ASB design group

Project Data/Environmental Impact Report
Definitive Subdivision and Notice of Intent

Lyle Estates

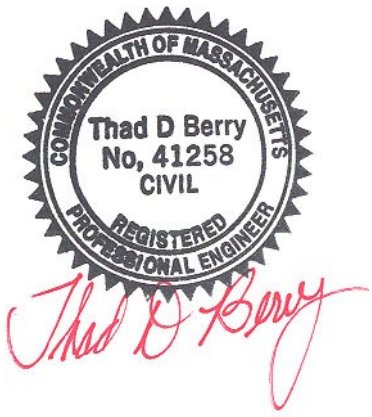
Reading, Massachusetts 01867

PREPARED FOR:

Jamison Properties LLC
627 Main Street
Suite 1
Woburn, MA. 01801

PREPARED BY:

ASB design group, llc
363 Boston Street, Route 1
Topsfield, MA 01983
T- 781 944 5606



April 2016

ASB design group

April 4, 2016

Ms. Jean J. Delios
Community Services Director and Town Planner
Town Hall, 16 Lowell Street
Reading, MA 01867

Re: **Wavier List**
Definitive Subdivision – Lyle Estates
4 Lot Subdivision
364 Lowell Street
Tax Map 26 Parcel 157
Reading MA. 01867

Dear Ms. Delios:

On behalf of Jamieson Properties LLC, **ASB** design group LLC (ASB), is submitting for your review the following waiver request for the Lyle Estates Definitive Subdivision.

Rules And Regulations Governing The Subdivision Of Land In Reading

Table 1 documents the waivers that are being requested from the *Rules and Regulations Governing the Subdivision of Land in Reading* (also see Sheet C1).

Table 1 Wavier Requests

Section Reference	Town of Reading (Standard)	Lyle Estates (Wavier)	Comment Justification
Section 7.1.1. a	Right of Way 60’	Right of Way 40’	Comment #1
Section 7.1.3 a	Pavement Width 30’	Pavement Width 28’	Comment #2
Section 7.1.3 b	Sidewalks Both Sides	Sidewalk one side	Comment #3
Section 7.1.3 b	Tree Planting	Tree Planting Easement	Comment #3
Section 7.1.3 b	Pavement Layout	Off Set From Center Line	Comment #3
Section 7.1.4 b	Curb Radii 30’	Curb Radii 20’	Comment #4
Section 7.1.5 a	40’ Paved Radius	36’ Paved Radius	Comment #5
Section 7.2 a	Sidewalks Both Sides	Sidewalk one side	Comment #6
Zoning 2.2.13❶	Front Set Back 20’	11.7’ Lyle Estates 39.1 Lowell Street	Comment #7

❶ Variance would be required for existing structure and proposed new garage.

Justification

Comment #1: Currently the parcel has an existing 40’ Right of Way (See Sheet C4). Existing houses on both sides of the current 40’ Right of Way restrict the width. The cul-

de-sac will have a property line radius 45’ instead of 60’.

Comment #2: With a reduced Right of Way the pavement will be reduced from a width of 30’ to 28’. The radius of pavement at the cul-de-sac will be reduced from 40’ to 36’.

Comment #3: In addition there will be one sidewalk on the northwesterly side of the roadway. The sidewalk will service the three new houses. There are no houses proposed on the southeasterly side of the proposed roadway. Lot 1 presently has a concrete sidewalk along Lowell Street (Route 129).

The reduced pavement and sidewalk on one side will accommodate a 3.5’ grass strip along the northwesterly side of the roadway and a 2.5’ grass strip along the southeasterly side of the roadway. To provide for tree planting a 4’ tree planting easement will be provided along the outside of the new Right-of Way. The center line for the proposed roadway will be located 3’ to the left following the crown of the new roadway (see Sheet C8).

Comment #4: Curb radius at the Lyle Estate and Lowell Street intersection will be reduced from 30’ to 20’ to coincide with the reduced right-of-way and pavement width.

Comment #5 See response to Comment 2.

Comment #6 See response to Comment 3.

Comment #7 364 Lowell Street will have frontage along Lowell Street and the new Right-of-Way. Zoning requires a front set back of 20’. Presently the existing structure faces Lowell Street with a front set back of 39.1’ (see Sheet C4). The front set back along the new Right-of-Way to the existing structure will be 11.7’. The applicant will request a variance from the Reading Zoning Board of Appeals.

Reading Wetland By – Law

Table 2 documents the waivers that are being requested from the *Reading Wetland By - Law* (also see Sheet C1).

Table 2 Wavier Requests

Section Reference	Town of Reading (Standard)	Lyle Estates (Wavier)	Comment Justification
Section 3.D.2	25’ Natural Vegetation Zone	Closest Activity 14.0’ ±	Comment #1
Section 3.D.4	35’ No Structure Zone	Closest Activity 23.7’ ±	Comment #2

Justification

Comment #1: There will be two areas within the project that will require work within the 25' Natural Vegetation Zone. Both of the locations presently have some degree of disturbance. There areas are described below with their impacts.

- Lot 1 The applicant will be removing the existing gravel driveway and abandoning the existing septic system at the rear/side of the property.

