STORMWATER REPORT

FOR

MAP U42, PARCEL 9-2
BEHIND 80 KING STREET

IN

LITTLETON,
MASSACHUSETTS

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CDG Project # 5770
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1.0 Project Narrative

1.1 Project Type

The proposed project includes the development of the 4.4-acre site located off King Street in the town of Littleton. The site will consist of 17 elderly housing apartment units including on-site parking and a stormwater drainage system.

1.2 Purpose and Scope

This report has been prepared to comply with the requirements of the Stormwater Management Standards incorporated in the Massachusetts Wetlands Protection Act Regulations, 310 CMR 10.00. These standards are intended to promote increased groundwater recharge and prevent stormwater discharges from causing or contributing to the pollution of surface waters and ground waters of the Commonwealth. The standards aim to accomplish these goals by encouraging the greater use of low impact development techniques and improving the operation and maintenance of stormwater best management practices.

This report addresses compliance of the proposed development with each of the ten stormwater standards, it provides calculations to support the compliance information, and it provides an Operation and Maintenance Plan and Long Term Pollution Prevention Plan for the stormwater management system.

1.3 Proposed Development

As mentioned, the proposed project is the development of 17 elderly housing apartments with associated driveways and a road. The project is being proposed pursuant to the Senior Residential Development and Aquifer & Water Resource District Special Permits.

The proposed road will have access off King Street approximately 100 feet east of the existing entrance to The Minor Chord music shop. The site will have access for municipal water and sewer so on-site wells and septic systems are not necessary.

1.4 LID Measures

Care has been taken to lay out the proposed site in a manner that works with existing topography. BMPs such as an infiltration basin and subsurface chambers are used to manage the stormwater runoff. Stormwater from the impervious areas are routed via curb and gutter systems and storm drains to an infiltration basin or subsurface chambers which contain sediment forebays for pretreatment. These systems will be used to promote groundwater recharge and limit the runoff.
1.5 Site Description

The current property consists of 2 acres of wooded area and 2.4 acres of grass area. The site is located on King Street approximately 0.5 miles west of I-495. The abutting properties consist of residential homes, a commercial building, a church and a school.

There are no wetlands located on or around the site. The topography of the site resembles a bowl shape with relatively flat slopes in the middle and steeper slopes along the outside, all draining towards one of two low points on site.

The Natural Resource Conservation Service (NRCS) soil survey information indicates that the site is underlain by soils classified as belonging to Hydrologic Soil Groups A.

1.6 Proposed Stormwater Management System

Runoff from the proposed impervious areas will be conveyed and treated through a combination of BMP’s and infiltrated to the groundwater. The infiltration will help to recharge the groundwater and ensure that the proposed development will not cause any off-site flooding. The following is a brief discussion of each conveyance and treatment BMP proposed.

Deep Sump Hooded Catch Basin
Deep sump hooded catch basins are proposed to convey the runoff from the proposed paved areas and roofs to the subsurface infiltration chambers. These catch basins will discharge to manholes and conventional storm drains.

Subsurface Infiltration Chambers
Four subsurface infiltration systems are included on site. Cultec pre-fabricated chambers, model 280HD, will be installed to collect the run off from a portion of the roofs and pavement after pretreatment in the deep sump hooded catch basins. A drainage manhole will be installed with a weir to direct flow into the first row of chambers. These chambers will be wrapped in a geotextile fabric and will act as a sediment forebay for additional pre-treatment. The infiltration systems will provide recharge for the groundwater as well. The chambers have been designed to accommodate the runoff associated with the 100-year storm event.
1.7 **Methods of Analysis**

United States Department of Agriculture Natural Resources Conservation Service (NRCS) soil cover complex methods (TR-20) were employed to compute runoff quantities for the subject property and, where appropriate, adjacent property that drains toward a common discharge point with runoff from the subject site. HydroCAD 10.0 computer software was employed in this hydrologic analysis. Due to the existing topography of the site, all runoff from the proposed property and adjacent properties collect at one of two low points on site. A pre- and post-development analysis was performed to determine that there will be no flooding in the existing low points during the 24-hour rainfall events of the 2-, 10-, 25-, 50- and 100-year return frequencies. Watershed boundaries for existing conditions are depicted on the attached Pre-development Watershed Plan. Post-Developed watershed boundaries are indicated on the Post-Development Watershed Plan.
2.0 Stormwater Standards Compliance

2.1 Standard 1 – Untreated Discharges

The stormwater management system for the proposed development will not result in any new discharges of untreated stormwater to wetland resource areas. Stormwater management structures have been designed such that there is no erosion or scour to wetland resource areas or waters of the Commonwealth.

2.2 Standard 2 – Peak Rate Attenuation

The stormwater management system for the proposed development will employ four subsurface infiltration chamber areas and an infiltration basin that have been sized to retain and recharge the runoff related to a 100-year, 24-hour rainfall event.

