at PL** Inflow=11.01 cfs 1.408 af
Outflow=11.01 cfs 1.408 af

**Pond DB: Detention Basin** Peak Elev=90.89' Storage=7,605 cf Inflow=4.14 cfs 0.403 af
Outflow=1.50 cfs 0.310 af

**Total Runoff Area = 15.671 ac Runoff Volume = 2.757 af Average Runoff Depth = 2.11"**
**90.33% Pervious Area = 14.155 ac 9.67% Impervious Area = 1.516 ac**

## Subcatchment E-1: Existing Conditions

Runoff = 11.07 cfs @ 12.33 hrs, Volume= 1.256 af, Depth> 1.92"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.45"

| Area (sf) | CN | Description |
|---|---|---|
| 96,180 | 78 | Wetlands |
| 93,521 | 74 | >75% Grass cover, Good, HSG C |
| 6,300 | 98 | Paved parking & roofs |
| 145,303 | 70 | Woods, Good, HSG C |
| 341,304 | 74 | Weighted Average |
| 335,004 | | Pervious Area |
| 6,300 | | Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.7 | 60 | 0.0200 | 0.15 | | **Sheet Flow,** Grass: Short n= 0.150 P2= 3.00" |
| 4.8 | 280 | 0.0375 | 0.97 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 11.6 | 230 | 0.0174 | 0.33 | | **Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps |
| 23.1 | 570 | Total | | | |

## Subcatchment P-1: West Area to DB

Runoff = 9.59 cfs @ 12.28 hrs, Volume= 1.015 af, Depth> 2.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.45"

| Area (sf) | CN | Description |
|---|---|---|
| 96,180 | 78 | Wetlands |
| 49,740 | 74 | >75% Grass cover, Good, HSG C |
| 16,732 | 98 | Paved parking & roofs |
| 90,000 | 70 | Woods, Good, HSG C |
| 2,280 | 90 | Patio |
| 254,932 | 76 | Weighted Average |
| 238,200 | | Pervious Area |
| 16,732 | | Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.4 | 89 | 0.0250 | 0.18 | | **Sheet Flow,** Grass: Short n= 0.150 P2= 3.00" |
| 1.5 | 62 | 0.0200 | 0.71 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 9.9 | 200 | 0.0180 | 0.34 | | **Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps |
| 19.8 | 351 | Total | | | |

## Subcatchment P-2: North Area to Rain Garden

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

Runoff = 1.11 cfs @ 12.07 hrs, Volume= 0.083 af, Depth> 3.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.45"

| Area (sf) | CN | Description |
|---|---|---|
| 2,650 | 74 | >75% Grass cover, Good, HSG C |
| 8,494 | 98 | Paved parking & roofs |
| 658 | 98 | Basin |
| 11,802 | 93 | Weighted Average |
| 2,650 | | Pervious Area |
| 9,152 | | Impervious Area |

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

## Subcatchment P-3: Northeast Area to Inf. Trench then DB

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

Runoff = 1.20 cfs @ 12.08 hrs, Volume= 0.085 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.45"

| Area (sf) | CN | Description |
|---|---|---|
| 8,865 | 74 | >75% Grass cover, Good, HSG C |
| 5,824 | 98 | Paved parking & roofs |
| 2,544 | 70 | Woods, Good, HSG C |
| 17,233 | 82 | Weighted Average |
| 11,409 | | Pervious Area |
| 5,824 | | Impervious Area |

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

## Subcatchment P-4: South East area to DB

Runoff = 2.49 cfs @ 12.21 hrs, Volume= 0.235 af, Depth> 2.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.45"

| Area (sf) | CN | Description |
|---|---|---|
| 13,348 | 74 | >75% Grass cover, Good, HSG C |
| 19,769 | 98 | Paved parking & roofs |
| 11,322 | 70 | Woods, Good, HSG C |
| 44,439 | 84 | Weighted Average |
| 24,670 | | Pervious Area |
| 19,769 | | Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.7 | 100 | 0.0200 | 0.11 | | **Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00" |
| 0.3 | 60 | 0.0233 | 3.10 | | **Shallow Concentrated Flow,** Paved Kv= 20.3 fps |
| 15.0 | 160 | Total | | | |

## Subcatchment P-5: South West area to DB

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

Runoff = 1.14 cfs @ 12.07 hrs, Volume= 0.083 af, Depth> 3.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.45"

| Area (sf) | CN | Description |
|---|---|---|
| 4,418 | 74 | >75% Grass cover, Good, HSG C |
| 3,440 | 98 | Paved parking & roofs |
| 4,800 | 98 | Basin |
| 240 | 90 | Patio |
| 12,898 | 90 | Weighted Average |
| 4,658 | | Pervious Area |
| 8,240 | | Impervious Area |

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

## Reach E-CP: Control Point-Stream at PL

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

Inflow Area = 7.835 ac, Inflow Depth > 1.92" for 10-Year event
Inflow = 11.07 cfs @ 12.33 hrs, Volume= 1.256 af
Outflow = 11.07 cfs @ 12.33 hrs, Volume= 1.256 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

## Reach P-CP: Control Point -Stream at PL

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

Inflow Area = 7.835 ac, Inflow Depth > 2.16" for 10-Year event
Inflow = 11.01 cfs @ 12.30 hrs, Volume= 1.408 af
Outflow = 11.01 cfs @ 12.30 hrs, Volume= 1.408 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

## Pond DB: Detention Basin

Inflow Area = 1.712 ac, Inflow Depth > 2.82" for 10-Year event
Inflow = 4.14 cfs @ 12.11 hrs, Volume= 0.403 af
Outflow = 1.50 cfs @ 12.55 hrs, Volume= 0.310 af, Atten= 64%, Lag= 26.0 min
Primary = 1.50 cfs @ 12.55 hrs, Volume= 0.310 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 90.89' @ 12.55 hrs Surf.Area= 4,887 sf Storage= 7,605 cf

Plug-Flow detention time= 177.8 min calculated for 0.310 af (77% of inflow)
Center-of-Mass det. time= 95.7 min ( 911.4 - 815.7 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 89.00' | 11,271 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |
| #2 | 89.00' | 94 cf | **24.0"D x 30.00'L 24" Inlet Pipe (from DMH to Basin) S= 0.0066 '/'** |
| #3 | 89.20' | 352 cf | **24.0"D x 112.00'L 24" Pipe (from SWTC to DMH) S= 0.0050 '/'** |
| #4 | 89.00' | 2,474 cf | **36.0"D x 70.00'L 36" Lateral Pipe x 5** x 5 |
| #5 | 89.00' | 339 cf | **36.0"D x 24.00'L 36" Header Pipe x 2** x 2 |
| | | 14,531 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 89.00 | 2,243 | 0 | 0 |
| 90.00 | 2,885 | 2,564 | 2,564 |
| 91.00 | 3,575 | 3,230 | 5,794 |
| 92.00 | 4,391 | 3,983 | 9,777 |
| 92.33 | 4,666 | 1,494 | 11,271 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 88.90' | **12.0" x 18.0' long Culvert** CPP, square edge headwall, Ke= 0.500<br>Outlet Invert= 88.75' S= 0.0083 '/' Cc= 0.900<br>n= 0.010 PVC, smooth interior |
| #2 | Device 1 | 90.20' | **10.0" Vert. Orifice/Grate** C= 0.600 |
| #3 | Device 1 | 89.00' | **2.0" Vert. Orifice/Grate** C= 0.600 |
| #4 | Primary | 91.67' | **6.0' long x 2.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50<br>Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32 |

**Primary OutFlow** Max=1.49 cfs @ 12.55 hrs HW=90.89' (Free Discharge)
- **1=Culvert** (Passes 1.49 cfs of 4.61 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 1.35 cfs @ 2.82 fps)
  - **3=Orifice/Grate** (Orifice Controls 0.14 cfs @ 6.46 fps)
- **4=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E-1: Existing Conditions** Runoff Area=341,304 sf Runoff Depth>3.59"
Flow Length=570' Tc=23.1 min CN=74 Runoff=21.00 cfs 2.346 af

**Subcatchment P-1: West Area to DB** Runoff Area=254,932 sf Runoff Depth>3.80"
Flow Length=351' Tc=19.8 min CN=76 Runoff=17.69 cfs 1.854 af

**Subcatchment P-2: North Area to Rain Garden** Runoff Area=11,802 sf Runoff Depth>5.67"
Tc=5.0 min CN=93 Runoff=1.68 cfs 0.128 af

**Subcatchment P-3: Northeast Area to Inf. Trench then DB** Runoff Area=17,233 sf Runoff Depth>4.45"
Tc=5.0 min CN=82 Runoff=2.05 cfs 0.147 af

**Subcatchment P-4: South East area to DB** Runoff Area=44,439 sf Runoff Depth>4.66"
Flow Length=160' Tc=15.0 min CN=84 Runoff=4.14 cfs 0.396 af

**Subcatchment P-5: South West area to DB** Runoff Area=12,898 sf Runoff Depth>5.33"
Tc=5.0 min CN=90 Runoff=1.77 cfs 0.132 af

**Reach E-CP: Control Point-Stream at PL** Inflow=21.00 cfs 2.346 af
Outflow=21.00 cfs 2.346 af

**Reach P-CP: Control Point -Stream at PL** Inflow=20.97 cfs 2.552 af
Outflow=20.97 cfs 2.552 af

**Pond DB: Detention Basin** Peak Elev=91.68' Storage=11,499 cf Inflow=6.83 cfs 0.674 af
Outflow=2.89 cfs 0.570 af

**Total Runoff Area = 15.671 ac Runoff Volume = 5.002 af Average Runoff Depth = 3.83"**
**90.33% Pervious Area = 14.155 ac 9.67% Impervious Area = 1.516 ac**

## Subcatchment E-1: Existing Conditions

Runoff = 21.00 cfs @ 12.32 hrs, Volume= 2.346 af, Depth> 3.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

| Area (sf) | CN | Description |
|---|---|---|
| 96,180 | 78 | Wetlands |
| 93,521 | 74 | >75% Grass cover, Good, HSG C |
| 6,300 | 98 | Paved parking & roofs |
| 145,303 | 70 | Woods, Good, HSG C |
| 341,304 | 74 | Weighted Average |
| 335,004 | | Pervious Area |
| 6,300 | | Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 6.7 | 60 | 0.0200 | 0.15 | | **Sheet Flow,** Grass: Short n= 0.150 P2= 3.00" |
| 4.8 | 280 | 0.0375 | 0.97 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 11.6 | 230 | 0.0174 | 0.33 | | **Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps |
| 23.1 | 570 | Total | | | |

## Subcatchment P-1: West Area to DB

Runoff = 17.69 cfs @ 12.27 hrs, Volume= 1.854 af, Depth> 3.80"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

| Area (sf) | CN | Description |
|---|---|---|
| 96,180 | 78 | Wetlands |
| 49,740 | 74 | >75% Grass cover, Good, HSG C |
| 16,732 | 98 | Paved parking & roofs |
| 90,000 | 70 | Woods, Good, HSG C |
| 2,280 | 90 | Patio |
| 254,932 | 76 | Weighted Average |
| 238,200 | | Pervious Area |
| 16,732 | | Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.4 | 89 | 0.0250 | 0.18 | | **Sheet Flow,** Grass: Short n= 0.150 P2= 3.00" |
| 1.5 | 62 | 0.0200 | 0.71 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 9.9 | 200 | 0.0180 | 0.34 | | **Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps |
| 19.8 | 351 | Total | | | |

## Subcatchment P-2: North Area to Rain Garden

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

Runoff = 1.68 cfs @ 12.07 hrs, Volume= 0.128 af, Depth> 5.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

| Area (sf) | CN | Description |
|---|---|---|
| 2,650 | 74 | >75% Grass cover, Good, HSG C |
| 8,494 | 98 | Paved parking & roofs |
| 658 | 98 | Basin |
| 11,802 | 93 | Weighted Average |
| 2,650 | | Pervious Area |
| 9,152 | | Impervious Area |

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

## Subcatchment P-3: Northeast Area to Inf. Trench then DB

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

Runoff = 2.05 cfs @ 12.07 hrs, Volume= 0.147 af, Depth> 4.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

| Area (sf) | CN | Description |
|---|---|---|
| 8,865 | 74 | >75% Grass cover, Good, HSG C |
| 5,824 | 98 | Paved parking & roofs |
| 2,544 | 70 | Woods, Good, HSG C |
| 17,233 | 82 | Weighted Average |
| 11,409 | | Pervious Area |
| 5,824 | | Impervious Area |

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

## Subcatchment P-4: South East area to DB

Runoff = 4.14 cfs @ 12.20 hrs, Volume= 0.396 af, Depth> 4.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

| Area (sf) | CN | Description |
|---|---|---|
| 13,348 | 74 | >75% Grass cover, Good, HSG C |
| 19,769 | 98 | Paved parking & roofs |
| 11,322 | 70 | Woods, Good, HSG C |
| 44,439 | 84 | Weighted Average |
| 24,670 | | Pervious Area |
| 19,769 | | Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.7 | 100 | 0.0200 | 0.11 | | **Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00" |
| 0.3 | 60 | 0.0233 | 3.10 | | **Shallow Concentrated Flow,** Paved Kv= 20.3 fps |
| 15.0 | 160 | Total | | | |

## Subcatchment P-5: South West area to DB

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

Runoff = 1.77 cfs @ 12.07 hrs, Volume= 0.132 af, Depth> 5.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

| Area (sf) | CN | Description |
|---|---|---|
| 4,418 | 74 | >75% Grass cover, Good, HSG C |
| 3,440 | 98 | Paved parking & roofs |
| 4,800 | 98 | Basin |
| 240 | 90 | Patio |
| 12,898 | 90 | Weighted Average |
| 4,658 | | Pervious Area |
| 8,240 | | Impervious Area |

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

## Reach E-CP: Control Point-Stream at PL

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

Inflow Area = 7.835 ac, Inflow Depth > 3.59" for 100-Year event
Inflow = 21.00 cfs @ 12.32 hrs, Volume= 2.346 af
Outflow = 21.00 cfs @ 12.32 hrs, Volume= 2.346 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

## Reach P-CP: Control Point -Stream at PL

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

Inflow Area = 7.835 ac, Inflow Depth > 3.91" for 100-Year event
Inflow = 20.97 cfs @ 12.27 hrs, Volume= 2.552 af
Outflow = 20.97 cfs @ 12.27 hrs, Volume= 2.552 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

## Pond DB: Detention Basin

Inflow Area = 1.712 ac, Inflow Depth > 4.72" for 100-Year event
Inflow = 6.83 cfs @ 12.11 hrs, Volume= 0.674 af
Outflow = 2.89 cfs @ 12.49 hrs, Volume= 0.570 af, Atten= 58%, Lag= 22.9 min
Primary = 2.89 cfs @ 12.49 hrs, Volume= 0.570 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 91.68' @ 12.49 hrs Surf.Area= 4,876 sf Storage= 11,499 cf