  The gravel parking area will be replace with a new 24' x 24' garage attached to the existing house. A paved driveway will connect to the garage to the new roadway. The existing gravel driveway occupies 1169 s.f. of which 295 s.f. ± falls within the 25' Natural Vegetation Zone. Within this same area there is an additional disturbance of the 25' Natural Vegetation Zone that includes 460 s.f. ± of lawn and general landscaping. The proposed garage will occupy 50 s.f. ± (roof) within the 25' Natural Vegetation Zone. The remaining gravel will be replace with loam and seed (245 s.f. ±). The existing septic system will be abandoned in accordance with the state local Board of Health requirements. A new sewer service will be provided to the existing house from the new roadway.

- Roadway Right-of- Way Roadway construction will require work within the 25' Natural Vegetation Zone. The work will occur between Station 2+34 (18.5' Left) and Station 2+69 (42.5' Left) and consists of 650 s.f. ±. This area has been previously disturbed with the construction of the existing dense grade-crushed pavement or gravel roadway.

  Fourteen square feet of dense grade-crushed pavement will be removed and 125 s.f.± of pavement will be added. The remaining 525 s.f. consisting of a gravel surface will be loamed and seeded.

Comment #2: There will be two areas within the project that will require work within the 35' No Structure Zone. Both of the locations presently have some degree of disturbance. There areas are described below with their impacts.

- Lot 1 The applicant will be removing the existing gravel driveway and constructing a new 24' x 24' garage with an additional 55 s.f. added to the existing house.

  Zoning for this district requires a 20' front yard setback (corner lot – frontage on both streets). The garage is being placed 16' from the side property line. Within the 35' No Structure Zone a total of 414 s.f.± of gravel will be removed. The new garage will comprise 252 s.f. with the remaining 162 s.f. of area to be loamed and seeded. The Applicant will file with the Reading Zoning Board of Appeals for a variance for the front set back along the new Right-of-Way.

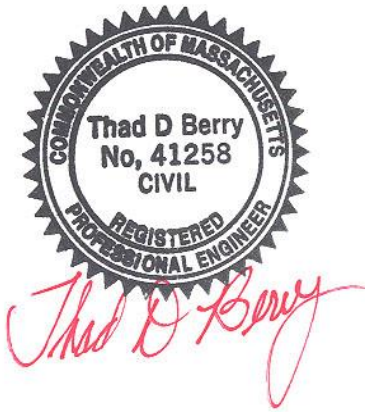
- Roadway Right-of- Way Roadway construction will require work within the 35' No Structure Zone. The work will occur between Station 2+34 (18.5' Left) and Station 2+69 (42.5' Left). Approximately 510 s.f.± of area has been previously disturbed within the 35' No Structure Zone for the construction of the existing gravel roadway. There is 388 s.f.± of gravel roadway within the 35' No Structure Zone. The remaining area consists of a loose dirt surface. The roadway construction will remove 388 s.f. of gravel and 122 s.f. dirt surface and replace it with 650 s.f.± of pavement.

If you have any other question and or concerns please do not hesitate to contact me at 978-500-8419.

Sincerely,

ASB design group, LLC.

Thad D. Berry, P.E
Principal



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Attached Pre Development Drainage Plan – D1 – Drainage Reports Only
Post Development Drainage Plan – D2 – Drainage Reports Only

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INTRODUCTION

The purpose of this report is to document the construction of a new 4 lot **Subdivision** located at 364 Lowell Street (Route 129) in Reading MA. (Tax Map 26, Lot 157 see **Figure 1A**). A new 326' roadway way ending in a cul-de-sac is being proposed to service 3 new lots (see **Figure 1B**). Lot 1 will encompasses the existing house at 364 Lowell Street. The new road will follow the existing gravel/dense grade driveway and connect to Lowell Street (see Sheets C5 and C6). The development will be serviced by Town of Reading sewer and water along with gas, telephone, electric and cable. A closed drainage system will collect the stormwater runoff from the roadway and direct it to Best Management Practice Pond 1 (BMP 1) located within the limits of Lot 1. Five LID BMP's have been placed within the development to capture site and driveway stormwater runoff (see **Figure 1B**). See Section 2.13 for a description of each BMP.

SECTION I EXISTING CONDITIONS

1.1 EXISTING SITE DESCRIPTION

The 2.574 acre project site location is depicted graphically in **Figure 1A** (also refer to Sheet C3 Existing Conditions Survey)**.** The parcel contains an existing house, gravel/dense grade road/driveway with lawn. A 56' curb cut on Lowell Street currently provides access to the site. The remainder of the site is forested with a mixture of soft and hard wood deciduous and evergreen trees with little to on underbrush. A high elevation of 198 is located in the northeast corner of the site. The site slopes to a low elevation of 190 that defines the existing wetland resource area. *A Notice of Intent prepared by Wetland and Land Management Inc. will filed with Reading Conservation Commission.*

The wetlands have been flagged by Wetland and Land Management Inc. and approved by the Reading Conservation Commission on July 25, 2013 (see ORAD – DEP # 270-0616)) and are shown on Sheet C3 along with the local and state wetland resource area buffer zones

The site does not fall within a Flood Insurance Rate Map (FIRM) for the Town of Reading but does fall within the Town of Reading Aquifer Protection District.