Hydrologic calculations for existing and proposed site conditions are included in Appendices D and E respectively. Calculations for 24-hour rainfall events of 2-, 10-, 25-, 50- and 100-year return frequencies are provided. For all rainfall events considered, the proposed stormwater management system will control runoff from the development such that corresponding water levels at the existing low points will not cause any off or on-site flooding.

2.3 Standard 3 – Recharge

As discussed in the Introduction, Natural Resource Conservation Service data indicates that the areas within the proposed development consist of soils from Hydrologic Group A.

Four subsurface infiltration chamber areas and a stormwater infiltration basin have been designed to provide infiltration of the required recharge and water quality volumes. Recharge calculations can be found in Appendix F.

2.4 Standard 4 – Water Quality

A total of 85% TSS removal was achieved using BMPs. As part of the proposed project, infiltration requires a minimum of 44% TSS removal provided prior to discharge. Two TSS calculation sheets have been provided. The sheet with a deep sump catch basin into a sediment forebay shows proper pre-treatment before entering the subsurface infiltration chambers. The sheet with deep sump catch basin into an infiltration basin shows there is enough TSS removal within the whole system. See Appendix F for detailed calculations.

2.5 Standard 5 – Land Uses with Higher Pollutant Loads

The current and proposed uses of the subject site do not constitute land use with
higher potential pollutant load, thus Standard 5 does not apply to the proposed project.

**Standard 6 – Critical Areas**

The proposed project does not involve a stormwater discharge within or near to any of the areas defined as “Critical Areas” at 314 CMR 9.02 and 310 CMR 10.04.

2.6 **Standard 7 – Redevelopment**

The project does not qualify for redevelopment provisions.

2.7 **Standard 8 – Construction Period Pollution Prevention and Erosion and Sediment Control**

Because the project is subject to the filing of an Environmental Protection Agency Notice of Intent (EPA NOI), the Stormwater Pollution Prevention Plan (SWPPP) will be prepared prior to construction. This document will be prepared to satisfy the requirements of the EPA NOI and the Standard 8 Construction Period Pollution prevention and Erosion and Sedimentation Control Plan.

2.8 **Standard 9 – Operation and Maintenance Plan**

Refer to Appendix G for a complete copy of the Stormwater Operation and Maintenance Plan.

2.9 **Standard 10 – Prohibition of Illicit Discharges**

An illicit discharge statement will be prepared after approvals are received and prior to construction.
APPENDIX A

Locus Map
APPENDIX B

Checklist for Stormwater Report Checklist
A. Introduction

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. 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
- 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.

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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.
B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer’s Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

☑ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment
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): Infiltration Basin, Subsurface Infiltration Chambers

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 (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

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

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume only to the maximum extent practicable for the following reason:
   ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
   ☒ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
   ☒ Solid Waste Landfill pursuant to 310 CMR 19.000
   ☒ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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1 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.
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 LUHPPPL;
- 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 (continued)

Standard 4: Water Quality (continued)

☑ The BMP is sized (and calculations provided) based on:
  ☑ The ½” or 1” Water Quality Volume or
  ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

☐ Critical areas and BMPs are identified in the Stormwater Report.
Checklist (continued)

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

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

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

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

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

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

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

☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.
Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

☐ Name of the stormwater management system owners;

☐ Party responsible for operation and maintenance;

☒ Schedule for implementation of routine and non-routine maintenance tasks;

☒ Plan showing the location of all stormwater BMPs maintenance access areas;

☒ Description and delineation of public safety features;

☐ Estimated operation and maintenance budget; and

☐ Operation and Maintenance Log Form.

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

☐ A copy of the legal instrument (deed, homeowner’s association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;

☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

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

☐ An Illicit Discharge Compliance Statement is attached;

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

NRCS Soils Data
MAP LEGEND

Area of Interest (AOI)

Soils
Soil Rating Polygons
A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features
Streams and Canals

Transportation
Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background
Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 17, Oct 6, 2017

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

Date(s) aerial images were photographed: Aug 29, 2014—Sep 19, 2014

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

<table>
<thead>
<tr>
<th>Map unit symbol</th>
<th>Map unit name</th>
<th>Rating</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>254B</td>
<td>Merrimac fine sandy loam, 3 to 8 percent slopes</td>
<td>A</td>
<td>37.2</td>
<td>43.7%</td>
</tr>
<tr>
<td>259A</td>
<td>Carver loamy coarse sand, 0 to 3 percent slopes</td>
<td>A</td>
<td>9.6</td>
<td>11.2%</td>
</tr>
<tr>
<td>262B</td>
<td>Quonset sandy loam, 3 to 8 percent slopes</td>
<td>A</td>
<td>1.1</td>
<td>1.3%</td>
</tr>
<tr>
<td>262C</td>
<td>Quonset sandy loam, 8 to 15 percent slopes</td>
<td>A</td>
<td>23.8</td>
<td>28.0%</td>
</tr>
<tr>
<td>262D</td>
<td>Quonset sandy loam, 15 to 25 percent slopes</td>
<td>A</td>
<td>10.2</td>
<td>12.0%</td>
</tr>
<tr>
<td>307C</td>
<td>Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony</td>
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<tr>
<td>656</td>
<td>Udorthents-Urban land complex</td>
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<td>3.0</td>
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<td><strong>Totals for Area of Interest</strong></td>
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<td><strong>85.1</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher
APPENDIX D

Existing Conditions – Hydrologic Calculations
APPENDIX E

Proposed Conditions – Hydrologic Calculations
APPENDIX F

Recharge Volume / Water Quality Volume / TSS Removal / Mounding Calculations
**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.