Plug-Flow detention time= 132.3 min calculated for 0.570 af (85% of inflow)
Center-of-Mass det. time= 67.9 min ( 869.5 - 801.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 89.00' | 11,271 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |
| #2 | 89.00' | 94 cf | **24.0"D x 30.00'L 24" Inlet Pipe (from DMH to Basin) S= 0.0066 '/'** |
| #3 | 89.20' | 352 cf | **24.0"D x 112.00'L 24" Pipe (from SWTC to DMH) S= 0.0050 '/'** |
| #4 | 89.00' | 2,474 cf | **36.0"D x 70.00'L 36" Lateral Pipe x 5** x 5 |
| #5 | 89.00' | 339 cf | **36.0"D x 24.00'L 36" Header Pipe x 2** x 2 |
| | | 14,531 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 89.00 | 2,243 | 0 | 0 |
| 90.00 | 2,885 | 2,564 | 2,564 |
| 91.00 | 3,575 | 3,230 | 5,794 |
| 92.00 | 4,391 | 3,983 | 9,777 |
| 92.33 | 4,666 | 1,494 | 11,271 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 88.90' | **12.0" x 18.0' long Culvert** CPP, square edge headwall, Ke= 0.500<br>Outlet Invert= 88.75' S= 0.0083 '/' Cc= 0.900<br>n= 0.010 PVC, smooth interior |
| #2 | Device 1 | 90.20' | **10.0" Vert. Orifice/Grate** C= 0.600 |
| #3 | Device 1 | 89.00' | **2.0" Vert. Orifice/Grate** C= 0.600 |
| #4 | Primary | 91.67' | **6.0' long x 2.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50<br>Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32 |

**Primary OutFlow** Max=2.88 cfs @ 12.49 hrs HW=91.68' (Free Discharge)
- **1=Culvert** (Passes 2.87 cfs of 5.71 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 2.70 cfs @ 4.96 fps)
  - **3=Orifice/Grate** (Orifice Controls 0.17 cfs @ 7.75 fps)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 0.01 cfs @ 0.20 fps)

# Appendix B – Soil Test Pit Information

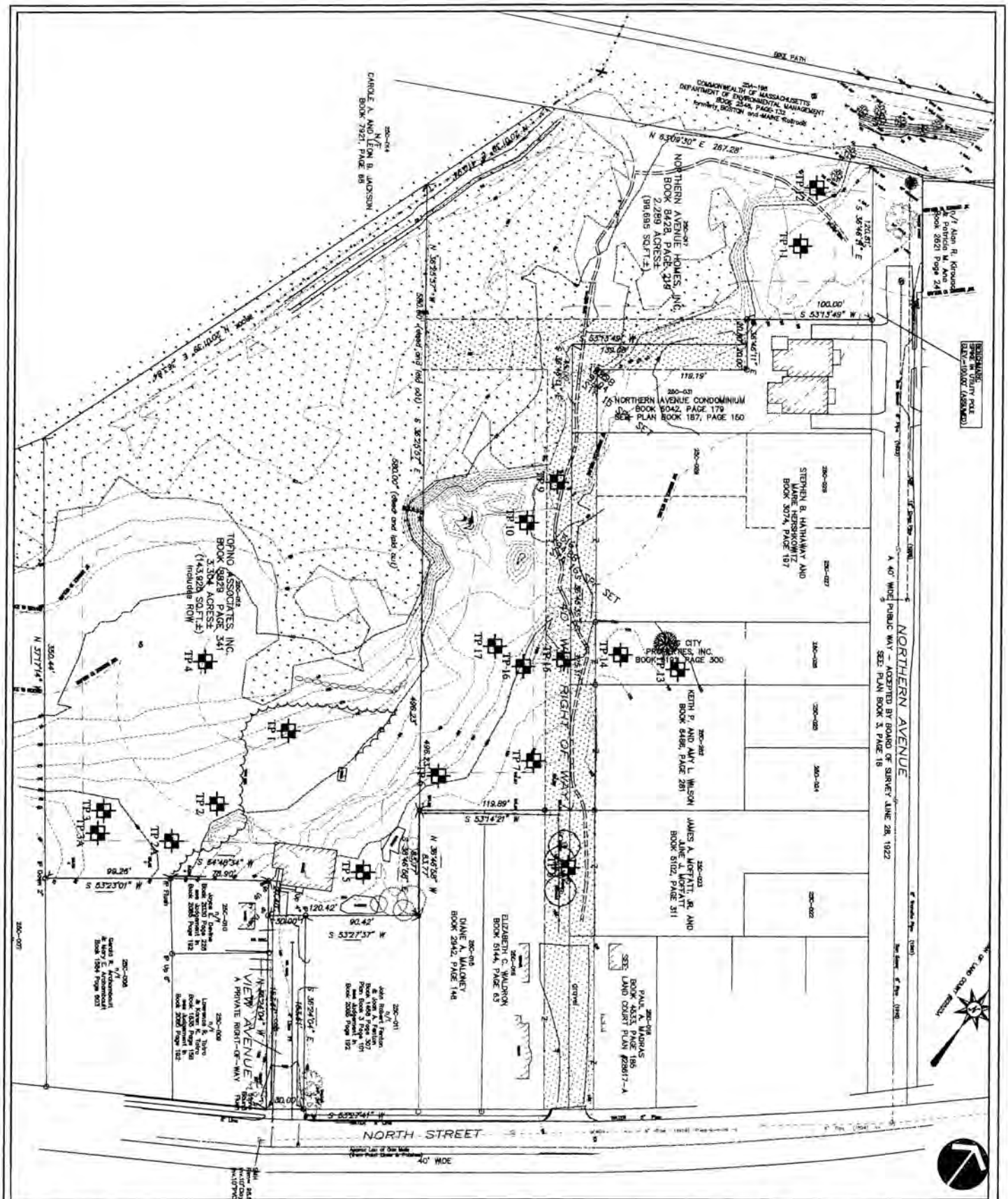



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Figure Title:
Test Pit Location Map (existing conditions)

NORTHERN AVENUE HOUSING
NORTHAMPTON MASSACHUSETTS

Reference:

Date: 11/11/08
Scale: 1"=100'

Sheet::
TP1

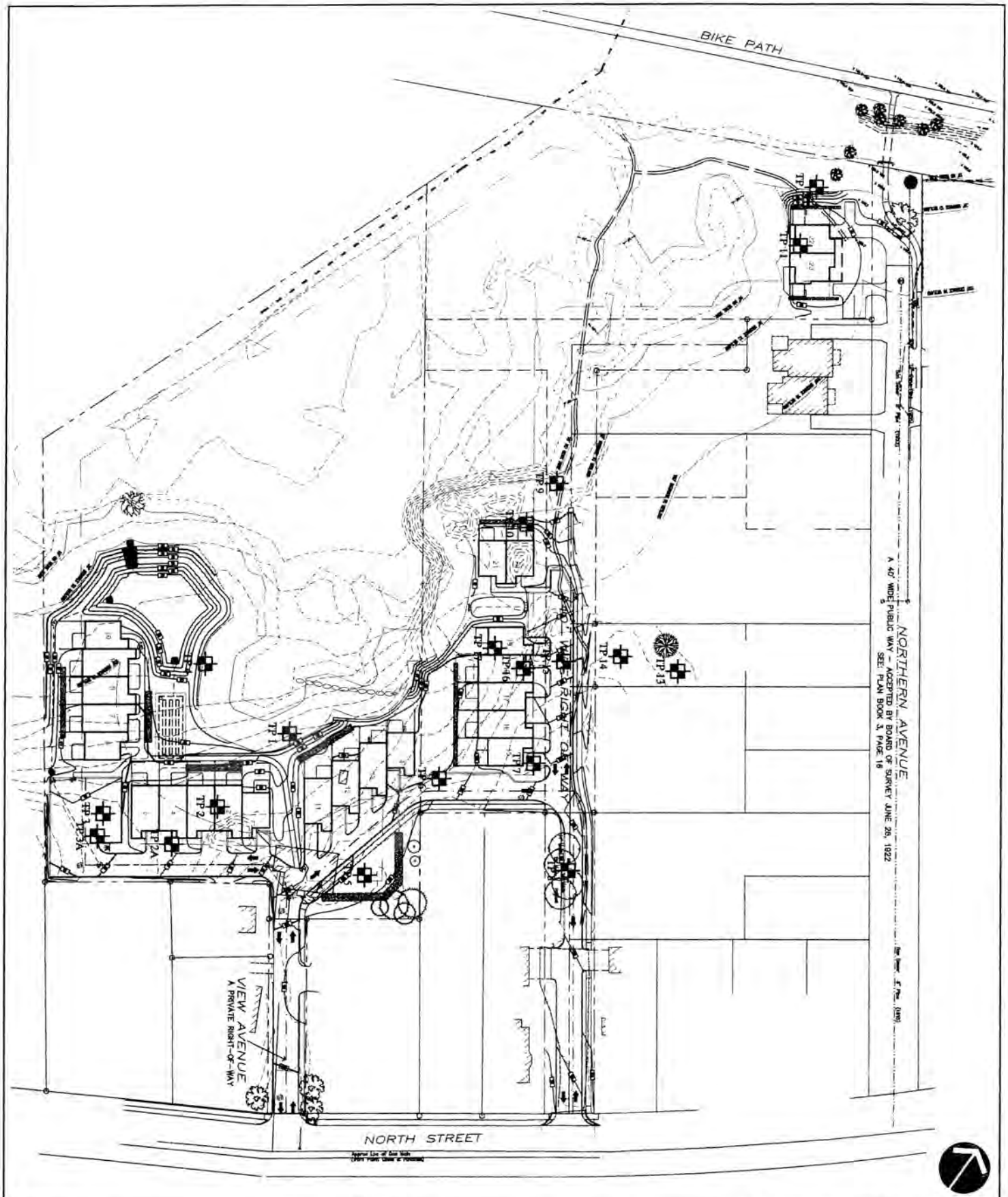


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Figure Title:
Test Pit Location Map (proposed conditions)

NORTHERN AVENUE HOUSING
NORTHAMPTON MASSACHUSETTS

Reference:

Date: 02/19/09
Scale: 1"=100'

Sheet:: TP2

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:
Deep Hole Number TP 1 Date: 01/05/07 Time: 9:15am Weather Clear 10 F
Location (identify on site plan) See Plan
Land Use Lawn Area Slope (%) See Plan Surface Stones n/o
Vegetation grass & some trees
Landform
Position on Landscape (sketch on back)
Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-9" | A | VFSL | 10YR3/3 | 5Y 4/6 <5% | Massive, Friable, roots |
| 9"-21" | $B_w$ | VFSL | 2.5Y4/4 | 5YR4/6 >10% @18" | Massive, Friable |
| 21"-53" | $C_1$ | VFSL/ Loam | 5Y5/2 | 5YR4/6 >35% | Massive, friable, stratified FS & Loam, some smearing, somewhat firm |
| 53"-80" | $C_2$ | SL | 10YR4/4 | 2.5YR3/6 >35% throughout | Massive, friable, sloughing |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) glaciolacustrine Depth to Bedrock: > 80"
Depth to Groundwater: Standing Water in the Hole: 57" @ 15 minutes Weeping from Pit Face: 55"
Estimated Seasonal High Ground Water: 18"

**Percolation Test:**
**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:
Deep Hole Number TP 2 Date: 01/05/07 Time: 9:40am Weather Clear 10 F
Location (identify on site plan) See Plan
Land Use Wooded Slope (%) See Plan Surface Stones n/o
Vegetation Norway Spruce
Landform
Position on Landscape (sketch on back)
Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-12" | A | VFSL | 10YR3/3 | 5Y 4/6 <5% | Massive, Friable, some roots, apparent fill at south end of TP down to 36" |
| 12"-19" | $B_w$ | VFSL | 2.5Y4/4 | 5YR4/6 >10% @18" | Massive, Friable |
| 19"-45" | $C_1$ | VFSL/ Loam | 5Y5/2 | 5YR4/6 >35% | Massive, friable, some smearing, somewhat firm, excavation collapsed |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) glaciolacustrine Depth to Bedrock: > 45"
Depth to Groundwater: Standing Water in the Hole: 40" Weeping from Pit Face:
Estimated Seasonal High Ground Water: 18"

**Percolation Test:**
**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:

Deep Hole Number TP 2A Date: 10/31/07 Time: 9:00am Weather P-Cloudy 40 F

Location (identify on site plan) See Plan

Land Use Wooded Slope (%) See Plan Surface Stones n/o

Vegetation Norway Spruce

Landform

Position on Landscape (sketch on back)

Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-10" | A | VFSL | 10YR3/3 | 5Y 4/6 <5% | Massive, Friable, some roots |
| 10"-30" | $B_w$ | VFSL | 2.5Y4/4 | 5YR4/6 >10% @22" | Massive, Friable, roots to 21" |
| 30"-70" | $C_1$ | VFSL/ Loam | 5Y5/2 | 5YR4/6 >35% | Massive, friable, some smearing, somewhat firm, excavation collapsed, fine sand in lower 12" |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) glaciolacustrine Depth to Bedrock: > 70"

Depth to Groundwater: Standing Water in the Hole: 66" @ 10 minutes Weeping from Pit Face: 66" (rapid)

Estimated Seasonal High Ground Water: 22"

**Percolation Test:**

**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:
Deep Hole Number TP 3 Date: 01/05/07 Time: 10:10am Weather Clear 10 F
Location (identify on site plan) See Plan
Land Use Wooded Slope (%) See Plan Surface Stones n/o
Vegetation Norway Spruce
Landform
Position on Landscape (sketch on back)
Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-9" | A | VFSL | 10YR3/3 | | Massive, Friable, roots |
| 9"-15" | $B_w$ | VFSL | 2.5Y4/4 | | Massive, Friable, roots |
| 15"-50" | $C_1$ | VFSL/ Loam | 5Y5/2 | 5YR4/6 >15% @ 20" | Massive, friable, sloughing, stratified FSL & Fine Sand |
| 50"-65" | $C_2$ | Fine Sand | 10YR4/4 | 2.5YR3/6 >35% throughout | Massive, friable, sloughing |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) glaciolacustrine Depth to Bedrock: > 65"
Depth to Groundwater: Standing Water in the Hole: 61" Weeping from Pit Face: 55"
Estimated Seasonal High Ground Water: 20"

**Percolation Test:**
**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:
Deep Hole Number TP 3A Date: 10/31/08 Time: 9:30am Weather Clear 10 F
Location (identify on site plan) See Plan
Land Use Wooded Slope (%) See Plan Surface Stones n/o
Vegetation Norway Spruce
Landform
Position on Landscape (sketch on back)
Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-7" | A | VFSL | 10YR3/3 | | Massive, Friable, roots |
| 7"-15" | $B_w$ | VFSL | 2.5Y4/4 | | Massive, Friable, roots |
| 15"-70" | $C_1$ | VFSL/ Loam | 5Y5/2 | 5YR4/6 >15% @ 30" | Massive, friable, roots down to 20", sloughing, stratified FSL & Fine Sand, fine sand at pit bottom, excavation collapsed |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) glaciolacustrine Depth to Bedrock: > 70"
Depth to Groundwater: Standing Water in the Hole: 67" @ 5 minutes Weeping from Pit Face: 64" (moderate)
Estimated Seasonal High Ground Water: 30"