The existing conditions site survey also includes detail of the existing drainage system that conveys the stormwater runoff from Route 129 (Lowell Street) and Plymouth Street to the stone culvert under the MBTA railroad tracks (see Sheet C3). Sheets C3 highlights the areas of fill that has occurred over time along with the approximate limit of roadway siltation deposited from the stormwater runoff from Route 129.

1.2 EXISTING UTILITIES

The site is serviced by Town of Reading water and sewer. Gas, telephone and electric are all located within the Lowell Street (Route 129) Right-Of-Way. There is also a closed drainage system within the Lowell Street Right-Of-Way. Presently the site does not contribute stormwater runoff to the closed drainage system (see Section 1.42)

1.3 SOILS

Soil information for the proposed new development were obtained from two sources. The first resource was the ***Soil Survey of Essex County – Northern Part, Massachusetts,*** as provided by the United States Department of Agriculture, Soil Conservation Service (see Figure 2A, Sheet C3 and Figures D1 and D2). The soils shown on the map are broken down into four hydrologic soil groups and are summarized below (also see Figure 2B).

Group A soils have a low runoff potential and high infiltration rates when thoroughly wetted. They consist chiefly of deep well to excessively drained sands and gravels and have a high rate of water transmission (greater than 0.3 in/hr.).

Group B soils have a moderate infiltration rates when thoroughly wetted, and consist chiefly of moderately deep-to-deep moderately well to well drained soils with moderately fine to moderately course textures. These soils have a moderate rate of water transmission (0.15-.30 in/hr.).

Group C soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water, and soils with moderately fine-to-fine texture. These soils have a low rate of water transmission (0.05-0.15 in/hr.).

Group D soils have high runoff potential. They have low infiltration rates when thoroughly wetted, and consist chiefly of clay soils with high swelling potential, soils with a permanent high water, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low transmission (0-0.05 in/hr.).

The site and associated water shed is comprised of 2 soil groups as shown in Figure 2A and Sheet C3. Table 1 below summarizes the 2 soil groups with their corresponding hydrologic soil groups.

Table 1 Soil Summary

Symbol	Soil Name	Slope %	Hydrologic Group
256A	Deerfield Loamy Sand	0 to 3	A
626B	Merrimac-Urban Land Complex	0 to 8	A

The second source was on site soil testing. Soil testing was conducted on June 18, 2013 by ASB design group llc (ASB). The soil logs are shown in Appendix A. See Sheets C3 for the locations of the onsite soil testing.

The predominant C soil horizon within in the area of the proposed development consisted of a course sand to sand.

The Hydrologic Soil Group (HSG) shown in Table 1 was determined from the soils map as shown in Figure 2B.

1.3 EXISTING CONDITIONS PRE-HYDROLOGY

1.31 Methodology

The pre and post hydrology study was conducted using ***HydroCAD*** a ***Stormwater Modeling System***. The Runoff Curve Numbers were selected from the tables listed within the ***Soil Conservation Service Technical Release 55***. The terminology used by ***HydroCAD*** is summarized below.

1. ***Subcatchment*** - refers to a relatively homogenous area of land that drains into a single reach or pond.
2. ***Reach***- refers to a uniform stream, Channel, or pipe that conveys water from one point to another reach or pond.
3. ***Pond***- refers to a pond, swamp, dam, or other impoundment that fills with water from one or more sources and empties in a manner determined by a weir, culvert, ex-filtration or devise(s) at its outlet.

Four storm events were analyzed as part of the pre-development drainage study. They are the 2, 10, 25, and 100 year twenty-four hour rainfall events. The rainfall data maps for Massachusetts were taken from the ***Guidelines for Soil & Water Conservation In Urbanizing Areas of Massachusetts*** (see Rainfall Data Maps for Massachusetts Figure 4). The ***Rainfall Distribution*** is ***Type III***, which is typical for Massachusetts and is shown on Figure 3.

1.32 Pre-Hydrology

A single design point was studied; Design Point 1 – Existing Wetland. Design Point 1 is shown on the Pre-Development Drainage Plan (D1) that is attached to this report. The Design Point is summarized below.

- **Design Point 1** represents the stormwater runoff that flows to the easterly side of the parcel. Point 1 represents the storm water runoff that flows to the existing wetland area flagged by Wetland and Land Management Inc.

The Pre-Development Drainage Plan (D1) depicts subcatchment E1 with the corresponding soil type taken from the Soil Conservation Service soils maps. The Design Point and longest flow path are also shown on D1 – Drainage Reports Only.

With the soil type, existing surface conditions, and hydrologic soil group, the runoff curve numbers can be determined. (See Existing Hydrology Calculations, Section 3-Drainage Reports Only)

The 2, 10, 25, and 100-year 24-hour storm events were run. The results of the peak flows are shown in Table 2 below and given in cubic feet/second (cfs). Table 1 summarizes the peak flow to Design Point 1.