**Location:**
88 King Street, Littleton MA

<table>
<thead>
<tr>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMP</td>
<td>TSS Removal Rate</td>
<td>Starting TSS Load*</td>
<td>Amount Removed (C*D)</td>
<td>Remaining Load (D-E)</td>
</tr>
<tr>
<td>Deep Sump and Hooded Catch Basin</td>
<td>0.25</td>
<td>1.00</td>
<td>0.25</td>
<td>0.75</td>
</tr>
<tr>
<td>Infiltration Basin</td>
<td>0.80</td>
<td>0.75</td>
<td>0.60</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.15</td>
<td>0.00</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.15</td>
<td>0.00</td>
<td>0.15</td>
</tr>
</tbody>
</table>

**Total TSS Removal =** 85%

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

**Location:**

<table>
<thead>
<tr>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMP&lt;sup&gt;1&lt;/sup&gt;</td>
<td>TSS Removal Rate&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Starting TSS Load*</td>
<td>Amount Removed (C*D)</td>
<td>Remaining Load (D-E)</td>
</tr>
<tr>
<td>Deep Sump and Hooded Catch Basin</td>
<td>0.25</td>
<td>1.00</td>
<td>0.25</td>
<td>0.75</td>
</tr>
<tr>
<td>Sediment Forebay</td>
<td>0.25</td>
<td>0.75</td>
<td>0.19</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.56</td>
<td>0.00</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.56</td>
<td>0.00</td>
<td>0.56</td>
</tr>
</tbody>
</table>

**Total TSS Removal =** 44%

**Project:** Fields
**Prepared By:** JPL
**Date:** 9-Oct-18

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

Separate form needs to be completed for each outlet or BMP train.
CALCULATIONS

Recharge Volume, \( R_v \):

\[
R_v = A_c \times F
\]

<table>
<thead>
<tr>
<th>Hydrologic Soil Group</th>
<th>Impervious Area (Ac) (^1)</th>
<th>Target Depth (F)</th>
<th>Recharge Volume (Rv) Ac-feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.312</td>
<td>0.6</td>
<td>0.016</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.312</td>
<td>0.6</td>
<td>0.016</td>
</tr>
</tbody>
</table>

\(^1\) See "POST B" subcatchment

Total Recharge Volume Required = 0.016 Ac-ft

Table 2.3.2: Recharge Target Depth by Hydrologic Soil Group

<table>
<thead>
<tr>
<th>NRCS Hydrologic Soil Group</th>
<th>Approx. Soil Texture</th>
<th>Target Depth Factor (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>sand</td>
<td>0.6 inch</td>
</tr>
<tr>
<td>B</td>
<td>loam</td>
<td>0.35 inch</td>
</tr>
<tr>
<td>C</td>
<td>silty loam</td>
<td>0.25 inch</td>
</tr>
<tr>
<td>D</td>
<td>clay</td>
<td>0.1 inch</td>
</tr>
</tbody>
</table>

Total Recharge Volume Required (Rv) = 680 C.ft

Recharge Vol. Provided (from Infl. Area 1) = 2,636.0 C.ft

Required Sediment Forebay vol, \( F_v \):

\[
F_v = A_c \times (u \times f) \times 0.1 \text{ inch of impervious area}
\]

\(^1\) Imp. area captured by ponds, \( A_p = 0.312 \) Ac

Required Sediment Forebay vol, \( F_v = 113 \) C.ft

Sediment Volume Provided = 771 C.ft

REFERENCES

Table 2.3.3: 1982 Rawls Rates

<table>
<thead>
<tr>
<th>Texture Class</th>
<th>NRCS Hydrologic Soil Group</th>
<th>Infiltration Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Sand</td>
<td>A</td>
<td>8.27 in/hr</td>
</tr>
<tr>
<td>2 Loamy Sand</td>
<td>A</td>
<td>2.41 in/hr</td>
</tr>
<tr>
<td>3 Sandy Loam</td>
<td>B</td>
<td>1.02 in/hr</td>
</tr>
<tr>
<td>4 Loam</td>
<td>B</td>
<td>0.52 in/hr</td>
</tr>
<tr>
<td>5 Silt Loam</td>
<td>C</td>
<td>0.27 in/hr</td>
</tr>
<tr>
<td>6 Sandy Clay Loam</td>
<td>C</td>
<td>0.17 in/hr</td>
</tr>
<tr>
<td>7 Clay Loam</td>
<td>D</td>
<td>0.09 in/hr</td>
</tr>
<tr>
<td>8 Silty Clay Loam</td>
<td>D</td>
<td>0.06 in/hr</td>
</tr>
<tr>
<td>9 Sandy Clay</td>
<td>D</td>
<td>0.05 in/hr</td>
</tr>
<tr>
<td>10 Silty Clay</td>
<td>D</td>
<td>0.04 in/hr</td>
</tr>
<tr>
<td>11 Clay</td>
<td>D</td>
<td>0.02 in/hr</td>
</tr>
</tbody>
</table>