**Percolation Test:**
**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:
Deep Hole Number TP 4 Date: 01/05/07 Time: 4:00pm Weather Cloudy 10 F
Location (identify on site plan) See Plan
Land Use Wooded Slope (%) See Plan Surface Stones n/o
Vegetation Norway Spruce
Landform
Position on Landscape (sketch on back)
Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-5" | A | VFSL | 10YR3/3 | 5Y 4/6 <5% | Massive, Friable, roots |
| 5"-15" | $B_w$ | VFSL | 2.5Y4/4 | 5YR4/6 <5% @18" | Massive, Friable, Roots down to 18" |
| 15"-65" | $C_1$ | FSL | 5Y5/2 | 5YR4/6 >10% @28" | Massive, friable, stratified FSL & Fine Sand, some smearing, somewhat firm |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) glaciolacustrine Depth to Bedrock: > 65"
Depth to Groundwater: Standing Water in the Hole: 51" Weeping from Pit Face: 48"
Estimated Seasonal High Ground Water: 28"

**Percolation Test:**
**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:
Deep Hole Number TP 5 Date: 01/05/07 Time: 3:00pm Weather Clear 10 F
Location (identify on site plan) See Plan
Land Use Lawn Area Slope (%) See Plan Surface Stones n/o
Vegetation grass
Landform
Position on Landscape (sketch on back)
Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-9" | A | VFSL | 10YR3/3 | | Massive, Friable, roots |
| 9"-21" | $B_w$ | VFSL | 2.5Y4/4 | | Massive, Friable |
| 21"-107" | $C_1$ | VFSL/ Loam | 5Y5/2 | 5YR4/6 >10% @60" | Massive, friable, no cobbles or gravel, stratified VFSL & Fine Sand, some smearing, |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) glaciolacustrine Depth to Bedrock: > 107"
Depth to Groundwater: Standing Water in the Hole: 92" Weeping from Pit Face: 92"
Estimated Seasonal High Ground Water: 60"

**Percolation Test:**

| | | |
|---|---|---|
| **Depth to Perc:** | 45" | |
| **Start Pre-Soak** | **12":** | 3:14 |
| **End Pre-Soak** | **12":** | 3:36 (8 gals used) |
| **Time at 12":** | | 3:36 |
| **Time at 9":** | | 3:42 |
| **Time at 6":** | | 4:00 |
| **Time (9"-6"):** | | 18 minutes |
| **Rate:** | | 6 min/inch |

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:

Deep Hole Number TP 6 Date: 01/05/07 Time: 11:10am Weather Clear 10 F

Location (identify on site plan) See Plan

Land Use Wooded Slope (%) See Plan Surface Stones n/o

Vegetation Mixed deciduous and evergreen

Landform

Position on Landscape (sketch on back)

Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-8" | A | Forest Mat | 10YR3/3 | | Massive, Friable, roots |
| 8"-29" | $B_w$ | VFSL | 2.5Y4/4 | | Massive, Friable |
| 29"-88" | $C_1$ | FSL | 5Y5/2 | 5YR4/6 Distinct >5% @38" | Massive, friable, stratified FSL and Fine Sand, roots throughout, sloughing |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Glaciolacustrine Depth to Bedrock: > 88"

Depth to Groundwater: Standing Water in the Hole: 79" Weeping from Pit Face: 67" (slow)

Estimated Seasonal High Ground Water: 38"

**Percolation Test:**

**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:
Deep Hole Number TP 7 Date: 01/05/07 Time: 11:45am Weather Clear 10 F
Location (identify on site plan) See Plan
Land Use Wooded Slope (%) See Plan Surface Stones n/o
Vegetation Mixed deciduous and evergreen
Landform
Position on Landscape (sketch on back)
Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-8" | A | Forest Mat | 10YR3/3 | | Massive, Friable, roots |
| 8"-19" | $B_w$ | VFSL | 2.5Y4/4 | | Massive, Friable |
| 19"-90" | $C_1$ | FSL | 2.5Y5/3 | 5YR4/6 Distinct >5% @58" | Massive, friable, stratified FSL and Fine Sand, roots down to 31", sloughing |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Glaciolacustrine Depth to Bedrock: > 90"
Depth to Groundwater: Standing Water in the Hole: 84" Weeping from Pit Face: 84" (slow)
Estimated Seasonal High Ground Water: 58"

**Percolation Test:**

| | | |
|---|---|---|
| **Depth to Perc:** | 46" | |
| **Start Pre-Soak** | **12":** | 12:18 |
| **End Pre-Soak** | **12":** | 12:33 (18 gals used) |
| **Time at 12":** | | 12:33 |
| **Time at 9":** | | 12:36 |
| **Time at 6":** | | 12:41 |
| **Time (9"-6"):** | | 5 minutes |
| **Rate:** | | < 2 min/inch |

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:

Deep Hole Number TP 8 Date: 01/05/07 Time: 1:45pm Weather P-cloudy 10 F

Location (identify on site plan) See Plan

Land Use Old roadway Slope (%) See Plan Surface Stones n/o

Vegetation Mixed deciduous and evergreen

Landform

Position on Landscape (sketch on back)

Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-15" | Fill | | | | Roadway bed, strong staining at fill/C1 interface (variegated colors) |
| 15"-95" | $C_1$ | VFSL | 2.5Y4/4 | 5YR4/6 Distinct >5% @60" | Massive, Friable, stratified FSL and Fine Sand |
| | | | | | |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Glaciolacustrine Depth to Bedrock: > 108"

Depth to Groundwater: Standing Water in the Hole: 90" Weeping from Pit Face: 69" (slow)

Estimated Seasonal High Ground Water: 60"

**Percolation Test:**

**Depth to Perc:** 49"

| | | |
|---|---|---|
| **Start Pre-Soak** | **12":** | 2:10 |
| **End Pre-Soak** | **12":** | 2:25 (10 gals used) |
| **Time at 12":** | | 2:25 |
| **Time at 9":** | | 2:30 |
| **Time at 6":** | | 2:36 |
| **Time (9"-6"):** | | 6 minutes |
| **Rate:** | | 2 min/inch |

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:

Deep Hole Number TP 9 Date: 01/05/07 Time: 1:20pm Weather P-cloudy 10 F

Location (identify on site plan) See Plan

Land Use Old roadway Slope (%) See Plan Surface Stones n/o

Vegetation Mixed deciduous and evergreen

Landform

Position on Landscape (sketch on back)

Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-42" | Fill | | | | Silty sand, debris, concrete, brick |
| | | | | | |
| | | | | | |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Depth to Bedrock: > 42"

Depth to Groundwater: Standing Water in the Hole: 36" Weeping from Pit Face:

Estimated Seasonal High Ground Water: 36"

**Percolation Test:**

**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:
Deep Hole Number TP 10 Date: 01/05/07 Time: 1:30pm Weather P-cloudy 10 F
Location (identify on site plan) See Plan
Land Use wooded Slope (%) See Plan Surface Stones n/o
Vegetation Mixed deciduous and evergreen
Landform
Position on Landscape (sketch on back)
Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-65" | Fill | | | | Silty sand, debris, concrete, brick |
| | | | | | |
| | | | | | |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Depth to Bedrock: > 65"
Depth to Groundwater: Standing Water in the Hole: 60" Weeping from Pit Face: 58"
Estimated Seasonal High Ground Water: 58"

**Percolation Test:**
**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:
Deep Hole Number TP 11 Date: 01/06/07 Time: 9:00am Weather P-cloudy 10 F
Location (identify on site plan) See Plan
Land Use wooded Slope (%) See Plan Surface Stones n/o
Vegetation Mixed deciduous and evergreen
Landform
Position on Landscape (sketch on back)
Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-25" | $Fill_1$ | FSL | Brwn | | Massive, Friable, roots |
| 25"-105" | $Fill_2$ | FSL | Drk. Brwn | | 10% cobbles and gravel, some glass and debris @ 100" |
| | | | | | |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Depth to Bedrock: > 105"
Depth to Groundwater: Standing Water in the Hole: 96" Weeping from Pit Face: 92" (rapid)
Estimated Seasonal High Ground Water:

**Percolation Test:**
**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:
Deep Hole Number TP 12 Date: 01/06/07 Time: 9:00am Weather P-cloudy 10 F
Location (identify on site plan) See Plan
Land Use wooded Slope (%) See Plan Surface Stones n/o
Vegetation Mixed deciduous and evergreen
Landform
Position on Landscape (sketch on back)
Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-36" | Fill | FSL | Brwn | | Loose, Friable, some stones, asphalt |
| 36"-46" | Ap/Bw | FSL | Drk. Brwn/ Brown | | 10% cobbles and gravel, some glass and debris @ 100" |
| 46"-64" | $C_1$ | FSL | 5Y5/2 | 5YR4/6 Distinct >5% @38" | Massive, friable, stratified FSL and Fine Sand, roots throughout, sloughing |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Depth to Bedrock: > 64"
Depth to Groundwater: Standing Water in the Hole: 55" Weeping from Pit Face: 50"
Estimated Seasonal High Ground Water:

**Percolation Test:**
**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:

Deep Hole Number TP 13 Date: 10/31/07 Time: 11:50am Weather P-Cloudy 45 F

Location (identify on site plan) See Plan

Land Use Wooded Slope (%) See Plan Surface Stones n/o

Vegetation Mixed deciduous and evergreen

Landform

Position on Landscape (sketch on back)

Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-4" | A | FSL | | | Topsoil, Grass, roots |
| 4"-15" | $B_w$ | VFSL | 2.5Y4/4 | | Massive, Friable |
| 15"-68" | $C_1$ | LS | 2.5Y5/3 | 5YR4/6 Distinct >5% @54" | Massive, friable, some stratified FSL and Fine Sand, roots down to 24", sloughing |
| 68"-108" | $C_2$ | LS | 5Y4/2 | 7.5YR5/6 >10% throughout | Mass, firm, some smearing |
| 108"-114" | $C_3$ | SL | 5Y4/2 | 7.5YR5/6 >10% throughout | Mass, firm, smearing, wet, pockets of loam |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Glaciolacustrine Depth to Bedrock: > 114"

Depth to Groundwater: Standing Water in the Hole: n/o Weeping from Pit Face: 96"

Estimated Seasonal High Ground Water: 54"

**Percolation Test:**

**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:

Deep Hole Number TP 14 Date: 10/31/07 Time: 10:45am Weather P-Cloudy 45 F

Location (identify on site plan) See Plan

Land Use Wooded Slope (%) See Plan Surface Stones n/o

Vegetation Mixed deciduous and evergreen

Landform

Position on Landscape (sketch on back)

Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-8" | A | Forest Mat | 10YR3/3 | | Massive, Friable, roots |
| 8"-19" | $B_w$ | VFSL | 2.5Y4/4 | | Massive, Friable |
| 19"-87" | $C_1$ | FLS | 2.5Y5/3 | 5YR4/6 Distinct >5% @75" | Massive, friable, some stratified FSL and Fine Sand, roots down to 24", sloughing |
| 87-112" | $C_2$ | FLS | 5Y4/2 | 7.5YR5/6 >10% (from excavator bucket) | Mass, firmer than C1, Wet, smearing |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Glaciolacustrine Depth to Bedrock: > 112"

Depth to Groundwater: Standing Water in the Hole: n/o Weeping from Pit Face: n/o

Estimated Seasonal High Ground Water: 75"

**Percolation Test:**

**Depth to Perc:** 42"
**Start Pre-Soak 12":** 11:01
**End Pre-Soak 12":** 11:16 (18 gals used)
**Time at 12":** 11:16
**Time at 9":** 11:18
**Time at 6":** 11:21
**Time (9"-6"):** 3 minutes
**Rate:** < 2 min/inch

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:

Deep Hole Number TP 15 Date: 10/31/07 Time: 1:00pm Weather P-Cloudy 45 F

Location (identify on site plan) See Plan

Land Use Wooded Slope (%) See Plan Surface Stones n/o

Vegetation Mixed deciduous and evergreen

Landform

Position on Landscape (sketch on back)

Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-20" | Fill | | | | Massive, Friable, roots |
| 20"-64" | $C_1$ | FLS | 2.5Y5/3 | 5YR4/6 Distinct >5% @68" | Massive, friable, some stratified FSL and Fine Sand, roots down to 24", sloughing |
| 64"-106" | $C_2$ | FLS | 5Y4/2 | 7.5YR5/6 >10% (from excavator bucket) | Mass, firmer than C1, Wet, smearing |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Glaciolacustrine Depth to Bedrock: > 106"

Depth to Groundwater: Standing Water in the Hole: n/o Weeping from Pit Face: n/o

Estimated Seasonal High Ground Water: 68"

**Percolation Test:**

**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:
Deep Hole Number TP 16 Date: 10/31/07 Time: 12:50am Weather P-Cloudy 45 F
Location (identify on site plan) See Plan
Land Use Wooded Slope (%) See Plan Surface Stones n/o
Vegetation Mixed deciduous and evergreen
Landform
Position on Landscape (sketch on back)
Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-31" | Fill | | | | Fill over 2" thick macadam layer @ 31" |
| 31"-50" | $C_1$ | FSL | 10YR5/8 | | Massive, friable, some stratified FSL and Fine Sand, roots down to 24", sloughing |
| 50"-90" | $C_2$ | LS | 5Y4/2 | 7.5YR5/6 >10% throughout | Mass, firm, some smearing |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Glaciolacustrine Depth to Bedrock: > 90"
Depth to Groundwater: Standing Water in the Hole: n/o Weeping from Pit Face: n/o
Estimated Seasonal High Ground Water: 50"

**Percolation Test:**
**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

Location Address or Lot No. Northern Avenue, Northampton, MA

# *Test Pits*

Performed By M.D'Urso, The Berkshire Design Group Witnessed By:

Deep Hole Number TP 17 Date: 10/31/07 Time: 1:30pm Weather P-Cloudy 45 F

Location (identify on site plan) See Plan

Land Use Wooded Slope (%) See Plan Surface Stones n/o

Vegetation Mixed deciduous and evergreen

Landform

Position on Landscape (sketch on back)

Distances from: ***See Plan***

| | | | |
|---|---|---|---|
| Open Water Body | Feet | Drainage way | Feet |
| Possible Wet Area | Feet | Property Line | Feet |
| Drinking Water Well | Feet | Other | |