Table 2 Peak Rate of Runoff – Pre Conditions (cfs)

Design Point	2 Year Storm (3.1”)	10 Year Storm (4.6”)	25 Year Storm (5.5”)	100 Year Storm (7.1”)
Design Point 1	.00	.02	.06	.53

As can be seen from Table 2 the stormwater flow generated from the site is negligible for all four storm events. This is not uncommon for sites with a Hydrological Soil Group A. Please also note, that although engineers like to report the results with an accuracy to the 100th there is no such accuracy in hydrology studies. The accuracy at best is to a whole number. So what we can see from Table 2 is that there is *no runoff generate from the site under existing conditions*. The storm water infiltrates into the soils on site.

SECTION II PROPOSED CONDITIONS

2.1 PROJECT DESCRIPTION

The proposed project will consist of the construction of a new 326' long roadway way which ends in a cul-de-sac. A total of 3 new single family homes with driveways are proposed for the site along with a new addition on the existing house now Lot 1.

2.2 PROPOSED ROADWAY LAYOUT RIGHT-OF-WAY

The new roadway will be located within the existing curb cut and an historic 40' Right – of – Way and follow the current gravel/dense graded driveway. The existing gravel/dense graded driveway varies in width from 35' to 20'.

The Reading Subdivision Regulations require a 60' Right – of – Way. A list of waivers that are being requested are shown on Sheet C1 and a Wavier Summary Letter is attached at the beginning of this report. Sheet C9 details the differences between the Standard Right – Of – Way and the one being proposed for Lyle Estates. All new drives ways will access onto Lyle Estates. One sidewalk is being proposed on the northwesterly side of the road. The sidewalk will service Lots 2-4 and the existing house at 370 Lowell Street. Lot 1 (364 Lowell Street) will be serviced by the existing concrete sidewalk along Lowell Street.

In order to provide for tree planting a 4' wide tree planting easement is being proposed along the outside edge of the new Right – Of – Way. The new trees will be planted within the tree planting easement.

2.3 PROPOSED UTILITIES

The site will be serviced with an 8" water line, 8" SDR 35 sewer line, gas, telephone and electric. All new utilities will be located within the new Road Right-Of-Way.

Proposed Sewer

A proposed 8" SDR 35 sewer line within the new roadway will connect to the existing 8" sewer line in Lowell Street (see Sheet C5 and C8). The sewer services to the new homes will be 4" SDR 35 sewer pipe.

Proposed Water

A proposed 8" Ductile Iron Class 52 water line will be installed and connect to the existing water line in Lowell. A fire hydrant is located at Station 6+20 approximately 23' to the right of the roadway center line. One-inch water lines will service each lot (see Sheet C5 and C8).

Proposed Gas, Telephone, Electric, and Cable

The site will be serviced by gas as shown on Sheets C5 and C8. Telephone, electric and cable will also service the site.

Please note, the final utility service connection locations for the individual lots will be determined at the time of application for a building permit with Town of Reading Building and Engineering Departments. The final locations will also be coordinated with the individual utility provider.

Proposed Drainage

See Section 2.4 Proposed Hydrology.

2.4 PROPOSED CONDITIONS POST HYDROLOGY

2.41 Methodology

See Section 1.41

2.42 Post-Hydrology

The proposed project involves the construction of a new roadway, a sidewalk on one side of the new roadway, 3 new single family homes, an addition to the existing house (Lot 1), driveways, utilities, stormwater management BMP's and site landscaping. As a result of the proposed development, there will be an increase in the amount of impervious surface (pavement and roof). This increase in impervious surface will result in an increase in the storm water runoff rate (cfs) and volume (cf) associated with the site. To mitigate the increase in the peak rate of storm water runoff a Best Management Practice (BMP 1) stormwater detention/retention/infiltration facility is being proposed along with 5 Low Impact Design Best Management Practice (LID BMP) detention/retention/infiltration facilities.

Roof runoff for Lots 1- 4 will be directed to stormwater infiltration units. The infiltration units for Lots 2-3 have been sized for the largest house foot print shown on Lot 2 (2012s.f.) and the 100 year storm event. For Lot 2 roof infiltration layout and details see Sheet C10. The remaining roof infiltration system layouts are shown on Sheets C5 and C6. The infiltration system for Lot 1 is

intended to infiltrate the roof runoff from the existing house only for the 100-year storm event (not the new addition).

The site has been designed to direct the stormwater runoff generated from the new roadway to BMP #1. Five LID BMP's have been placed on Lots 2-4 to capture, detain and infiltrate the site and driveway storm water runoff. The LID BMP's have been designed to detain and infiltrate the 100 year storm event.

Under proposed conditions, the flow to Design Point 1 was broken down into 9 subcatchments. The subcatchments are labeled as follows: DP1-1 to DP1-9.

The subcatchments are shown on the Post Development Drainage Plan D2 (Drainage Reports Only). Please also refer to Sheet C14 and 16 for the BMP's layout and details. Figure D2 is intended to highlight the subcatchment areas. The Post Development Drainage Plan depicts each of the subcatchments with their corresponding soil types taken from the Soil Conservation Service soils maps. The longest flow paths for the subcatchments areas are also shown. The BMP's are disused below.

Please note, under proposed conditions any subcatchment that resulted in a Time of Concentration (Tc) of less than 5 minutes was entered as Direct Entry with a corresponding Tc of 5 minutes. For these subcatchments the Longest Flow Paths are not shown.