NOTES:

Input Values

\(^1\) = Refer to Proposed Conditions HydroCAD modeling report
Infiltration Area #2
Stormwater Recharge Calculations

CALCULATIONS

Recharge Volume, \( R_v \):

\[
R_v = A_i \times F
\]

<table>
<thead>
<tr>
<th>Hydrologic Soil Group</th>
<th>Impervious Area (Ac)</th>
<th>Target Depth (F)</th>
<th>Recharge Volume (Rv) Ac-feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.407</td>
<td>0.6</td>
<td>0.020</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.407</td>
<td>0.6</td>
<td>0.020</td>
</tr>
</tbody>
</table>

*Half of "POST C" subcatchment impervious area

Total Recharge Volume Required = 0.020 Ac-ft
Total Recharge Volume Required (Rv) = 886 C.ft
Recharge Vol. Provided (from Infl. Area 2) = 2,557.0 C.ft

Required Sediment Forebay vol, \( F_v \):

\[
F_v = A_p (0.020) \times 0.1 \text{ inch of impervious area}
\]

\( A_p = 0.407 \text{ Ac} \)

Required Sediment Forebay vol, \( F_v \) = 42.6 C.ft

Drawdown Calculations

Proposed Infiltration Area Calculations:

\[
\text{Drawdown} = \frac{R_v}{(\text{Rawls Rate})(\text{Bottom Area})}
\]

Drawdown Calculations:

<table>
<thead>
<tr>
<th>Soil Texture</th>
<th>1 Sand</th>
</tr>
</thead>
</table>

Bottom Surface Area (A) = 1,260 SF
Rawls Rate = 8.27 in/hr
Total Recharge Volume Required = 886 C.ft
Drawdown = 1.02 hr

Drawdown is less than 72 Hours as Required

REFERENCES

Table 2.3.2: Recharge Target Depth by Hydrologic Soil Group

<table>
<thead>
<tr>
<th>NRCS Hydrologic Soil Group</th>
<th>Approx. Soil Texture</th>
<th>Target Depth Factor (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>sand</td>
<td>0.6 inch</td>
</tr>
<tr>
<td>B</td>
<td>loam</td>
<td>0.35 inch</td>
</tr>
<tr>
<td>C</td>
<td>silty loam</td>
<td>0.25 inch</td>
</tr>
<tr>
<td>D</td>
<td>clay</td>
<td>0.1 inch</td>
</tr>
</tbody>
</table>

Table 2.3.3: 1982 Rawls Rates

<table>
<thead>
<tr>
<th>Texture Class</th>
<th>NRCS Hydrologic Soil Group</th>
<th>Infiltration Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Sand</td>
<td>A</td>
<td>8.27 in/hr</td>
</tr>
<tr>
<td>2 Loamy Sand</td>
<td>A</td>
<td>2.41 in/hr</td>
</tr>
<tr>
<td>3 Sandy Loam</td>
<td>B</td>
<td>1.02 in/hr</td>
</tr>
<tr>
<td>4 Loam</td>
<td>B</td>
<td>0.52 in/hr</td>
</tr>
<tr>
<td>5 Silt Loam</td>
<td>C</td>
<td>0.27 in/hr</td>
</tr>
<tr>
<td>6 Sandy Clay Loam</td>
<td>C</td>
<td>0.17 in/hr</td>
</tr>
<tr>
<td>7 Clay Loam</td>
<td>D</td>
<td>0.09 in/hr</td>
</tr>
<tr>
<td>8 Silty Clay Loam</td>
<td>D</td>
<td>0.06 in/hr</td>
</tr>
<tr>
<td>9 Sandy Clay</td>
<td>D</td>
<td>0.05 in/hr</td>
</tr>
<tr>
<td>10 Silty Clay</td>
<td>D</td>
<td>0.04 in/hr</td>
</tr>
<tr>
<td>11 Clay</td>
<td>D</td>
<td>0.02 in/hr</td>
</tr>
</tbody>
</table>

NOTES:

Input Values

1 = Refer to Proposed Conditions HydroCAD modeling report
Infiltration Area #3

Stormwater Recharge Calculations

CALCULATIONS

Recharge Volume, Rv:

\[ R_v = A_c \times F \]

<table>
<thead>
<tr>
<th>Hydrologic Soil Group</th>
<th>Impervious Area (Ac)</th>
<th>Target Depth (F)</th>
<th>Recharge Volume (Rv) Ac-feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.407</td>
<td>0.6</td>
<td>0.020</td>
</tr>
<tr>
<td>B</td>
<td>0.35</td>
<td>0.6</td>
<td>0.021</td>
</tr>
<tr>
<td>C</td>
<td>0.25</td>
<td>0.6</td>
<td>0.015</td>
</tr>
<tr>
<td>D</td>
<td>0.1</td>
<td>0.6</td>
<td>0.010</td>
</tr>
<tr>
<td>Total</td>
<td>0.407</td>
<td>0.6</td>
<td>0.020</td>
</tr>
</tbody>
</table>