## DEEP OBSERVATION HOLE LOG *

| Depth from Surface(Inches) | Soil Horizon | Soil Texture (USDA) | Soil Color (Munsell) | Soil Mottling | Other (Structure, Stones, Boulders, Consistency, % Gravel) |
|---|---|---|---|---|---|
| 0-46" | Fill | Silty Sand | | | Few bricks, cobbles, plastic, roots (new growth) |
| 46"-59" | $C_1$ | LS | 2.5Y5/3 | 5YR4/6 Distinct >10% throughout | Massive, friable, some stratified FSL and Fine Sand, roots down to 24", sloughing |
| 59"-108" | $C_2$ | SL | 5Y4/2 | 7.5YR5/6 >35% throughout | Massive, firm, some pockets of loam, smearing, wet @ bottom |
| | | | | | |

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Glaciolacustrine Depth to Bedrock: > 108"

Depth to Groundwater: Standing Water in the Hole: 6" @ 30 minutes Weeping from Pit Face: 95"

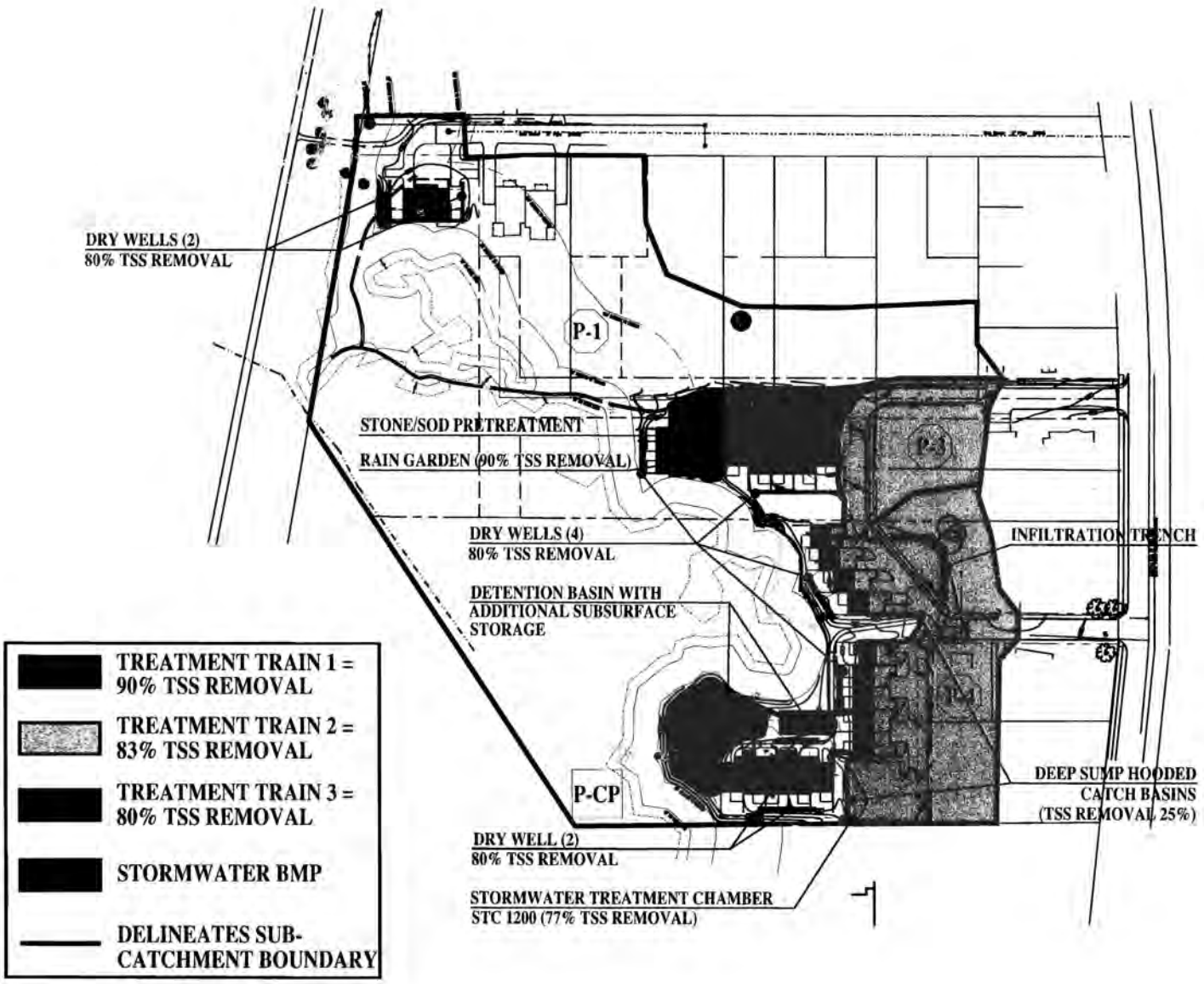
Estimated Seasonal High Ground Water: 54"

**Percolation Test:**

**Depth to Perc:**
**Start Pre-Soak 12":**
**End Pre-Soak 12":**
**Time at 12":**
**Time at 9":**
**Time at 6":**
**Time (9"-6"):**
**Rate:**

**Note: This test pit was performed for investigation of general soil conditions and should not be used for purposes related to Title 5 and/or soil suitability assessments for on-site sewage disposal.**

# Appendix C – TSS Removal Summary




Appendix C

Reference:

Date: 02/19/09

Scale: 1"=150'

Figure Title: Treatment Chain Area Map

North Street Condominiums

NORTHAMPTON MASSACHUSETTS

The Berkshire Design Group, Inc.
4 Allen Place Northampton, Massachusetts 01060
(413) 582-7000 • FAX (413) 582-7005

INSTRUCTIONS:

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

*Version 1, Automated: Mar. 4, 2008*

Location: Treatment Train 1 for P-2

## TSS Removal Calculation Worksheet

| B<br>BMP[1] | C<br>TSS Removal Rate[1] | D<br>Starting TSS Load* | E<br>Amount Removed (C*D) | F<br>Remaining Load (D-E) |
|---|---|---|---|---|
| **Rain Garden** | **0.90** | **1.00** | **0.90** | **0.10** |
| | **0.00** | **0.10** | **0.00** | **0.10** |
| | **0.00** | **0.10** | **0.00** | **0.10** |
| | **0.00** | **0.10** | **0.00** | **0.10** |
| | **0.00** | **0.10** | **0.00** | **0.10** |

**Total TSS Removal =** **90%**

**Separate Form Needs to be Completed for Each Outlet or BMP Train**

| | |
|---|---|
| Project: | **North Street Condominiums, Northampton, MA** |
| Prepared By: | **Brian Darnold** |
| Date: | **2/19/2009** |

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

*Version 1, Automated: Mar. 4, 2008*

Location: Treatment Train 2 for P-3 and P-4

## TSS Removal Calculation Worksheet

| B<br>BMP[1] | C<br>TSS Removal Rate[1] | D<br>Starting TSS Load* | E<br>Amount Removed (C*D) | F<br>Remaining Load (D-E) |
|---|---|---|---|---|
| **Deep Sump and Hooded Catch Basin** | 0.25 | 1.00 | 0.25 | 0.75 |
| **Proprietary Treatment Practice** | 0.77 | 0.75 | 0.58 | 0.17 |
| | 0.00 | 0.17 | 0.00 | 0.17 |
| | 0.00 | 0.17 | 0.00 | 0.17 |
| | 0.00 | 0.17 | 0.00 | 0.17 |

**Total TSS Removal =** 83%

**Separate Form Needs to be Completed for Each Outlet or BMP Train**

Project: North Street Condominiums, Northampton, MA
Prepared By: Brian Darnold
Date: 2/19/2009

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

*Version 1, Automated: Mar. 4, 2008*

Location: Treatment Train 3 for P-1 and P-5 - Roof Areas

## TSS Removal Calculation Worksheet

| B<br>BMP[1] | C<br>TSS Removal Rate[1] | D<br>Starting TSS Load* | E<br>Amount Removed (C*D) | F<br>Remaining Load (D-E) |
|---|---|---|---|---|
| Dry Well | 0.80 | 1.00 | 0.80 | 0.20 |
| | 0.00 | 0.20 | 0.00 | 0.20 |
| | 0.00 | 0.20 | 0.00 | 0.20 |
| | 0.00 | 0.20 | 0.00 | 0.20 |
| | 0.00 | 0.20 | 0.00 | 0.20 |

**Total TSS Removal =** 80%

**Separate Form Needs to be Completed for Each Outlet or BMP Train**

Project: North Street Condominiums, Northampton, MA
Prepared By: Brian Darnold
Date: 2/19/2009

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

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JOB North Street condominiums
SHEET NUMBER 1 OF 3
CALCULATED BY BCD DATE 2/14/14
CHECKED BY _____ DATE _____
SCALE

# Standard 4: Water Quality

**Rain Garden** required volume:

Impervious area to system = 8,494 sf

Required water quality Volume = $D_{WQ} * A_{Imp}$

$D_{WQ}$ = 0.5in (Non critical area, land is not LH/PPL, no rapid inf rate)

$A_{Imp}$ = 8,494

$$R_{WQV} = (0.5in)\left(\frac{1ft}{12in}\right)(8,494sf) = 354cf$$

Rain Garden Volume = 369 cf (see Rain Garden in HydroCAD up to cumulative Vol 97.20")

**Dry Well 1**

Imp Area to system = 708 sf

$$R_{WQV} = (0.5in)\left(\frac{1ft}{12in}\right)(708sf) = 30cf$$

* Volume provided = 51 cf ✓OKAY

**Dry Well 2**

Imp Area to system = 1988 sf

$$R_{WQV} = (0.5in)\left(\frac{1ft}{12in}\right)(1988sf) = 83cf$$

*Volume provided = 99 cf ✓OKAY

* Dry Well Volume = 1ft (typ. depth) × footprint (in sq ft) (Area) * 0.40 (Voids) = volume

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CHECKED BY _____ DATE _____
SCALE

**Dry Well 3**

Imp Area to system = 1732 sf

$R_{WQV} = (0.5in)\left(\frac{1ft}{12in}\right)(1732sf) = 72\ cf$

Volume provided = 100 cf ✓ OKAY

**Dry Well 4**

Imp Area to system = 2076 sf

$R_{WQV} = (0.5in)\left(\frac{1ft}{12in}\right)(2076\ sf) = 88\ cf$

Volume provided = 89 cf ✓ OKAY

**Dry Well 5**

Imp. Area to system = 1900 sf

$R_{WQV} = (0.5in)\left(\frac{1ft}{12in}\right)(1900sf) = 80\ cf$

Volume provided = 80 cf ✓ OKAY

**Dry Well 6**

Imp. Area to system = 765 sf

$R_{WQV} = (0.5in)\left(\frac{1ft}{12in}\right)(765sf) = 32\ cf$

Volume provided = 32 cf ✓ OKAY

**Dry Well 7**

Imp Area to system = 765 sf

$R_{WQV} = (0.5in)\left(\frac{1ft}{12in}\right)(765sf) = 32\ cf$

Volume provided = 32 cf ✓ OKAY

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JOB North Street Condominiums
SHEET NUMBER 3 OF 3
CALCULATED BY BCD DATE 2/19/09
CHECKED BY DATE
SCALE

Dry Well 8

Imp Area to system = 1900 sf

$R_{WQV} = (0.5\text{in})\left(\frac{1\text{ft}}{12\text{in}}\right)(1900\text{sf}) = 80\text{cf}$

Volume provided = 90cf ✓OKAY

## Site Net TSS Removal Check

Treatment Chain 1 (Rain Garden) = 90% TSS Removal
Impervious Area = 8,494 sf

Treatment Chain 2 (Deep sump hooded (B → STC 1200) = 83% TSS Removal
Impervious Area = 25,593 sf

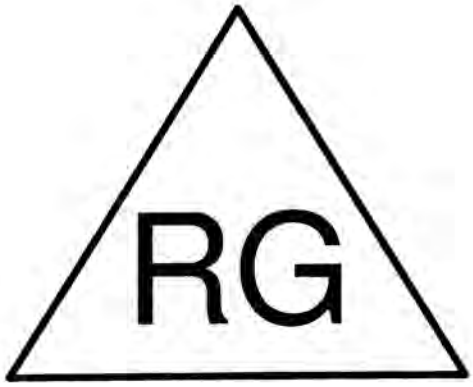
Treatment Chain 3 (8 Dry Wells) = 80% TSS Removal
Impervious Area = 11,834 sf

Treatment Chain 4 (No treatment) = 0% TSS Removal
Impervious Area = 2038 sf

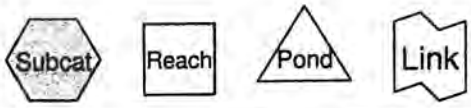
Total New Impervious Area = 47,959 sf

$$\text{Net TSS Removed} = \frac{\overset{TC1}{(8{,}494\text{sf} * 0.90)} + \overset{TC2}{(25{,}593\text{sf} * 0.83)} + \overset{TC3}{(11{,}834\text{sf} * 0.80)} + \overset{TC4}{(2038\text{sf} * 0.00)}}{47{,}959\text{ sf}}$$

$= 0.80 \geq 80\%$ TSS Removed ✓ OKAY




# Rain Garden




**Drainage Diagram for Northern Avenue Housing-Active**
Prepared by The Berkshire Design Group 2/25/2009

## Pond RG: Rain Garden

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

Routing by Stor-Ind method
Peak Elev= 0.00' @ 0.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated)
Center-of-Mass det. time= (not calculated)

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 96.50' | 403 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 96.50 | 380 | 0 | 0 |
| 97.00 | 595 | 244 | 244 |
| 97.20 | 658 | 125 | 369 ← |
| 97.25 | 696 | 34 | 403 |

*Fact Sheet #4*

# Stormwater Technology: Stormceptor

## (Hydro Conduit, formerly CSR New England Pipe)

Revised February 2003

*The **Stormceptor Fact Sheet** is one in a series of fact sheets for stormwater technologies and related performance evaluations, which are undertaken by the **Massachusetts STrategic Envirotechnology Partnership (STEP).***

A summary of the STEP evaluation entitled, *Technology Assessment, Stormceptor CSR New England Pipe*, January 1998 is provided in this fact sheet. When a more thorough understanding of a system is required, the full *Technology Assessment* should be reviewed. Copies are available for downloading from the STEP Web site (www.stepsite.org/progress/reports) or by contacting the STEP Program (Phone: 617/626/1197, FAX: 617/626/1180, email: linda.benevides@state.ma.us). The information in this fact sheet is subject to future updates as additional performance information becomes available.

## Description/Definition

Stormceptor is a prefabricated, underground unit that separates oils, grease, and sediment from stormwater runoff when installed with an existing or new pipe conveyance system. The unit is divided into two chambers–a treatment and a flow bypass chamber. During typical storm events, runoff is directed by the inflow weir through a drop pipe into the lower treatment chamber where sediment, oil, and grease are separated from the flow by gravity. The bypass chamber is designed to convey excess stormwater, which overtops the inflow weir, through the system without treatment.