BMP #1 Detention/Retention and Infiltration Pond

BMP 1 will collect the storm water runoff generated from the proposed roadway. The storm water will first be collected by deep sump Catch Basins 1 and 2. The storm water will be directed to DMH 1 and then to BMP 1. BMP 1 will detain, retain, and infiltrate the storm water runoff. BMP 1 has been designed to include a vegetated sump to trap and further treat the stormwater runoff prior to storm water infiltration (see TSS Work Sheets 1 and 2). Sheet C14 details BMP 1.

LID BMP's 1-5 Detention/Retention and Infiltration Pond

LID BMP's 1-5 have been located within the individual lots. LID BMP's 1-5 are intended to:

- Detain, retain and infiltrate the stormwater runoff from the lots and driveways,
- Provide water quality treatment,
- Minimize concentrated stormwater runoff by trapping the stormwater in smaller subcatchment (drainage) areas,

- Minimize additional site clearing by locating BMP's within areas that are already being disturbed by the overall site development.

Each LID BMP has been designed to provide stormwater infiltration. Sheet C15 details each of the LID BMP's.

Overall Drainage Summary

The design team worked to minimize the amount of area that would be impacted (tree removal and site grading) due to the construction process. This included implementing:

- A reduced roadway pavement width a sidewalk on one side,
- The placement of BMP's within areas that would be already be disrupted by the construction process,
- The creation of smaller BMP's is size but greater in number to minimize concentrated stormwater flow,
- The location of BMP's to fit into the final landscape to minimize additional site clearing,
- Providing landscaping to the BMP's to promote water quality treatment and stormwater infiltration. This also allows the BMP's to become part of the overall final landscape.

Braking the subcatchments (drainage areas) into smaller areas prevents the stormwater from being concentrated. The importance of smaller drainage areas can be appreciated and visualized by thinking of stormwater runoff as ordinary vehicular traffic. The same mathematical principals that are applied in Storm Water Hydrology Studies are also apply to Traffic Studies. Table 3 summarizes some of the similarities.

Table 3 Similarities

Comparison	Hydrology Studies	Traffic Studies
Peak Rate	Peak Rate of Runoff – cubic feet per second	Peak Rate of Traffic – Vehicle Trips per hour
Velocity	feet per second	miles per hour
Volume	Peak Rate of Runoff – cubic feet	Peak Rate of Traffic – Total Vehicles
Flow	Water	Vehicle
Conveyance	Pipe	Road

Making use of Table 3 we can visualize the importance of small drainage areas. They create:

- smaller peak rates or less vehicles,
- lower velocities mean less erosion or safer driving conditions,
- smaller BMP's mean less site clearing or smaller parking areas (less pavement),
- greater water quality treatment or less air pollution.

Stone infiltration/landscape inlets will allow the stormwater contained within the LID BMP's to infiltrate into the sandy soils. This will allow for greater water quality treatment, stormwater infiltration into the existing soils and creates an environment for divers' landscape plantings.

The critical features of the LID BMP's are their location and size (volume). During the construction process ASB will coordinate with the applicant on the final shape and plantings. Prior to planting, the LID BMP's will be checked to confirm proper location and size. Infiltration stone lined channels and/or pine bark mulch planting beds will be created to promote storm water infiltration.

We have attached a Home Owners Rain Garden Guide in Appendix B. The soils associated with this site – sandy soils with a high infiltration rate will allow for a greater selection in plants (always native). The long term maintenance associated with these types of LID BMP revolve around early spring cleaning and late fall winter protection – if required.

Post Development Drainage

The same four storm events were also studied in the post condition. The results of the peak flows given in cubic feet per second to the **Design Point 1** are summarized below in **Table 4** (See Proposed Hydrology Calculations, Section 4 – Drainage Reports Only).

As result of the Best Management Practice Detention/Retention Systems, there will be a net decrease in the rate of stormwater runoff from the site during the 10, 25 and 100 year storm events. During the 100 year storm event there was a slight increase. No change occurred during the 2 year storm event. The decreases are shown red in Table 4 below.

As discussed above in Section 1.32, the numbers shown in Table 4 reflect a zero increase in stormwater runoff as well as a zero decrease in stormwater runoff generated at the site. Again, the accuracy in hydrology is at best a whole number. As stated earlier, we would expect these types of results from sites with these of soil conditions.

Table 4 Peak Rate of Runoff (cfs) - Proposed Conditions

Design Point (DP)	2 Year Storm (3.1")	10 Year Storm (4.6")	25 Year Storm (5.4")	100 Year Storm (7.1")
DP 1 Pre	0.00	0.02	0.06	.53
DP 1 Post	0.00	0.00 (0.02)	0.00 (0.06)	.35 (0.18)

2.43 Drainage Improvements

Along with the proposed drainage design, the applicant is also proposing the following drainage improvements to the existing drainage system. The existing drainage system conveys stormwater runoff from Route 129 (Lowell Street) and Plymouth Road to the stone culvert underneath the MBTA rail road tracks. Years of dumping within the drainage system and lack of maintenance has limited the systems capacity. Down gradient culverts are clogged or block. The drainage swales are full of debris, trash, and leaves.