\*Half of "POST C" subcatchment impervious area

Total Recharge Volume Required = 0.020 Ac-ft
Total Recharge Volume Required (Rv) = 886 C.ft
Recharge Vol. Provided (from Infil. Area 3) = 2,824.0 C.ft

Required Sediment Forebay vol, Fv:

\[ F_v = A_c \times (u \times f) \times 0.1 \text{ inch of impervious area} \]

Imp. area captured by ponds, Ap = 0.407 Ac
Required Sediment Forebay vol, Fv = 148 C.ft
Sediment Volume Provided = 565.0 C.ft

Drawdown Calculations

Proposed Infiltration Area Calculations:

\[ \text{Drawdown} = \frac{R_v}{(\text{Rawls Rate})(\text{Bottom Area})} \]

Drawdown Calculations:

Soil Texture: 1 Sand

Bottom Surface Area (A): 1,391 SF
Rawls Rate: 8.27 in/hr
Total Recharge Volume Required = 886 C.ft
Drawdown: 0.92 hr

Drawdown is less than 72 Hours as Required

REFERENCES

Table 2.3.2: Recharge Target Depth by Hydrologic Soil Group

<table>
<thead>
<tr>
<th>NRCS Hydrologic Soil Group</th>
<th>Approx. Soil Texture</th>
<th>Target Depth Factor (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>sand</td>
<td>0.6 inch</td>
</tr>
<tr>
<td>B</td>
<td>loam</td>
<td>0.35 inch</td>
</tr>
<tr>
<td>C</td>
<td>silty loam</td>
<td>0.25 inch</td>
</tr>
<tr>
<td>D</td>
<td>clay</td>
<td>0.1 inch</td>
</tr>
</tbody>
</table>

Table 2.3.3: 1982 Rawls Rates

<table>
<thead>
<tr>
<th>Texture Class</th>
<th>NRCS Hydrologic Soil Group</th>
<th>Infiltration Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Sand</td>
<td>A</td>
<td>8.27 in/hr</td>
</tr>
<tr>
<td>2 Loamy Sand</td>
<td>A</td>
<td>2.41 in/hr</td>
</tr>
<tr>
<td>3 Sandy Loam</td>
<td>B</td>
<td>1.02 in/hr</td>
</tr>
<tr>
<td>4 Loam</td>
<td>B</td>
<td>0.52 in/hr</td>
</tr>
<tr>
<td>5 Silt Loam</td>
<td>C</td>
<td>0.27 in/hr</td>
</tr>
<tr>
<td>6 Sandy Clay Loam</td>
<td>C</td>
<td>0.17 in/hr</td>
</tr>
<tr>
<td>7 Clay Loam</td>
<td>D</td>
<td>0.09 in/hr</td>
</tr>
<tr>
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<td>D</td>
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</tr>
<tr>
<td>9 Sandy Clay</td>
<td>D</td>
<td>0.05 in/hr</td>
</tr>
<tr>
<td>10 Silty Clay</td>
<td>D</td>
<td>0.04 in/hr</td>
</tr>
<tr>
<td>11 Clay</td>
<td>D</td>
<td>0.02 in/hr</td>
</tr>
</tbody>
</table>

NOTES:

Input Values

\* = Refer to Proposed Conditions HydroCAD modeling report
Infiltration Basin

Stormwater Recharge Calculations

CALCULATIONS

Recharge Volume, Rv:

\[ R_v = A_c \times F \]

<table>
<thead>
<tr>
<th>Hydrologic Soil Group</th>
<th>Impervious Area (Ac) (^1)</th>
<th>Target Depth (F)</th>
<th>Recharge Volume (Rv) Ac-feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.217</td>
<td>0.6</td>
<td>0.011</td>
</tr>
<tr>
<td>Total</td>
<td>0.217</td>
<td></td>
<td>0.011</td>
</tr>
</tbody>
</table>

Total Recharge Volume Required = 0.011 Ac-ft
Total Recharge Volume Required (Rv) = 473 C.ft
Recharge Vol. Provided (from Infl. Basin) = 1,459.0

Required Sediment Forebay vol, Fv:

\[ F_v = A_c \times (u_t \times f_t) \times 0.1\text{inch} \text{ of impervious area} \]

\(^1\) Imp. area captured by ponds, Ap = 0.217 Ac
Required Sediment Forebay vol, Fv = 79 C.ft
Sediment Volume Provided = 365 C.ft

Drawdown Calculations

Proposed Infiltration Area Calculations:

\[ Drawdown = \frac{R_v}{(Rawls\ Rate)(Bottom\ Area)} \]

Drawdown Calculations:

Soil Texture: 1 Sand

Bottom Surface Area (A) = 728 SF
Rawls Rate: 8.27 in/hr
Total Recharge Volume Required = 473 C.ft
Drawdown: 0.94 hr

Drawdown is less than 72 Hours as Required

REFERENCES

Table 2.3.2: Recharge Target Depth by Hydrologic Soil Group

<table>
<thead>
<tr>
<th>NRCS Hydrologic Soil Group</th>
<th>Approx. Soil Texture</th>
<th>Target Depth Factor (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>sand</td>
<td>0.6 inch</td>
</tr>
<tr>
<td>B</td>
<td>loam</td>
<td>0.35 inch</td>
</tr>
<tr>
<td>C</td>
<td>silty loam</td>
<td>0.25 inch</td>
</tr>
<tr>
<td>D</td>
<td>clay</td>
<td>0.1 inch</td>
</tr>
</tbody>
</table>

Table 2.3.3: 1982 Rawls Rates

<table>
<thead>
<tr>
<th>Texture Class</th>
<th>NRCS Hydrologic Soil Group</th>
<th>Infiltration Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Sand</td>
<td>A</td>
<td>8.27 in/hr</td>
</tr>
<tr>
<td>2 Loamy Sand</td>
<td>A</td>
<td>2.41 in/hr</td>
</tr>
<tr>
<td>3 Sandy Loam</td>
<td>B</td>
<td>1.02 in/hr</td>
</tr>
<tr>
<td>4 Loam</td>
<td>B</td>
<td>0.52 in/hr</td>
</tr>
<tr>
<td>5 Silt Loam</td>
<td>C</td>
<td>0.27 in/hr</td>
</tr>
<tr>
<td>6 Sandy Clay Loam</td>
<td>C</td>
<td>0.17 in/hr</td>
</tr>
<tr>
<td>7 Clay Loam</td>
<td>D</td>
<td>0.09 in/hr</td>
</tr>
<tr>
<td>8 Silty Clay Loam</td>
<td>D</td>
<td>0.06 in/hr</td>
</tr>
<tr>
<td>9 Sandy Clay</td>
<td>D</td>
<td>0.05 in/hr</td>
</tr>
<tr>
<td>10 Silty Clay</td>
<td>D</td>
<td>0.04 in/hr</td>
</tr>
<tr>
<td>11 Clay</td>
<td>D</td>
<td>0.02 in/hr</td>
</tr>
</tbody>
</table>

NOTES:

Input Values

\(^1\) = Refer to Proposed Conditions HydroCAD modeling report
Adjusted Recharge/WQV Calcs

Stormwater Recharge Calculations

Capture Area Adjustment, \( R_{\text{adj}} \):

\[
R_{\text{adj}} = \frac{A_p}{A_T} x R_v
\]

\(^1\) Imp. area captured by ponds, \( A_p \) = 1.343 Ac
\(^2\) Total impervious area on site, \( A_T \) = 4,428 C.ft
Recharge volume required, \( R_v \) = 2,033 Ac
Capture Rate= 66% OK
Capture Area Adjustment Factor= 1.51
Adjusted Recharge Volume Required \( R_{\text{adj}} \) = 6,703 C.ft

\(^1\) Total Recharge Volume Provided = 9,476.0 C.ft

NOTES:


Water Quality Calculations

WATER QUALITY CALCULATIONS

\[
V_{\text{WQ}} = B_{\text{WQ}}(ft) x A_T(ft^2)
\]

Water Quality Depth = 1 in
Water Quality Depth , \( D_{\text{WQ}} \) = 0.08 ft.
Total impervious area on site, \( A_T \) = 2,033 Ac.

Required Water Quality Volume, \( V_{\text{WQ}} \) = 7,380 C.ft.

Stormwater system is sized to accommodate both \( R_{\text{adj}} \) and WQV
(11,468.2 > 5,147 and 7,010)

REFERENCES

1 inch depth
- Zone II discharges
- IWPA discharges
- Critical Area
- Runoff from LUHPPL
- Infiltration rate >2.4 inches/hour

1/2 inch depth
- Discharge to other area
- 8 inch
- 9 inch
- 10 inch
- 11 inch
APPENDIX G

Operation and Maintenance Plan
STORMWATER OPERATION & MAINTENANCE MANUAL

FOR

MAP U42, PARCEL 9-2
BEHIND 80 KING STREET

IN

LITTLETON, MASSACHUSETTS

PREPARED BY: DUCHARME & DILLIS
CIVIL DESIGN GROUP, INC.
P.O. Box 428
Bolton, MA 01740

PREPARED FOR: FIELD DEVELOPMENT, LLC
442 King Street
Littleton, MA 01460

OCTOBER 9TH, 2018

CDG PROJECT # 5770
TABLE OF CONTENTS:

1.0 Project Narrative

1.1 Overview of Drainage System
1.2 Routine Operation & Maintenance Tasks
1.3 O&M Schedule

2.0 Appendices

Appendix A – Cultec Operation & Maintenance
Appendix B – Stormwater Management System Owners/Operators
1.0 Project Narrative

1.1 Proposed Stormwater Management System

Runoff from the proposed development will be conveyed and treated through a combination of Best Management Practices (BMP’s). The following is a brief discussion of each conveyance and treatment BMP proposed.