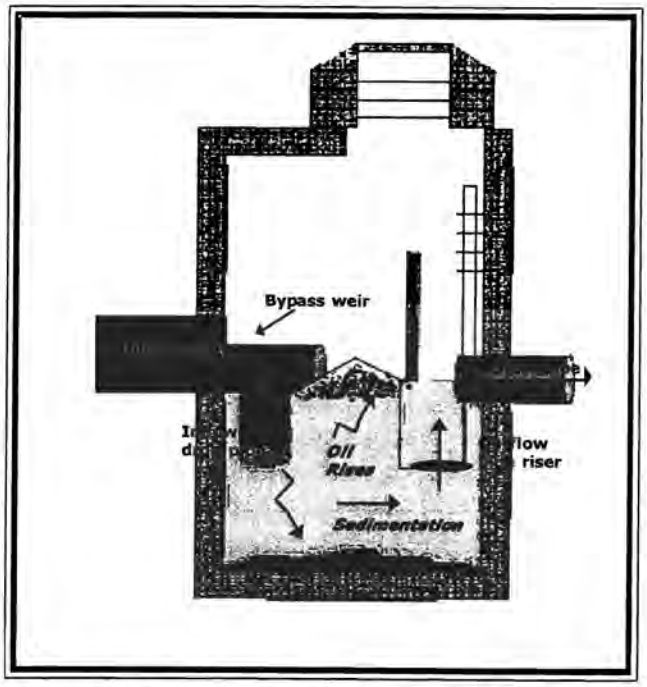



**Figure 1. Stormceptor operation during average flow conditions.**

## Equipment and Sizing

The on-line Stormceptor units are available in eight sizes ranging from six and twelve feet in diameter with capacities of 900 to 7200 gallons. Since issuing the STEP assessment in 1998, the manufacturer has expanded the Stormceptor product line to include a storm drain inlet (STC 450i) and three units (Models STC 11000, STC 13000, and STC16000). These systems are not included in the STEP evaluation. Users and decision-makers may require additional field test results and new data for these new systems in order to accept performance ratings, particularly if they are higher than those reported in the STEP technology assessment and this fact sheet.

Stormceptor units are available in either precast concrete or fiberglass for special applications. Concrete units are pre-engineered for HS-20 min. traffic loading at the surface. Fiberglass units can be used in areas where there is a potential for oil and chemical spills.

## Performance/Effectiveness

The system is designed to provide separation of sediment, oil, and grease from stormwater by routing runoff into a low-turbulence environment where solids settle and oils float out of solution. The system sizing is based on the drainage area, historical rainfall data, and

the solids removal efficiency required. It is recommended that the system be used in combination with other stormwater controls to conform with the Massachusetts Stormwater Management Policy and standards.

An Imperial Model STC 2000 (equivalent to the Model STC 2400) in Edmonton, Canada treats flow from a 9.8 acre commercial parking lot. This system was monitored during four storm events in 1996 and shown to have an average total suspended solids (TSS) removal efficiency of 52 percent. In designing a system to achieve a comparable removal efficiency, the relationship between system size and impervious drainage area should be considered, as detailed in Table 1 and the Technology Assessment Report.

A Model STC 1200 in Westwood, Massachusetts treats flow from 0.65 acres consisting of a paved truck loading area at a manufacturing facility. The unit was monitored for six storm events in 1997, but only four events had measurable TSS influent concentrations. Of these four events, the average TSS removal efficiency was calculated to be 77 percent, which is less than the 80 percent removal targeted by the manufacturer.

Based on these field monitoring results, and when the unit sizing follows the guidance in Table 1, removal efficiencies between 52 percent and 77 percent may be achieved where installations have similar rainfall and land use characteristics as those reviewed for the STEP evaluation. It is recommended that additional field research and new data be evaluated to validate performance ratings higher than those verified by STEP.

| Stormceptor Model Number | Maximum Impervious Area (acre 77% TSS removal | 52% TSS remo |
|---|---|---|
| STC 900 | 0.45 | 0.9 |
| STC 1200 | 0.7 | 1.45 |
| STC 1800 | 1.25 | 2.55 |
| STC 2400 | 1.65 | 3.35 |
| STC 3600 | 2.6 | 5.3 |
| STC 4800 | 3.6 | 7.25 |
| STC 6000 | 4.6 | 9.25 |
| STC 7200 | 5.55 | 11.25 |

**Table 1: Adapted from the Stormceptor sizing for TSS removal in the STEP Technology Assessment.** Notes: 1) On some sites, the maximum impervious area may need to be reduced to achieve these TSS removal rates. 2) The terms "critical area sizing" (to achieve 77 percent TSS removal) and "treatment train sizing" (for 52 percent removal) are no longer used by the manufacturer, but unit sizing is still applicable.

Specific performance claims for oil and grease were not evaluated by STEP. However, total petroleum hydrocarbons (TPH) were analyzed during the Westwood study. Results indicated that the unit was effective in capturing oils.

## Technology Status

The Stormceptor system provides greater solids separation and higher TSS removal efficiencies than oil and grit separators. Stormceptor systems are among the category of hydrodynamic separators, which are flow-through devices with the capacity to settle or separate grit, oil, sediment, or other pollutants from stormwater. According to the U.S. Environmental Protection Agency, "Hydrodynamic separators are most effective where the materials to be removed from runoff are heavy particulates - which can be settled - or floatables - which can be captured, rather than solids with poor settleability or dissolved pollutants."

Although Stormceptor appears to remove sediment, grit, oil, and grease as claimed by the manufacturer, additional research is needed to determine how much sediment moves through the system untreated. The field studies evaluated for the STEP assessment predate the Stormwater Best Management Practice Demonstration Tier II Protocol (2001), which is applicable in Massachusetts and other states in the Technology Acceptance Reciprocity Partnership (TARP), to ensure quality controlled studies that can be shared among participating states. Therefore, interstate reciprocity is not available to the manufacturer, based on performance claims that were evaluated by STEP in 1998. If the TARP Protocol requirements are fulfilled in the future, the manufacturer could pursue reciprocal verification for Stormceptor systems in participating TARP states. More information on the TARP Protocol is available on the following Web site: www.dep.state.pa.us/dep/deputate/pollprev/techservices/tarp.

## Applications/Advantages

- Stormceptor systems identified in Table 1 should be used in combination with other BMPs to remove 80 percent of the average annual load of TSS (DEP Stormwater Policy Standard 4). Systems may be well suited for pretreatment in a mixed component system designed for stormwater recharge.
- Performance data show that Stormceptor may provide TSS removal rates in the range of 52 percent to 77 percent when sized according to Table 1. Higher TSS removal rates were achieved during low flow, low intensity storms with less than one third of an inch of runoff. Also, by reducing the impervious drainage area,

relative to the system size, the STEP Technology Assessment Report indicated that higher removal efficiencies may be achievable. However, STEP recommends collection of additional data "representing a varied set of operating conditions over a realistic maintenance cycle to verify TSS removal rates greater than 80 percent."

- The Stormceptor system is suitable for new and retrofit applications. For retrofit applications, it should not take the place of a catch basin for the systems that have been verified. Also, for retrofit applications, it should be installed in lateral lines and not main trunk lines.
- The system is particularly well suited in constricted areas and where space is limited.
- It also is suitable for use in areas of high potential pollutant loads (DEP Stormwater Policy Standard 5), where it may be used effectively in capturing and containing oil and chemical spills. *Web site:* www.state.ma.us/dep/brp/stormwtr/stormpub.htm.

## Considerations/Limitations

- Systems are not expected to provide significant nutrient (nitrogen and phosphorus) or fecal coliform removal.
- The systems are not recommended for use in critical areas, such as public drinking water supplies, certified vernal pools, public swimming beaches, shellfish growing areas, cold water fisheries, and some Areas of Critical Environmental Concern (ACECs), except as a pretreatment device for BMPs that have been approved by DEP for use in critical areas. The structural BMPs approved for use in critical areas are described in Standard 6 of the Stormwater Management Policy, www.state.ma.us/dep/brp/stormwtr/stormpub.htm.
- There is a limited set of useful data for predicting the relationship between treatment efficiency and loading rates. Removal efficiencies have not been demonstrated for all unit sizes.
- Further research is needed to determine how much TSS bypasses the treatment chamber during certain, higher velocity storm events which recur less frequently.
- Systems require regular maintenance to minimize the potential for washout of the accumulated sediments.

## Reliability/Maintenance

All BMPs require scheduled, routine maintenance to ensure that they operate as efficiently as possible. Although maintenance requirements are site specific, a general relationship between cleaning needs and depths of sediment has been established by the manufacturer. Inspection of the Stormceptor interior should be done after major storm events, particularly in the first year of operation. It is recommended that material in the treatment chamber be pumped out by a vacuum truck semiannually, or when the sediment and pollutant loads reach about 15 percent of the total storage. If the unit is used for spill containment, it should be pumped after the event is contained. Typical cleaning costs were estimated by the manufacturer in 1998 to be $250, with disposal costs averaging $300 to $500. The expected life of a system has been estimated to be 50 to 100 years.

| Sediment Depths Indicating Required Maintenan | |
|---|---|
| **Model Number** | **Sediment Depth (feet)** |
| STC 900 | 0.5 |
| STC 1200 | 0.75 |
| STC 1800 | 1 |
| STC 2400 | 1 |
| STC 3600 | 1.25 |
| STC 4800 | 1 |
| STC 6000 | 1.5 |
| STC 7200 | 1.25 |

Table 2: The Stormceptor system clean out is based on 15 percent of the sediment storage volume in the unit.

## References


Winkler, E.S. 1998. "Technology Assessment, Stormceptor." University of Massachusetts, Amherst, MA. *STEP Web site:* www.stepsite.org/progress/reports

Massachusetts Department of Environmental Protection and Office of Coastal Zone Management. 1997. "Stormwater Management Handbooks, Volumes One and Two." Boston, MA. *Handbooks Web site:* www.state.ma.us/dep/brp/stormwtr/stormpub.htm.

"Performance of a Proprietary Stormwater Treatment Device: The Stormceptor. The Practice of Watershed Protection: Article 120. Thomas. R. Schueler and Heather K. Holland editors. 2000. Ellicott City, MD.

United States Environmental Protection Agency. "Storm Water Technology Fact Sheet Hydrodynamic Separators." EPA 832-F-99-017.

*Stormceptor Web sites:* www.rinkermaterials.com/stormceptor

*TARP Web site:* www.dep.state.pa.us/dep/deputate/pollprev/techservices/tarp.

# Appendix D – Standard 3 Recharge Calculations

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JOB North Street Condominiums
SHEET NUMBER 1 OF 5
CALCULATED BY BCD DATE 2/19/09
CHECKED BY DATE
SCALE

## Standard 3 – Recharge

Target Depth factor = 0.25 in for type "C" soils

System Sizing:

### Dry Well 1

Impervious Area to System = 708 sf

$Rv = (708\,sf) * (\frac{1\,ft}{12\,in}) * (0.25\,in) = 15\,cf$

Volume provided = 52 cf ✓OKAY

### Dry Well 2

Imp Area to system = 1988 sf

$Rv = (1988\,sf) * (\frac{1\,ft}{12\,in}) * (0.25\,in) = 41\,cf$

Volume Provided = 99 cf ✓OKAY

### Dry Well 3

Imp Area to system = 1732 sf

$Rv = (1732\,sf) * (\frac{1\,ft}{12\,in}) * (0.25\,in) = 36\,cf$

Volume provided = 100 cf ✓OKAY

### Dry Well 4

Imp Area to system = 2076 sf

$Rv = (2076\,sf) (\frac{1\,ft}{12\,in}) (0.25\,in) = 44\,cf$

Volume provided = 89 cf ✓OKAY

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SHEET NUMBER 2 OF 5
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CHECKED BY _____ DATE _____
SCALE

## Dry Well 5

Imp Area to system = 1900 sf

$R_v = (1900\ sf) * \left(\frac{1\ ft}{12\ in}\right) * (0.25\ in) = 40\ cf$

Volume Provided = 80 cf (Note: plans state Dry Well 5 holds 67cf. This is an error on the plans)
√OKAY

## Dry Well 6

Imp Area to system = 765sf

$R_v = (765\ sf) * \left(\frac{1\ ft}{12\ in}\right) * (0.25\ in) = 16\ cf$

Volume Provided = 32 cf √OKAY

## Dry Well 7

Imp Area to system = 765 sf

$R_v = (765\ sf) * \left(\frac{1\ ft}{12\ in}\right) * (0.25\ in) = 16\ cf$

Volume provided = 32 cf √OKAY

## Infiltration Trench

Impervious Area to system = 5824 sf

$R_v = (5824\ sf) * \left(\frac{1\ ft}{12\ in}\right) * (0.25\ in) = 121\ cf$

Volume provided = 152 cf √OKAY

## Dry Well 8

Imp Area to system

$R_v = (1900\ sf) * \left(\frac{1\ ft}{12\ in}\right) * (0.25\ in) = 40\ cf$

Volume provided = 90 cf √OKAY

The Berkshire Design Group, Inc.

*Landscape Architecture*
*Civil Engineering*
*Planning*
*Urban Design*
*Environmental Services*

4 Allen Place
Northampton, Massachusetts 01060

JOB North Street Condominiums
SHEET NUMBER 3 OF 5
CALCULATED BY BCD DATE 2/19/09
CHECKED BY DATE
SCALE

## Drawdown in 72 Hours

$$\text{Time} = \frac{Rv}{K * \text{Bottom Area}}$$

### Dry Well 1

$Rv = 51cf$

* $K = 0.17 in/hr$

Bottom Area = 128sf

$$\frac{51cf}{(0.17in/hr \times \frac{1}{12})(128sf)} = 28hrs$$

28hrs < 72hrs ✓OKAY

### Dry Well 2

$Rv = 99cf$

* $K = 0.17 in/hr$

Bottom Area = 246sf

$$\frac{99cf}{(0.17in/hr \times \frac{1}{12})(246sf)} = 28.4hrs$$

28.4hrs < 72hrs ✓OKAY

### Dry Well 3

$Rv = 100cf$

* $K = 0.17 in/hr$

Bottom Area = 250sf

$$\frac{100cf}{(0.17in/hr \times \frac{1}{12})(250sf)} = 28.2hrs$$

28.2hrs < 72hrs ✓OKAY

### Dry Well 4

$Rv = 89cf$

* $K = 0.17 in/hr$

Bottom Area = 222sf

$$\frac{89cf}{(0.17in/hr \times \frac{1}{12})(222sf)} = 28.3hrs$$

28.3hrs < 72hrs ✓OKAY

### Dry Well 5

$Rv = 80cf$

* $K = 0.17 in/hr$

Bottom Area = 200sf

$$\frac{80cf}{(0.17in/hr \times \frac{1}{12})(200sf)} = 28.2hrs$$

28.2hrs < 72hrs ✓OKAY

*K values based on Rawls Rates in Table 2.3.3 in Vol 3 chp 1
see appendix for TP Data

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JOB North Street Condominiums
SHEET NUMBER 4 OF 5
CALCULATED BY BCD DATE 2/19/09
CHECKED BY _____ DATE _____
SCALE

## Dry Well 6

$R_v = 16\,cf$

*$K = 0.17\,in/hr$

Bottom Area = 80 sf

$$\frac{16\,cf}{(0.17\,in/hr \div \frac{1}{12})(80\,sf)} = 14.1\,hrs$$

14.1 hrs < 72 hrs ✓OKAY

## Dry Well 7

$R_v = 16\,cf$

*$K = 0.17\,in/hr$

Bottom Area = 80 sf

$$\frac{16\,cf}{(0.17\,in/hr)(\frac{1}{12})(80\,sf)} = 14.1\,hrs$$

14.1 hrs < 72 hrs ✓OKAY

## Infiltration Trench

$R_v = 152\,cf$

*$K = 0.17\,in/hr$

Bottom Area = 695 sf

$$\frac{152\,cf}{(0.17\,in/hr)(\frac{1}{12})(695\,sf)} = 15.4\,hrs$$

15.4 hrs < 72 hrs ✓OKAY

## Dry Well 8

$R_v = 90\,cf$

*$K = 0.17\,in/hr$

Bottom Area = 224 sf

$$\frac{90\,cf}{(0.17\,in/hr \times \frac{1\,ft}{12\,in})(224\,sf)} = 28.4\,hrs$$

28.4 hrs < 72 hrs ✓OKAY

* K values based on Rawls Rates in Table 2.3.3 in Vol 3. chp 1 see appendix for table

The Berkshire Design Group, Inc.