Drainage Improvements:

- Removal of roadway siltation at outlet to Route 129 drainage system (see Sheet C13).
- Construction of sedimentation forbay at outlet to Route 129 drainage system to trap and contain roadway siltation. This will improve yearly maintenance and prevent down gradient impacts.
- Removal of trash, debris, and leaves form the drainage system.
- Clean 15" RCP culvert and install 18" PVC T inlet control (if the applicant receives permission to enter on to the property). This will improve flow and allow for a future over flow mechanism in case the pipe becomes clogged.
- Removal of fill placed along the Plymouth Road edge of the drainage system.
- Excavation and removal of Not Weed and fill as detailed on Sheet C 10. This too will improve down gradient stormwater flow while also removing an invasive wetland species. This work along with the wetland restoration will be detailed in the Notice of Intent being prepared by Wetland and Land Management Inc. to be submitted to the Reading Conservation Commission.

2.5 EROSION CONTROL MITIGATION MEASURES

The proposed project includes a comprehensive set of mitigation measures to protect the existing and surrounding sites from impacts due to construction and they are shown on Sheets C7, C12, C13.

Erosion and Sedimentation Control Program

An Erosion Control and Sedimentation Control Program will be implemented to prevent indirect impacts to existing roadways and surrounding sites during the construction of the proposed new, utility/stormwater installation, roadway construction, and building site construction. The program incorporates Best Management Practices (BMP's) as specified in the guidelines developed by DEP and the Environmental Protection Agency and complies with the requirements of the NPDES General Permit for Storm Water Discharges for Construction Activities. These measures include the installation of temporary erosion and sedimentation controls and construction sequencing. Areas of exposed soil will be kept to a minimum and a permanent vegetative cover or other forms of stabilization will be established as soon as practicable.

Proper implementation of the erosion and sedimentation control program will:

- Minimize exposed soils through temporary mulching and/or temporary seeding
- Place structures to manage runoff and erosion
- Establish a permanent vegetative cover or other forms of stabilization as soon as practicable

The following erosion and sedimentation control BMP's are presented in the sequence they will be implemented at the site. The measures will be inspected on a weekly basis or immediately before and or after storm events. The controls will be routinely maintained throughout the duration of the project. Any damaged controls will be repaired and or replaced immediately. The locations of the specific sedimentation and erosion control measures are depicted on Sheets, C7, C12, C13 and OM1 – OM3. A typical inspection form is shown on OM2.

Erosion Control Barriers

Erosion control barriers will be installed at the down gradient limit of work prior to undertaking any ground disturbance for the parking, roadway, or building construction. The barriers will consist of siltation fence, hay bales, or erosion control sock and will be entrenched into the substrate to prevent under flow. When necessary, additional hay bales, silt fence, erosion control sock barriers will be installed immediately down gradient of the erosion-prone areas, such as the base of steep exposed slopes and around the base of stockpile areas, throughout the construction phase of the project. A sufficient supply of materials will be kept at the work site to facilitate the repair or replacement of the barriers. Final erosion control barriers will be dependent on final Town of Reading approvals. Contractor must obtain all conditions of approval as documented by the City prior to construction.

Temporary Surface and Slope Stabilization

Any areas of exposed soils that remain un-stabilized for a period of more than 30 days will be covered with a layer of hay, mulch, or temporary seeding until the time of final loam and seeding.

Temporary Seeding

A temporary vegetative cover of fast growing indigenous grasses will be established on areas of exposed soils that remain un-stabilized for a period of 30 days. Depending on the slope, the seeded surfaces will be covered with a layer of mulch.

Construction Entrance

A temporary construction entrance/vehicle wash area will be placed at the entrance to staging area as shown on Sheet C7 and detailed on Sheet C12. A temporary construction entrance/vehicle wash area will also be placed close to the existing house on Lot 1at the time of construction. The temporary construction entrance will remain in place until the first coat of pavement is placed on the roadway.

Permanent Seeding

Upon completion of final grading, any areas not covered by pavement, other forms of stabilization, or other landscape methods will be loomed and seeded with conventional grass seed. See details for stabilization of BMP's and LID BMP's.

Catch Basin Inlet Protection

The inlets to the proposed catch basins will be protected from sediment inflow during construction through the installation of Silt Sacks or by surrounding them with a barrier of staked hay bales. When the hay bales are used, a layer of filter fabric will be installed beneath the grates of the catch basins. These protection measures will be utilized until the drainage area tributary to each inlet has been stabilized and pavement is in place.

Pavement Sweeping

If necessary, the new paved entrance roadway and parking lot will be swept until the site has been stabilized. Sweeping will occur as necessary on paved areas within the site.
All of the erosion and sedimentation controls shall be inspected on at least a weekly basis and before/after rainfall event in excess of .25 inches. Sediment that collects behind or in the controls will be removed when it reaches a depth of 6" and 12" within the temporary

sedimentation ponds. Any damaged controls will be repaired within 48 hours or discovery.

2.6 CONSTRUCTI0N SEQUENCING

Prior to the start of the construction the selected contractor will submit a Construction Sequencing Schedule to the Town of Reading Engineering Department and Reading Conservation Commission for review and approval.