Deep Sump Hooded Catch Basins

Deep sump hooded catch basins are proposed to convey the runoff from the proposed roadway to the subsurface infiltration system. These catch basins will discharge to manholes and conventional storm drains.

Subsurface Infiltration Chambers

Four subsurface infiltration systems are included on site. Cultec pre-fabricated chambers, model 280HD, will be installed to collect the run off from a portion of the roofs and pavement after pretreatment in the deep sump hooded catch basins. A drainage manhole will be installed with a weir to direct flow into the first row of chambers. These chambers will be wrapped in a geotextile fabric and will act as a sediment forebay for additional pre-treatment. The infiltration systems will provide recharge for the groundwater as well. The chambers have been designed to accommodate the runoff associated with the 100-year storm event.

1.2 Operation & Maintenance Tasks

The following activities should be performed routinely to allow for proper functioning of the stormwater system. The following are guidelines referring to each major component of the stormwater management system.

1.2.1 Street Sweeping

Street sweeping should be performed at least semi annually. For most effective results, sweeping should be performed by a vacuum style truck in the early spring before spring rain events can wash silt and sediment into the stormwater system. Silt and sediment should be disposed of in accordance with local, state and federal guidelines for hazardous waste.

1.2.2 Drain Manholes

Manholes shall be inspected semi-annually for signs of wear, settling, cracking or other fatigue. Manhole casting should be inspected for signs of root intrusion, or significant water infiltration. Weirs shall be inspected for signs of cracking or other fatigue. Manhole sumps should be checked
for silt/sediment buildup and cleaned as necessary. Cleaning should be performed by a vacuum truck. Manholes should be resealed as required and outlets should be inspected incidentally with all structure inspections.

### 1.2.3 Storm Drain Lines

Storm drainage inlets and outlets should be inspected incidentally with all structure inspections. Evidence of debris intrusion or excessive siltation or sedimentation could result in the need to clean a storm drain line. Flushing or jetting should be performed as required. All flushing and jetting should be performed in the direction away from any outlet devices. A vacuum truck should be used at the opposite end of the flushing or jetting to remove any silt or sediment that is cleaned from the storm drain.

### 1.2.4 Deep Sump Catch Basins

Deep sump catch basins shall be inspected at least semi-annually for signs of wear, settling, cracking or other fatigue. Catch basin castings should be inspected for signs of root intrusion, or significant water infiltration. Catch basin sump should be checked for silt/sediment buildup and cleaned as necessary. Cleaning should be performed by a vacuum truck. Catch basins should be resealed as required and outlets should be inspected incidentally with all structure inspections.

### 1.2.5 Subsurface Infiltration System

The subsurface infiltration systems should be monitored and maintained regularly to ensure no obstructions in the systems are present. Any depressions noticed in the areas could indicate that the system has collapsed and should be inspected immediately. The systems are equipped with inspection ports to monitor the buildup of sedimentation. If the depth of sedimentation is in excess of the manufacturer’s guidelines, the systems will need to be cleaned out with high pressure water. The high-pressure water should be used on one end and a vacuum truck will be used on the opposite end to remove any silt or sediment that is cleaned from the chambers. Other maintenance will include checking the inlets and outlet for debris, survey the surrounding area for depressions and confirm no unauthorized modifications have been performed to the system. See Appendix A for the Cultec Operation and Maintenance Guidelines.
### O&M Schedule

<table>
<thead>
<tr>
<th>O&amp;M Task</th>
<th>Monthly</th>
<th>Quarterly</th>
<th>Spring</th>
<th>Fall</th>
<th>2-years</th>
<th>As-required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Street Sweeping</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Drain Manholes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect Rims</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect inside/inlet and outlet pipes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Remove sediment</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3. Storm drain Lines</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspection</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Clean</td>
<td></td>
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<td></td>
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<tr>
<td>4. Catch Basins</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect Rims</td>
<td>x</td>
<td>x</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Inspect inside/inlet and outlet pipes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Remove sediment</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Infiltration Basin/Sed. forebay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspected</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Remove Debris</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Remove Silt/Sediment</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>6. Underground Infiltration Areas</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>(See appendix A)</td>
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</tr>
</tbody>
</table>
APPENDIX A

Cultec Operation & Maintenance
Operation and Maintenance Guidelines
Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer’s recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Operation and Maintenance Requirements

I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

II. Inspection and Maintenance Options

A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pre-treatment device). CCTV inspection of this row can be deployed through this access port to determine if any sediment has accumulated in the inlet row.

B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.

1. Manhole Access

This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.
2. StormFilter Access
Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

III. Maintenance Guidelines
The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system’s operational capacity.

B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.

C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.