4 Allen Place
Northampton, Massachusetts 01060

*Landscape Architecture*
*Civil Engineering*
*Planning*
*Urban Design*
*Environmental Services*

JOB North Street Condominiums
SHEET NUMBER 5 OF 5
CALCULATED BY BCD DATE 2/19/09
CHECKED BY _____ DATE _____
SCALE

## Capture Area

Total New impervious area = 47,959 sf

Impervious Area sent to infiltration system =

| | |
|---|---|
| 708 sf | Dry Well 1 |
| 1988 sf | Dry Well 2 |
| 1732 sf | Dry Well 3 |
| 2076 sf | Dry Well 4 |
| 1900 sf | Dry Well 5 |
| 765 sf | Dry Well 6 |
| 765 sf | Dry Well 7 |
| 5824 sf | Infiltration Trench |
| 1900 sf | Dry Well 8 |
| 17,658 sf | |

% of new impervious area to infiltration system =

$$100\% \times \frac{17,658\ sf}{47,959\ sf} = 36.8\%$$

Note: Due to high ground water and hydrologic group 'C' soils throughout the site, infiltration was could only be achieved to the maximum extent practicable.

# Appendix E – Proposed Stormwater Management System Operation & Maintenance Plan

# Proposed
# Stormwater Management System
# *Operation & Maintenance Plan*

## *During Construction*

The Contractor shall be responsible for inspection and maintenance during construction.

At all times, siltation fabric fencing and stakes sufficient to construct a sedimentation control barrier a minimum of 50 feet long will be stockpiled on the site in order to repair established barriers which may have been damaged or breached.

An inspection of all erosion control and stormwater management systems shall be conducted by the Contractor at least once a week and during all rain storms until the completion of construction. In case of any noted breach or failure, the Contractor shall immediately make appropriate repairs to any erosion control system and notify the engineer of any problems involving stormwater management systems.

A rain storm shall be defined as all or one of the following:

- Any storm in which rain is predicted to last for twelve consecutive hours or more.
- Any storm for which a flash flood watch or warning is issued.
- Any single storm predicted to have a cumulative rainfall of greater than one-half inch.
- Any storm not meeting the previous three thresholds but which would mark a third consecutive day of measurable rainfall.

The Contractor shall also inspect the erosion control and stormwater management systems at times of significant increase in surface water runoff due to rapid thawing when the risk of failure of erosion control measures is significant.

In such instances as remedial action is necessary, the Contractor shall repair any and all significant deficiencies in erosion control systems within two days.

The Conservation Commission shall be notified of any significant failure of stormwater management systems and erosion and sediment control measures and shall be notified of any release of pollutants to a water body (stream, brook, pond, etc.).

The Contractor shall remove the sediment from behind the fence of the sedimentation control barrier when the accumulated sediment has reached one-half of the original installed height of the barrier.

## *Post-Construction*

***Stormwater Management System Owner:***

The Owner,

Tofino Associates, Inc.
31 Campus Plaza Road
Hadley, MA 01035

shall own the stormwater management system.

***Party Responsible for Operation & Maintenance:***

The Owner,

Tofino Associates, Inc.
31 Campus Plaza Road
Hadley, MA 01035

shall operate and maintain the stormwater management system.

***Inspection & Maintenance Schedule:***

1) **Street Sweeping**
Street and parking area sweeping shall take place twice annually.

2) **Rain Garden**

A rain garden has been incorporated into the stormwater system to remove pollutants within the stormwater runoff. Both the pre-treatment stone diaphragm/sod system and bioretention areas should be inspected monthly for sediment build-up, litter and debris, structural damage and standing water. Inspect soil and repair eroded areas within the bioretention system monthly and re-mulch void areas as needed. Treat diseased vegetation as needed. Remove and replace dead vegetation at least once per year. Remove invasive species as needed to prevent them from spreading into the bioretention area. Replace mulch every year in the early spring. In the winter, it is important to ensure that snow is not plowed into the rain garden as this will cause the runoff to bypass the system without proper treatment.

**3) Detention Basin** (The following recommendations follow the MADEP Stormwater Policy guidelines.)

### *Inspections*

a. Initial six months of use.
Examine for stabilization and function, including determination of the duration of water standing in the basin, any sediment erosion, excessive compaction of soils, or low spots.

b. Twice per year.
Examine basin for the following: differential settlement, cracking, erosion, leakage, or tree growth on embankments, condition of riprap, sediment accumulation, and health of turf where applicable.

Any adverse conditions noted during any inspections shall be addressed by repair or reconsideration of design components.

### *Mowing and General Maintenance*

Occasional mowing (2 times per year min.) shall be performed on the side slopes and basin bottom where turf is present. Accumulated grass clippings and/or organic matter and trash and debris shall be removed. Any clogged surface areas can be loosened by deep tilling; tilled areas must be immediately revegetated. Tilling may be used in this manner for no more than two consecutive maintenance periods. Thereafter, sediment in the clogged areas shall be removed, liner material replaced, and revegetation established.

*Dredging/Sediment Removal*

Accumulated sediment shall be removed from the basin at five (5) year intervals, or as required to maintain the function of the stormwater management system as designed. During this process and until the disturbed sediment has settled, the outlet pipe shall be sealed so as to minimize the risk of conveying sediment beyond the basin.

### 3a) Subsurface Detention Basin

The subsurface portion of the detention basin should be visually inspected at least twice per year for sediment and debris accumulation in and around the inlet grate as well as within the structure itself. Sediments and debris should be removed and disposed of in accordance with local, state and federal guidelines and regulations.

### 4) Grassed Swales

Swales shall be mowed at least once per growing season to prevent establishment of woody growth and other undesirable plants that inhibit proper performance. Grass vegetation should not be cut shorter than 4". It is important not to engage in excessive mowing operations, as this keeps the grass too short and decreases the efficiency of the vegetation to reduce runoff borne sediments and velocities.

Sediment and debris shall be removed manually at least once per year before the vegetation is adversely impacted.

### 5) Hooded Catch Basin and/or Drain Manhole with Sump

Oil and water separators should be inspected at least four times per year and cleaned annually or more often if required. Oil and sediments should be removed and disposed of in accordance with local, state and federal guidelines and regulations. In the case of an oil or bulk pollutant release, the system must be cleaned immediately following the spill and the proper authorities notified.

### 6) Stormwater Treatment Chambers

The Stormwater Treatment System requires minimal routine maintenance; however, it is important that the system be properly inspected and cleaned when necessary in order to function at its best. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit, e.g. heavy winter sanding will cause the grit chamber to fill more quickly, but regular sweeping will slow accumulation. The water quality treatment system shall consist of **Storm***ceptor* or equal treatment chambers. For more detail of how the **Storm***ceptor* should be maintained see the **Storm***ceptor* Owner Manual.

### 7) Dry Wells

Dry wells basins have been incorporated into the stormwater system for the site to specifically receive roof runoff and, therefore, are not expected to receive large amounts of bulk sediments. Proper maintenance of roof gutters that drain to the system will help to protect the integrity of the infiltration basins. Sediments and

debris should be removed and disposed of in accordance with local, state and federal guidelines and regulations.

**8) Infiltration Trench**

Infiltration trenches require regular removal of accumulated sediment to maintain an optimal rate of infiltration. Pretreatment BMPs (Deep Sump Hooded Catch Basins) should be routinely inspected and cleaned at least twice a year to prevent sediment from entering the infiltration system. Inspect the infiltration trench after the first several rainfall events, after all major storms, and on regularly scheduled dates every six months. After large storms the trench should be inspected for ponding water through the observation well. If ponding is occurring this may indicate that the trench requires rehabilitation. To rehabilitate a trench all accumulated sediment must be stripped from the bottom, the bottom of the trench must be scarified and tilled to induce infiltration, and all of the stone aggregate and filter fabric or media must be removed and replaced. The grass on top of the trench should be mowed seasonally to maintain a level of no higher than 4 inches.

**8) Snow Removal & Management Plan**

General

The stormwater management system is designed to accommodate volumes from snow melt. Since plowed snow from paved surface may contain salts, sediment, oils and various pollutants, all snow melt from vehicular areas on the site shall be routed through the drainage system or removed from the site.

Principles

1. The Owner shall provide a copy of this plan and a schedule or vehicle rotation scheme to plowing contractors such that plowing may occur in an efficient manner. This may be altered based on employee schedules or severity or frequency of snow events.

2. No such snow shall be dumped or stockpiled directly into any resource area or within any area such that untreated snow melt may enter a resource area.

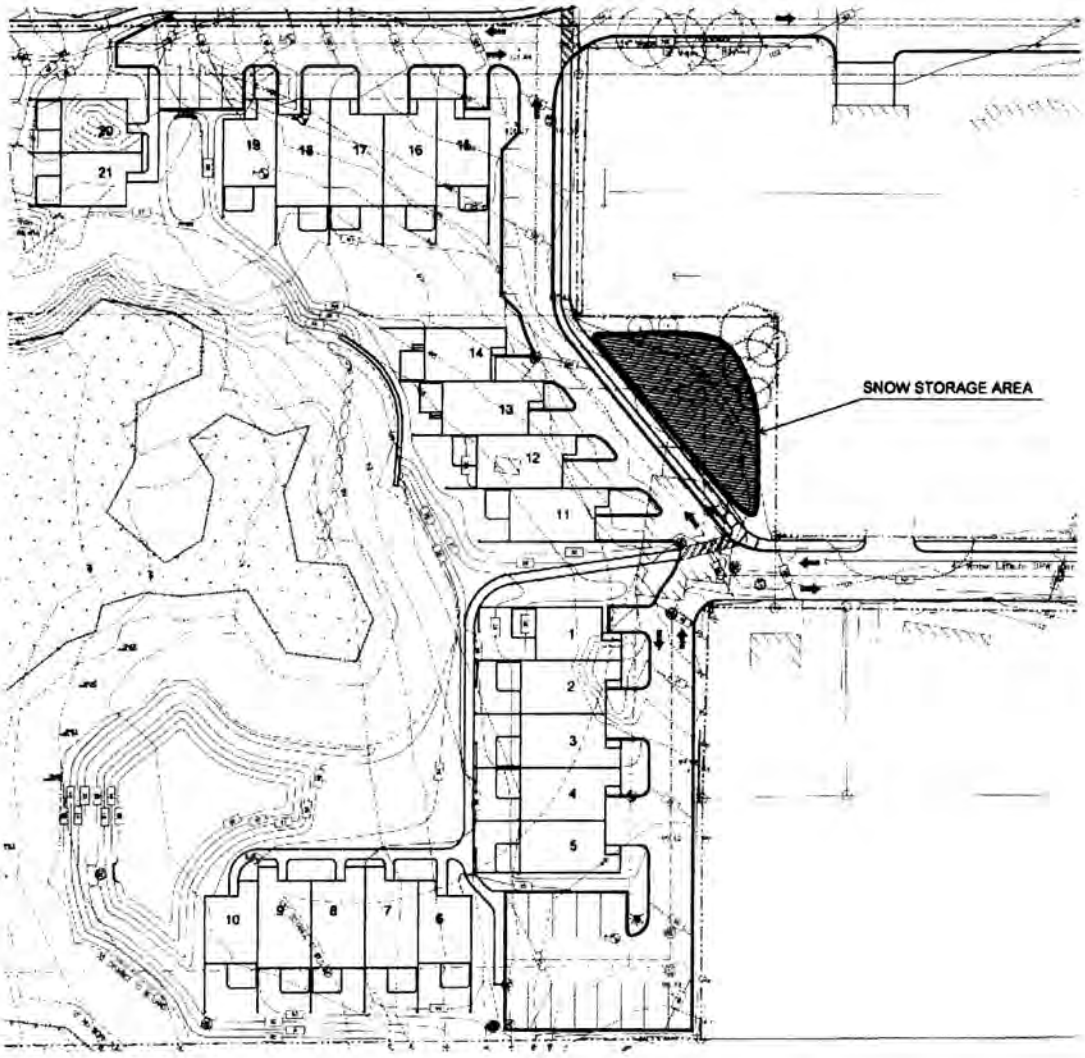
3. Snow removed from the site shall be disposed of such that it or its melt will have no adverse effect on other resource areas.