The Construction Sequencing outline below provides for a general over view for the proposed roadway construction.

- Submit Construction Sequencing Schedule to the Town of Reading Engineering Department and Reading Conservation Commission for review and approval.
- Schedule on-site pre-construction meeting. Prior to the meeting have the erosion control installed for inspection and approval. Also place MADEP sign in a clear and visible location. Determine inspection schedule for all work as required by the Town of Reading.
- Clearly identify all trees that are to remain during the pre-construction meeting.
- Review drainage improvements and wetland restoration requirements as outline on the drawings, the Town of Reading Order of Conditions and the Notice of Intent by Wetland and Land Management Inc.
- Clear trees and stumps from the roadway area and construction area for Lots 2-4. Lot 4 will act as the temporary staging material stockpile area for the roadway construction.
- Strip all top and subsoil for reuse on site. Place top and subsoil on Lot 4 (surround soil with erosion control sock.
- Coordinate with Reading Police Department for work in Lowell Street. Also notify the Reading Engineering Department. Saw cut pavement in Lowell street for utility installation. Install new utilities to Lyle Estates. Patch Lowell Street. Final pavement repair in Lowell Street to be completed at the time of pavement for Lyle Estates.
- Install new utilities within the Lyle Estates Roadway – sewer, water, hydrant, drainage BMP 1, street lighting, power and gas.
- Construct final roadway, sidewalks and curbing.
- Pave new roadway and pavement repair in Lowell Street.
- Place loam and seed.
- Plant BMP 1.
- Prepare as-built drawing.

During construction the contractor shall have in his possession at the site the following documents (but not limited to):

- Complete set of plans and Reports prepared by the engineer.
- Notice of Intent by prepared by the wetlands consultant.
- Oder of Conditions issued by the Reading Conservation Commission.
- Conditions of Approval issued by the Reading Planning Board.

Prior to the start of construction and before the on-site pre-construction meting the contractor shall review all documents related to the project. It is the responsibility of the contractor to confirm that he has obtained and review all documents for the proposed project.

2.7 LONG TERM OPERATION AND MAINTENANCE

The long term Operation and Maintenance Program will include the following items:

Roadway:

- Roadway sweeping and winter conditions plowing will be performed by the applicant until such time that roadway is accepted by the Town of Reading. Roadway sweeping will be done in the early spring and as needed do to the ongoing site construction.

- Catch Basin cleaning will be performed by the applicant until such time that roadway is accepted by the Town of Reading. Catch Basin clearing will be done in the early spring and as needed do to the ongoing site construction. In the fall catch basin inlets will be inspected clean after leaf drop.

- BMP 1 maintenance will be performed by the applicant until such time that roadway is accepted by the Town of Reading. At that time the maintenance will become the responsibility of the Lot 1 home owner and or a home owner's association.

Lots 1-4:

- Lots 1-4 will be responsible for maintaining the stormwater infiltration systems and LID BMP's. this maintenance would include:

    1. Inspection and cleaning of gutters in late fall.
    2. Inspection and maintenance of Infiltration Systems in early spring.
    3. Inspections and cleaning of LID BMP's (see attached Home Owners Rain Garden Guide – Appendix B).

2.8 TRAFFIC

INTRODUCTION

The purpose of this technical section of the Report is to document the existing traffic information at the proposed Lyle Estates Subdivision located on Lowell Street (Route 129) Reading, Massachusetts in accordance with the Town of Reading Rules and Regulations. The project consists of the subdivision of a parcel of land on Lowell Street (Route 129) that when fully constructed will include 3 new buildable lots along with the existing house (364 Lowell Street). Frontage for the new lots will be on a new fully built roadway and all driveways will access the new roadway.

The standards used for analysis conform to the most recent editions of the ***Manual on Uniform Traffic Control Devices (MUTCD)***, the ***Highway Capacity Manual (HCM)***, and are consistent with the guidelines set forth by the ***Massachusetts Department of Transportation (MassDOT)***.**Figure T1 – Locus Plan**

EXISTING CONDITIONS

The following section documents the existing traffic conditions in the vicinity of the project.

Lowell Street (Route 129)

The project's primary impact area is proposed to be identified by the immediate roadway segment of Lowell Street. Lowell Street (Route 129) is classified as a Rural Minor Arterial under the Federal Functional Classification system. Lowell Street is a two-way roadway, and runs in a general east-west direction and provides commuters access between Reading, Wilmington, and Interstates 93 and 95. The roadway operates with one travel lane in each direction. The overall roadway width is approximately 30 feet with 5' concrete sidewalks on each side of the roadway. A double yellow centerline separates the travel lanes at the site. Parking is prohibited on both sides of the roadway and utility poles are located along the eastbound side.

Looking westbound on Lowell Street

Looking eastbound on Lowell Street

Existing Traffic Volumes

Automated Traffic Recorders

A traffic counting program is conducted each year by the Statewide Traffic Data Collection section of the Massachusetts Department (MassDOT) of transportation. The program involves the systematic collection of traffic data utilizing automatic traffic recorders located on various roadways throughout the state.

The principal traffic volume parameters from MassDOT data for Route 129 (south of 93) in Reading are given below for this section of the roadway.