D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

IV. Suggested Maintenance Schedules
A. Minor Maintenance
The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly in first year</td>
<td>Check inlets and outlets for clogging and remove any debris as required.</td>
</tr>
<tr>
<td>Spring and Fall</td>
<td>Check inlets and outlets for clogging and remove any debris as required.</td>
</tr>
<tr>
<td>One year after commissioning and every third year following</td>
<td>Check inlets and outlets for clogging and remove any debris as required.</td>
</tr>
</tbody>
</table>

B. Major Maintenance
The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)
**Major Maintenance**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlets and Outlets</td>
<td>Every 3 years • Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.</td>
</tr>
<tr>
<td></td>
<td>Spring and Fall • Check inlet and outlets for clogging and remove any debris as required.</td>
</tr>
<tr>
<td>CULTEC Stormwater Chambers</td>
<td>2 years after commissioning • Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique.</td>
</tr>
<tr>
<td></td>
<td>• Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.</td>
</tr>
<tr>
<td></td>
<td>9 years after commissioning every 9 years following • Clean stormwater management chambers and feed connectors of any debris.</td>
</tr>
<tr>
<td></td>
<td>• Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique.</td>
</tr>
<tr>
<td></td>
<td>• Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.</td>
</tr>
<tr>
<td></td>
<td>45 years after commissioning • Clean stormwater management chambers and feed connectors of any debris.</td>
</tr>
<tr>
<td></td>
<td>• Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required.</td>
</tr>
<tr>
<td></td>
<td>• Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique.</td>
</tr>
<tr>
<td></td>
<td>45 to 50 years after commissioning • Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection.</td>
</tr>
<tr>
<td></td>
<td>• Attain the appropriate approvals as required.</td>
</tr>
<tr>
<td></td>
<td>• Establish a new operation and maintenance schedule.</td>
</tr>
<tr>
<td>Surrounding Site</td>
<td>Monthly in 1st year • Check for depressions in areas over and surrounding the stormwater management system.</td>
</tr>
<tr>
<td></td>
<td>Spring and Fall • Check for depressions in areas over and surrounding the stormwater management system.</td>
</tr>
<tr>
<td></td>
<td>Yearly • Confirm that no unauthorized modifications have been performed to the site.</td>
</tr>
</tbody>
</table>

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.
APPENDIX B

Stormwater Management System Owners/Operators
1. Stormwater Management System Owners: To be determined
2. Current and future operators: To be determined
3. Emergency contact information: To be determined
4. Change of trustee: To be determined
5. Financial Responsible Party: To be determined
6. Routine Maintenance: To be determined
7. O&M activities: To be determined
8. Record keeping To be determined
APPENDIX H

Long Term Pollution Prevention Plan
LONG-TERM POLLUTION PREVENTION PLAN

FOR

MAP U42, PARCEL 9-2
BEHIND 80 KING STREET

IN

LITTLETON,
MASSACHUSETTS

PREPARED BY: DUCHARME & DILLIS
CIVIL DESIGN GROUP, INC.
P.O. Box 428
Bolton, MA 01740

PREPARED FOR: FIELD DEVELOPMENT, LLC
442 King Street
Littleton, MA 01460

OCTOBER 9TH, 2018

CDG PROJECT # 5770
1.0 Summary

This Long-Term Pollution Prevention Plan (LTPPP) has been prepared by Ducharme & Dillis Civil Design Group, Inc. pursuant to the Massachusetts Stormwater Regulations. The proposed project includes the development of 30 elderly housing apartments with associated driveways and a road. The project is being proposed pursuant to the Senior Residential Development and Aquifer & Water Resource District Special Permits.

The layout of the proposed site has been carefully planned to reduce the amount of stormwater leaving the site. The stormwater management system has been designed in accordance with the Massachusetts Stormwater Regulations to provide pretreatment of the stormwater prior to discharge.

2.0 Spill Prevention Plan

No hazardous materials other than normal cleaning items are expected to be stored on site after the construction period has ended.

It is expected that normal DEP notification procedures would be triggered for major spills such as heating oil or propane and natural gas leaks.

3.0 Stormwater System O&M

A Stormwater Operation & Maintenance plan has been prepared for the proposed stormwater management system. Refer to this document for details pertaining to the required inspections, routine maintenance and operation details.

4.0 Fertilizers, herbicides and pesticides

Application of fertilizer, herbicides and pesticides shall be performed in a manner consistent with the industry standards for the application.

No application of chemicals is to be performed within the stormwater management areas on the site.

5.0 Snow/Salt Management

5.1 Snow Plowing

It is expected that the site will be plowed by a private contractor. Refer to the Erosion Control Plans for snow storage locations.

5.2 Salt/Sand Usage

It is expected that sanding and salting will be performed on an infrequent basis.
during times when unusually icy conditions persist for periods of time.

5.3 Street Sweeping

The Stormwater Operation & Maintenance Plan calls for the road and parking areas to be swept in the spring, after the threat of winter precipitation has passed, and in the fall.

6.0 Waste Management

6.1 Solid Waste

A dumpster will be located on the site during construction. This area will be the primary area for the on-site storage of solid waste prior to pick-up by a waste management company.