4. The Owner shall use alternative eco-friendly solutions throughout the site in place of standard de-icing materials.

5. The Conservation Commission and DPW shall be notified where a violation of this plan occurs.

6. See Figure 1 below depicting the snow stockpiling plan.

**Figure 1 – Snow Stockpiling Plan**



# INSPECTION AND MAINTENANCE REPORT FORM

For

North Street Condominiums – Stormwater Infrastructure

| *Inspection Schedule:* FORM TO BE COMPLETED PER SCHEDULE PRESENTED IN OPERATION & MAINTENANCE PLAN | |
|---|---|
| Inspector: | |
| Date: | Time: |
| Inspector's Qualifications: | |
| Days Since Last Rainfall: | |
| Amount of Last Rainfall (inches): | |

## *Catch Basins*

| CB | Is Surface Runoff Being Directed to Catch Basins Properly | Are Sediment Traps Installed at Catch Basin Inlets | Are Catch Basin Outlet Hoods Installed and Working Properly | Depth of Sediment in Basin Sump | Are Any Correction Measures Required |
|---|---|---|---|---|---|
| CB#1 | | | | | |
| CB#2 | | | | | |
| CB#3 | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Maintenance Required:**

| **To Be Performed By:** | **On or Before:** |
|---|---|

## STRUCTURAL CONTROLS –CON'T

*Stormwater Treatment Chambers*

| SWTC | Is Surface Runoff Being Directed Through SWTS Properly | Depth of Sediment in Basin Sump | Are Any Correction Measures Required |
|---|---|---|---|
| SWTC #1 | | | |
| | | | |

**Maintenance Required:**

| To Be Performed By: | On or Before: |
|---|---|

*Rain Garden*

| Structure | Is Structure Working Properly | Depth of Sediment in Structure | Are Any Correction Measures Required | Additional Notes |
|---|---|---|---|---|
| Stone/Grass Pretreatment | | | | |
| Rain Garden | | | | |

**Maintenance Required:**

| To Be Performed By: | On or Before: |
|---|---|

*Grassed Swale*

| Structure | Is Structure Working Properly | Depth of Sediment in Structure | Are Any Correction Measures Required | Additional Notes |
|---|---|---|---|---|
| Grass swale | | | | |
| | | | | |

**Maintenance Required:**

| To Be Performed By: | On or Before: |
|---|---|

*Surface Stormwater Detention Basin*

| Is Stormwater Entering Basin Correctly | Is Stormwater Being Detained and Discharged Properly | Depth of Sediment | Is Erosion Stabilization Properly Installed & Maintained | Is There Any Evidence of Erosion Or unintended Flow Patterns | Is Mowing Required |
|---|---|---|---|---|---|
| | | | | | |

*Sub-Surface Stormwater Detention Basin*

| Is Stormwater Entering Basin Correctly | Is Stormwater Being Detained and Discharged Properly | Depth of Sediment | Is Erosion Stabilization Properly Installed & Maintained | Is There Any Evidence of Erosion Or unintended Flow Patterns |
|---|---|---|---|---|
| | | | | |

**Maintenance Required:**

| To Be Performed By: | On or Before: |
|---|---|

*Dry Wells*

| Structure | Is Structure Working Properly | Are Any Correction Measures Required | Additional Notes |
|---|---|---|---|
| Dry Well 1 | | | |
| Dry Well 2 | | | |
| Dry Well 3 | | | |
| Dry Well 4 | | | |
| Dry Well 5 | | | |
| Dry Well 6 | | | |
| Dry Well 7 | | | |
| Dry Well 8 | | | |

**Maintenance Required:**

| To Be Performed By: | On or Before: |
|---|---|

## OTHER CONTROLS

*List Other Miscellaneous Controls and Observations*

| Item | Describe Failure/Inadequate Control | Describe Recommended Remedy |
|---|---|---|
| | | |
| | | |
| | | |
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| | | |

**Maintenance Required:**

| To Be Performed By: | On or Before: |
|---|---|

# Appendix F – Long Term Pollution Prevention Plan

# Long Term Pollution Prevention Plan

This plan was developed in compliance with the Massachusetts Department of Environmental Protection Stormwater requirements.

### *Good Housekeeping*

The proposed site is designed to maintain high water quality treatment for all runoff. A general maintenance plan has been prepared and will be followed in a strict and complete manner as required.

### *Spill Prevention Plan*

No hazardous materials are will be stored on site. However the following spill prevention plan will be incorporated into the Long Term Pollution Prevention Plan:

- Manufacturers' recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies.
- Materials and equipment necessary for spill cleanup will be kept in the on-site material storage area. Equipment and materials will include, but is not limited to, brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, sawdust and plastic and metal trash containers specifically for this purpose.
- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
- Spills of toxic or hazardous material will be reported, regardless of size, to the Massachusetts Department of Environmental Protection at 888-304-1133.
- Should a spill occur, the spill prevention plan will be adjusted to include measures to prevent another spill and to cleanup up the spill should another occur. A description of the spill, along with the causes and cleanup measures will be included in the updated spill prevention plan.
- The construction superintendent responsible for daily operation on the construction site will be the spill prevention and cleanup coordinator. The superintendent will designate at least three site personnel to receive spill prevention cleanup and training. These individuals will each become responsible for a particular phase of prevention and cleanup. The names of responsible spill personnel will be posted in the material storage area and in the on-site job trailer.

### *Stormwater BMP Maintenance*

A full stormwater operation and maintenance plan has been prepared (see Appendix D of this report) in order to ensure that the system will function properly throughout the year.

### *Landscape and Lawn Maintenance*

Routine mowing and associated maintenance of all landscape features will occur weekly or as needed to prevent excessive growth and debris from occurring on site.

***Solid Waste Management***
Solid waste is handled on site and will comply with all requirements on a local, state, and federal level.

***Parking/Road Area Maintenance***
Street sweeping shall occur 2-4 times per year. A snow management plan has been prepared (see Appendix D) to prevent dirty snow and salt from entering the resource area.

***Training of Staff***
All personnel on site will be well briefed on all requirements for implementing the Long Term Pollution Prevention Plan.

***Emergency Contact for Implementing Long Term Pollution Prevention Plan***

Tofino Associates, Inc.
31 Campus Plaza Rd
Hadley, MA 01035
413 256 0321

# Appendix G – Stormwater Pollution Prevention Plan

DRAFT

# Stormwater Pollution Prevention Plan

*Prepared in compliance with City of Northampton*
*Stormwater Management Permit*

***North Street Condominiums***
*Northern Avenue and North Street*
*Northampton, Massachusetts*

~~November 11, 2008~~
*Revised February 19, 2009*

**Prepared by:**
The Berkshire Design Group, Inc.
4 Allen Place, Northampton, Massachusetts 01060

**Prepared For:**
*Tofino Associates, Inc.*
*31 Campus Plaza Road*
*Hadley, MA 01035*

TABLE OF CONTENTS

## SITE & PROJECT DESCRIPTION

### Project Name and Location

Northern Avenue Housing
56 Northern Avenue
Northampton MA 01060

### Applicant/Owner Name and Address:

Tofino Associates, Inc.
31 Campus Plaza Road
Hadley, MA 01035

### Notification – Prior To Construction:

City of Northampton
Department of Public Works
30 Locust Street
Northampton, MA 01060

Mr. Douglas McDonald
NPDES Coordinator
Phone: 413-587-1582

### General Contractor/Operator:

To Be Determined

### Existing Zoning & Land Use & Site Area

The project parcel is zoned URB district and is located on the west side of Northern Avenue and north of North Street. The site currently contains a large wetland area to the west, with woods, grassed, and small roadway areas throughout the rest of site. The overall curve number in existing conditions is 74 and water flows in a westerly direction through the wetlands and to a small river located at the southwest portion of the property line (see figure 1 on page 3). The total area of the site is approximately 6 acres, of which approximately 2.44 acres will be disturbed by construction activities.

### Proposed Project

The proposed development includes 23 new housing units and associated parking areas, driveways, and sidewalks, utilities, landscape features and stormwater management system. A large wetland area exists on the west part of the site and will not be disturbed as a result of construction.

Stormwater management will consist of catch basins, manholes, a stormwater treatment chamber, a detention basin, dry wells, an infiltration trench, a rain garden and temporary erosion control devices during construction (see attached plan EC1). Treated stormwater discharge will flow into the wetlands as it does in existing conditions.

Soil disturbing activities will include: installation of erosion and sediment controls; tree removal and grubbing; grading; excavation for building foundation, utility trenches, and landscape features, and site grading; installation of retaining walls, curbs, fences/guardrails, light pole foundations; paving of driveways, walkways and parking areas; and preparation for final seeding and planting.

**Runoff Coefficient**

Drainage calculations for this project, developed using the SCS TR20 method, resulted in an SCS overall curve number (CN) of 79 for the proposed project site.

**Sequence of Major Construction Activities**

The general order of construction activities at the site will be as follows:

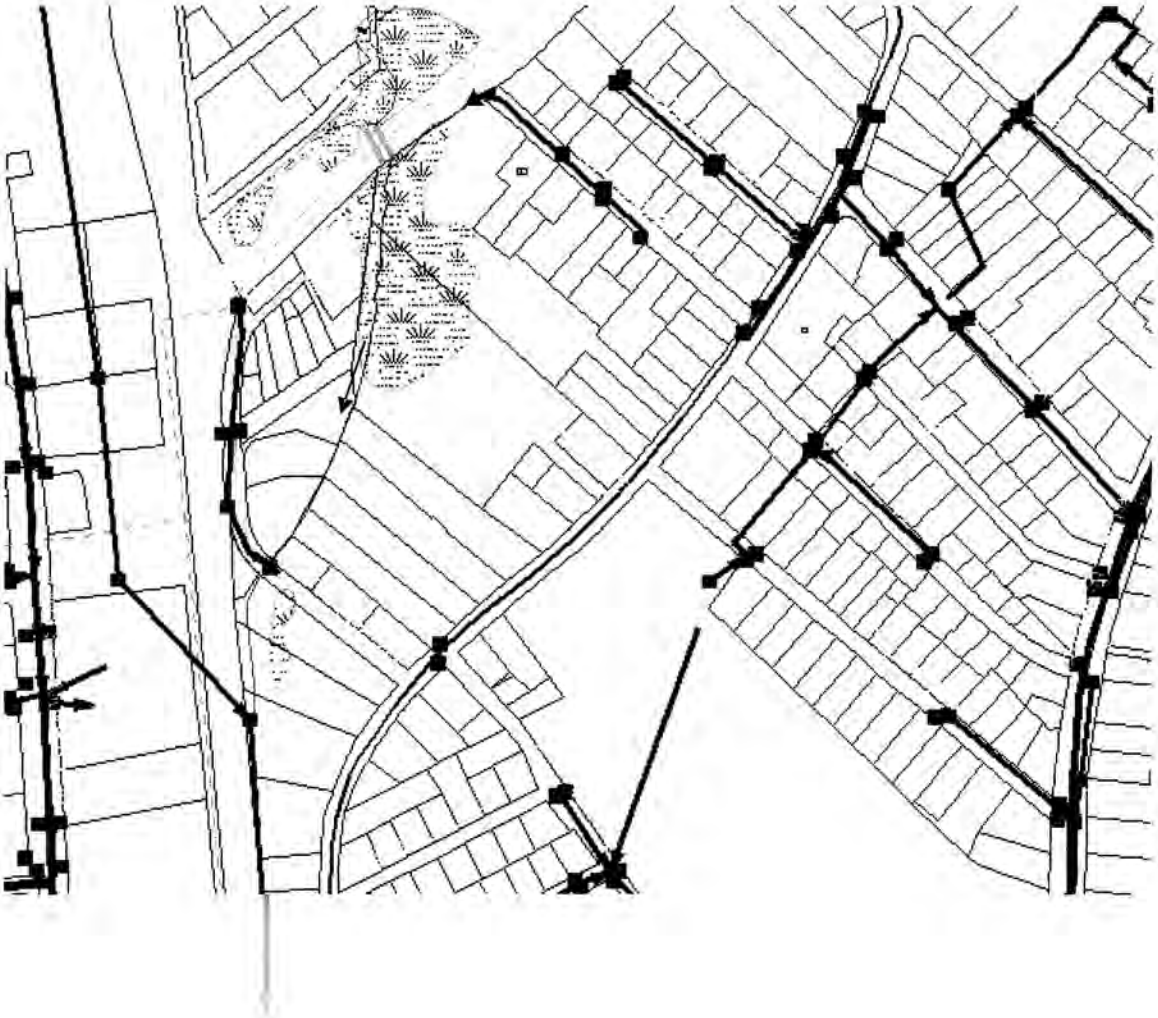
1. Hold preconstruction meeting at least one week prior to start of construction
2. Install stabilized construction entrances
3. Install perimeter sediment barrier in the following four steps:
    a. Field marking of the work limit/sediment barrier location.
    b. Review the marked locations by the approving authority, or the designer, as ordered by the Conservation Commission.
    c. Cutting and removal of vegetation in the area as necessary to allow equipment access for most effective sediment barrier installation (no stumping or grubbing of stumps)
    d. Installation of the sediment barrier, with equipment use as needed. No other work is permitted within 100 feet of the wetland until the Perimeter Sediment Barrier is installed.
4. Clear and grub for sedimentation basins
5. Construct detention basins and swales to be used as temporary sedimentation basins during construction activities
6. Convey overland flow directly to sedimentation basins until stormwater infrastructure is constructed
7. Continue clearing and grubbing
8. Stockpile topsoil
9. Install utilities, storm drainage structures and basins, and curbs.
10. Protect stormwater structure inlets with sediment control devices.
11. Install building foundations and construct buildings
12. Grade and apply gravel base to driveways, walkways, and roadways
13. Complete grading and install paving
14. Install permanent seeding and plantings
15. Remove sediments accumulated in sedimentation basin and in front of silt fence barrier
16. Remove silt fence barrier and reseed areas disturbed by its removal

17. Remove temporary sedimentation basin outlet piping. Grade and seed areas as specified on the grading and utility plans.
18. Clean and flush all drainage structures and lines
19. Schedule post construction conference and inspection

**Name of Receiving Waters**

The site ultimately to a stream which flows to Market Street Brook which is piped parallel to the railroad tracks all the way to the Old Mill River near the Waste Water Treatment Plant off of Hockanum Road. Please see figure 1 below depicting the stream flow direction.

Figure 1



## CONTROLS DURING CONSTRUCTION

### Erosion and Sediment Controls

***General Sedimentation Control Practices***

The following general erosion and sediment controls will be utilized during construction in order to maintain local water quality:

1. Erosion control barriers will be installed prior to clearing and excavation work.
2. Grading and other soil disturbance will be done so as to minimize erosion during wet seasons.
3. A temporary sedimentation basin with required controls will be constructed early in the project to allow the basin to treat runoff prior to discharging from the site.
4. Sediment will periodically be removed from behind sediment trapping devices and from within the temporary sedimentation basin.
5. The clearing of natural vegetation will be minimized; remaining natural vegetation will be protected from nearby construction to the greatest degree possible.
6. Staging and soil stockpile areas shall have a siltation fence or other approved barrier installed immediately downgradient of such areas.
7. Designated temporary dewatering basins will be used for dewatering.
8. Disturbed areas will be stabilized as soon as possible after construction.
9. Maintenance and cleaning of construction vehicles and equipment will take place in designated staging areas only.

***Stabilization Practices***

The following stabilization practices will be utilized during construction in order to maintain local water quality:

1. Temporary stabilization: temporary seeding, mulching or other suitable stabilization measures will be utilized to protect disturbed areas and stockpiles during prolonged construction periods.

2. Permanent stabilization: areas disturbed by construction will be permanently stabilized by paving with concrete or bituminous concrete, by installation of plant material, or by seeding and mulching with seed mix as described in the project specifications. Seeded areas will be covered with straw mulch or biodegradable netting in order to protect surface until seed germination.

***Structural Practices***

The following structural erosion and sediment controls will be utilized during construction in order to maintain local water quality:

1. Sediment Barriers: silt barriers will be installed along the downslope edge of areas of work.

   - Sediment will be removed from behind silt fence when it reaches half the original height of the fence.
   - Fences will be inspected weekly and both before and after storm events. Repairs and replacement will take place as necessary.

2. Dewatering Basins/collectors: Dewatering basins/collectors will be constructed where required prior to excavation activities. These basins will act to settle suspended solids from pumped groundwater.

   - Dewatering Basins and collectors will be sized according to the amount of groundwater encountered at a particular location.
   - Dewatering Basins will utilize a perforated standpipe wrapped in filter fabric for discharge

3. Catch Basin Filters: Filters consisting of silt sack and/or filter fabric fence, embedded 4-6" in the ground, will surround each existing and proposed catch basin. Filter fabric will also be installed under each inlet grate.

   - Filters will be placed around each catch basin prior to paving or planting.
   - Sediment will be removed when it reaches half of the original height of the filter.
   - Filter fabric under the inlet grate will be monitored and replaced as required.
   - Filters will be removed only after upgradient areas have been permanently stabilized.

4. Dust Control: Dust control will be maintained by sprinkler or water truck during construction to minimize sediment transport and maintain air quality at an acceptable level.

5. Roadway Stabilization: Until final paving takes place, project roadways and parking areas will be stabilized by grading with clean gravel. Emergency access and service roadways will be maintained as clean gravel surfaces. A temporary Stabilized Construction Access will be constructed prior to the start of excavation work.

**Stormwater Management**

A system for stormwater management has been designed for this project. The system, designed by a professional engineer, utilizes curbs and gutters, catch basins, a stormwater treatment chamber, a rain garden, an infiltration trench, dry wells, and a detention basin to reduce total suspended solids (TSS) equal to or in excess of 80% and ensure that peak flows for 2-, 10-, and

100-year storms remain at or below their estimated historic levels. Water from the project site will be discharged to the wetlands on the west part of the site as it does in existing conditions.

A maintenance plan for the stormwater management system has also been developed. The maintenance plan includes removal of oil and sediment from hooded catch basins, removal of oil and sediment from stormwater treatment chambers, clearing and mowing of debris for all basins, and annual sweeping of drives and parking lots.

## Other Controls

### *Waste Disposal*

Waste Materials: Waste materials will be collected and stored in a lidded metal dumpster rented from a licensed solid waste management company. All trash and construction debris will be stored in the dumpster. The dumpster will be emptied at least twice a week, or more if necessary, and disposed of in accordance with local, state and federal regulation. No construction waste materials will be buried on site. Notices stating these procedures will be posted in the job trailer. Site personnel will be instructed in these procedures and site construction supervisor(s) will ensure that the procedures are followed.

Hazardous Waste: Hazardous waste will be disposed of in the manner specified by local, state and federal regulation or by the manufacturer. Site personnel will be instructed in these procedures and site construction supervisor(s) will ensure that the procedures are followed.

Sanitary Waste: Sanitary waste will be collected from portable units a minimum of three times per week by a licensed sanitary waster contractor and disposed of in accordance with local, state and federal regulation.

### *Off-Site Vehicle Tracking*

A stabilized construction entrance will be provided to help reduce tracking of sediments off the site. Stone will be used, which will be large enough not to become embedded in truck tires, at the entrance. The paved street adjacent to the construction entrance will be swept daily to reduce mud, dirt or sediment tracked from the site. Dump trucks hauling material to and from the site will be covered by tarps as necessary.

## Timing of Controls

As indicated in the Sequence of major Activities, silt fence barrier, stabilized construction entrance and sedimentation basin will be constructed prior to clearing or grading of any other portions of the site. No excavation or dewatering activities will take place in an area until appropriate dewatering basins or sediment control structures have been installed. Areas where construction activity temporarily ceases for more than 21 days will be stabilized with temporary seed and mulch within 14 days of the last disturbance. Once construction activity ceases permanently in an area that area will be stabilized with plant material or pavement as indicated in

the plans. After the entire site is stabilized, the accumulated sediment will be removed from the sediment basin.

## MAINTENANCE AND INSPECTION PROCEDURES

### Erosion and Sediment Control Inspection and Maintenance Practices

The following inspection and maintenance practices will be utilized in this project to maintain sediment and erosion controls:

- All control measures will be inspected weekly (at a minimum) and within 24 hours after any storm event of 0.5 inches or greater.
- All measures will be maintained in good working order; if a repair is necessary, it will be initiated within 48 hours of report.
- Contractor will stockpile on site or make available all equipment, materials (e.g. filter fabric, crushed stone, etc.) and labor necessary to make emergency erosion control improvements within 24 hours if necessary.
- Built-up sediment will be removed from silt fence when it has reached one-third the height of the fence.
- Silt fence will be inspected for depth of sediment, tears, to verify that fabric is securely attached to the stakes and to verify that stakes are firmly in the ground.
- Sediment basin(s) will be inspected for depth of sediment, and accumulated sediment will be removed when it reaches 10 percent of the design capacity or at the end of the job.
- Temporary and permanent seeding will be inspected for bare spots, washouts and healthy growth.
- A maintenance inspection report will be made after each inspection.
- The site contractor will select one or more individuals who will be responsible for inspections, maintenance and repair activities and for completing inspection and maintenance reports.
- Individuals selected for inspection and maintenance responsibilities will receive training in all inspection and maintenance practices necessary for keeping the on-site erosion and sediment controls in good working order.

### Non-Stormwater Discharges

It is expected that the following non-stormwater discharges will occur from the site during the construction period:

- Water from water line flushings.
- Pavement wash waters (where no spills or leaks of toxic or hazardous chemicals have occurred.
- Uncontaminated groundwater from dewatering excavations.
- Water from washing the exterior of construction vehicles.

Non-stormwater discharges will be directed to stabilized surfaces or the detention basin prior to discharge. Exterior washing and rinsing of vehicles will take place more than 100 feet from wetlands or waterways.

**Inventory for Pollution Prevention Plan**

| | |
|---|---|
| Asphalt | Masonry block |
| Cleaning solvents | Metal studs |
| Concrete | Paints (enamel and latex) |
| Detergents | Petroleum-based products |
| Fertilizers | Solvents |
| Gravel | Wood |

**Spill Prevention**

All employees will be instructed regarding the following spill prevention practices. Notice of these practices will be posted in the job trailer, and the site construction supervisor will hold responsibility for ensuring that the procedures are followed.

***Material Management Practices***
The following material management practices will be used to reduce the risk of spills or other accidental exposure of materials and substances to stormwater runoff:

***Good Housekeeping***
The following good housekeeping practices will be followed on-site during the construction period:

An effort will be made to store only enough product to do the job.
All materials stored on-site will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
Products will be kept in their original containers with the original manufacturer's label.
Substances will not be mixed with one another unless recommended by the manufacturer.
Whenever possible, all of a product will be used up before disposing of the container.
Manufacturer's recommendations for proper used and disposal will be followed.
The site superintendent will inspect daily to ensure proper use and disposal of material on-site.

***Hazardous Products***
The following practices will reduce the risks associated with hazardous materials (e.g. petroleum products, solvents, etc.):

- Products will be kept in original containers unless they are not resealable.
- Original labels and material safety data sheets (MSDS) will be retained; they contain important product information.
- A copy of the Material Safety Data Sheet (MSDS) for each product used in construction will be kept in the job trailer.
- If surplus product must be disposed of, manufacturer' or local- and state-recommended methods for proper disposal will be followed.

***Product Specific Practices***

*Petroleum Products*: All on-site vehicles will be monitored for leaks and will receive regular preventative maintenance to reduce the chance of leakage. Petroleum products will be stored in tightly sealed, clearly labeled containers. Any asphalt substances used on-site will be applied according to the manufacturer's recommendations. No vehicle refueling or maintenance will take place within 100 feet of a wetland or waterway. No petroleum-based or asphalt substances will be stored within 100 feet of a wetland or waterway.

*Fertilizers*: Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to stormwater. Unused fertilizer will be stored in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills. No fertilizers will be stored within 100 feet of a wetland or waterway.

*Solvents, Paints and Other Hazardous Substances*: All containers will be tightly sealed when not required for use. Excess material will not be discharged to the storm sewer system but will be properly disposed of according to manufacturers' instruction or local and state regulations. No solvents, paints or other hazardous substances will be stored within 100 feet of a wetland or waterway.

*Concrete Trucks*: Concrete trucks will not be allowed to wash out or discharge surplus concrete or drum wash water on the site.

**Spill Control Practices**

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup:

- Manufacturers' recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies.
- Materials and equipment necessary for spill cleanup will be kept in the on-site material storage area. Equipment and materials will include, but is not limited to, brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, sawdust and plastic and metal trash containers specifically for this purpose.
- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
- Spills of toxic or hazardous material will be reported, regardless of size, to the Massachusetts Department of Environmental Protection at 888-304-1133.
- Should a spill occur, the spill prevention plan will be adjusted to include measures to prevent another spill and to cleanup up the spill should another occur. A description of

the spill, along with the causes and cleanup measures will be included in the updated spill prevention plan.

- The construction superintendent responsible for daily operation on the construction site will be the spill prevention and cleanup coordinator. The superintendent will designate at least three site personnel to receive spill prevention cleanup and training. These individuals will each become responsible for a particular phase of prevention and cleanup. The names of responsible spill personnel will be posted in the material storage area and in the on-site job trailer.

## CERTIFICATION OF COMPLIANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS

This stormwater pollution prevention plan reflects State of Massachusetts requirements for stormwater management and sediment and erosion control as established by the *Wetlands Protection Act* (310 CMR 10.00) and by the Department of Environmental Protection *Stormwater Management Policy*. To ensure compliance, this plan was prepared in consultation with the following publications:

Commonwealth of Massachusetts, Department of Environmental Protection. *Stormwater Management Policy*. November 1997.

Commonwealth of Massachusetts, Department of Environmental Protection. *Wetlands Protection Act Regulations: 310 CMR 10.00 for Administering M.G.L. Chapter 31, Section 40.* November 1997.

Commonwealth of Massachusetts, Department of Environmental Protection and Office of Coastal Zone Management. *Stormwater Management, Volume One: Stormwater Policy Handbook.* March 1997.

Commonwealth of Massachusetts, Department of Environmental Protection and Office of Coastal Zone Management. *Stormwater Management, Volume Two: Stormwater Technical Handbook.* March 1997.

United States Environmental Protection Agency. *Storm Water Management For Construction Activities, Developing Pollution Prevention Plans And Best Management Practices, Summary Guidance.* October 1992.

## POLLUTION PREVENTION PLAN CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: _____

## CONTRACTOR'S CERTIFICATION

I certify under penalty of law that I understand the terms and conditions of the general National Pollutant Discharge Elimination System (NPDES) permit that authorizes the stormwater discharges associated with industrial activity from the construction site identified as part of this certification.

| **Signature** | **Company** | **Responsible For** |
|---|---|---|
| _____ | _____ | _____ |
| | _____ | _____ |
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# STORMWATER POLLUTION PREVENTION PLAN
# INSPECTION AND MAINTENANCE REPORT FORM
For
North Street Condominiums

*Inspection Schedule:*
FORM TO BE COMPLETED EVERY 7 DAYS
(General Permit Section 3.10 Inspections)

| | |
|---|---|
| Inspector: | |
| Date: | Time: |
| Inspector's Qualifications: | |
| Days Since Last Rainfall: | |
| Amount of Last Rainfall (inches): | |

## STABILIZATION MEASURES

| Area of Site | Date Since Last Disturbed | Date of Next Disturbance | Stabilized? (Yes/No) | Stabilized With | Condition |
|---|---|---|---|---|---|
| Access Drive | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Stabilization Required:**

| | |
|---|---|
| **To Be Performed By:** | **On or Before:** |

# STRUCTURAL CONTROLS

## *Entrance Tracking Pad*

| Is Sediment Tracking Pad Catching Sediment Before Collector Road | Is Gravel Clean or Filled With Sediment | Is Tracking Pad Width and Length Adequate to be Effective | Does Tracking Pad Require Replacement/Maintenance |
|---|---|---|---|
| | | | |

**Maintenance Required:**

| To Be Performed By: | On or Before: |
|---|---|

## *Catch Basins*

| CB | Is Surface Runoff Being Directed to Catch Basins Properly | Are Sediment Traps Installed at Catch Basin Inlets | Are Catch Basin Outlet Hoods Installed and Working Properly | Depth of Sediment in Basin Sump | Are Any Correction Measures Required |
|---|---|---|---|---|---|
| CB#1 | | | | | |
| CB#2 | | | | | |
| CB#3 | | | | | |
| | | | | | |
| | | | | | |

**Maintenance Required:**

| To Be Performed By: | On or Before: |
|---|---|

## STRUCTURAL CONTROLS –CON'T

*Stormwater Treatment Chambers*

| SWTC | Is Surface Runoff Being Directed Through SWTC Properly | Depth of Sediment in Basin Sump | Are Any Correction Measures Required |
|---|---|---|---|
| SWTC #1 | | | |
| | | | |

**Maintenance Required:**

| To Be Performed By: | On or Before: |
|---|---|

*Rain Garden/ Infiltration Trench*

| Structure | Is Structure Working Properly | Depth of Sediment in Structure | Are Any Correction Measures Required | Additional Notes |
|---|---|---|---|---|
| Rain Garden | | | | |
| Infiltration Trench | | | | |

**Maintenance Required:**

| To Be Performed By: | On or Before: |
|---|---|

*Surface Stormwater Detention Basin*

| Is Stormwater Entering Basin Correctly | Is Stormwater Being Detained and Discharged Properly | Depth of Sediment in Spreader | Is Erosion Stabilization Properly Installed & Maintained | Is There Any Evidence of Erosion Or unintended Flow Patterns |
|---|---|---|---|---|
| | | | | |

**Maintenance Required:**

| To Be Performed By: | On or Before: |
|---|---|

*Subsurface Stormwater Detention Basin*

| Is Stormwater Entering Basin Correctly | Is Stormwater Being Detained and Discharged Properly | Depth of Sediment in Spreader | Is Erosion Stabilization Properly Installed & Maintained | Is There Any Evidence of Erosion Or unintended Flow Patterns |
|---|---|---|---|---|
| | | | | |

**Maintenance Required:**

| To Be Performed By: | On or Before: |
|---|---|

*Dry Wells*

| Structure | Is Structure Working Properly | Are Any Correction Measures Required | Additional Notes |
|---|---|---|---|
| Dry Well 1 | | | |
| Dry Well 2 | | | |
| Dry Well 3 | | | |
| Dry Well 4 | | | |
| Dry Well 5 | | | |
| Dry Well 6 | | | |
| Dry Well 7 | | | |
| Dry Well 8 | | | |

**Maintenance Required:**

| To Be Performed By: | On or Before: |
|---|---|

## OTHER CONTROLS

*List Other Miscellaneous Controls and Observations*

| Item | Describe Failure/Inadequate Control | Describe Recommended Remedy |
|---|---|---|
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## RECOMENDED MODIFICATION(S) TO SWPPP

**CHANGES REQUIRED TO THE POLLUTION PREVENTION PLAN**

**REASONS FOR CHANGES:**

**MISCELLANEOUS COMMENTS:**

**INSPECTOR'S CERTIFICATION:**

**Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.**

| **Signature:** | **Date:** |
|---|---|