Table T1 MassDOT Statewide Traffic Data

Location	ADT	D	A.M. Peak	P.M. Peak
Lowell Street (Route 129)	17,000	52% WB	1,400	1,550

PROPOSED CONDITIONS

The proposed new roadway is located approximately 1200' west of the signalized intersection of Willow Street/Grove Street and Lowell Street. The proposed intersection is a 3-legged un-signalized intersection with the proposed roadway approaching from the south, and Lowell Street approaching from the east and west. The posted speed limit at the intersection of the new roadway and Lowell Street is 40 mph in both directions. However, the speed limit is reduced to 30 mph between Plymouth Street and the Willow Street/Grove Street and Lowell Street Intersection (see Figure SD 2).

The proposed roadway is 28 feet with double yellow line separating the travel lanes. There is a 5' wide bituminous concrete sidewalk on the easterly side of the proposed roadway, and a crosswalk across the roadway at the intersection with pedestrian ramps on either end to facilitate crossing. The proposed roadway is the minor movement at the intersection and is controlled by a stop sign (see Sheets C8, C9, and C10).

Future Vehicular Traffic

This proposed development would include a new roadway intersecting Lowell Street (Route 129) in Reading to service 3 new residential lots. To be conservative for our assessment we have assumed that each new residence will generate two (2) vehicular trips during the morning and evening peak hours, one (1) in, and one (1) out.

Based on the MassDOT Statewide Traffic Data, and our assumptions above, we believe that the proposed development will not significantly impact the area traffic, and Lowell Street will continue to operate at its current levels of service with no additional delays on all approaches.

Site Distance

Sight distance is the length of roadway ahead that is visible to the roadway user. In most cases, specific sight distance measures apply to motor vehicles and bicyclists. At intersections sight distance is provided to allow drivers to perceive the presence of potentially conflicting vehicles. This should occur in sufficient time for a motorist to stop or adjust their speed, as appropriate, to avoid colliding in the intersection. Sight distance also allows drivers of stopped vehicles with a sufficient view of the intersecting roadway to decide when to enter or cross the intersecting roadway. AASHTO's *A Policy on the Geometric Design of Highways and Streets* provides

procedures to determine desirable sight distances at intersections for various cases are described below and include:

- Case A – Intersections with no control on any approach
- Case B – Intersections with stop control on the minor street
- Case C – Intersections with yield control on the minor street
- Case D – Intersections with traffic signal control
- Case E – Intersections with all-way stop sign control
- Case F – Left turns from the major road

The proposed roadway is the minor movement at the 3-legged intersection and is controlled by a stop sign, which is in conformance with Case B. The excerpt below from Section 3.7.4.4 of MassDOT Project Development & Design Guide 2006 Edition describes the method used to determine the desirable Site Distance.

3.7.4.4 Case B – Stop Control on Minor Street
At an intersection with stop control on the minor street, as illustrated in Exhibit 3-11, the stopped minor-street driver must be able to see motor vehicles and bicycles approaching on the major street from either direction, at sufficient distance to allow crossing or turning maneuvers from the minor street. The leg of the intersection sight triangle on the minor street (Dimension A) is the distance between the driver's eye and front of vehicle (8 feet) plus distance from front of vehicle to edge of pavement (6.5 feet, prefer 10 feet) plus the distance from edge of pavement to middle of lane of interest (e.g., 6 feet for a right turn, 18 feet for a left turn on an undivided 2-lane highway, etc.) The major street leg of the triangle is the intersection sight distance along the major road (Dimension B).

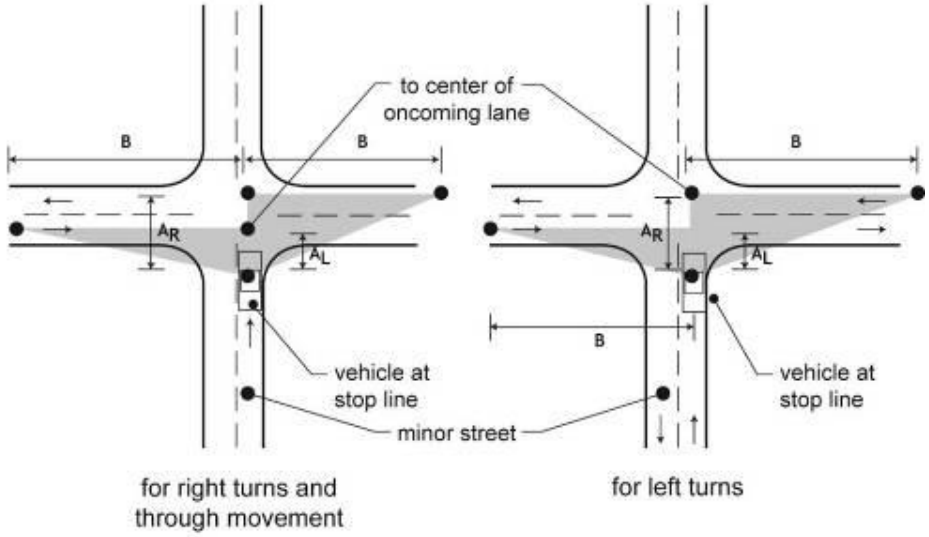
Left Turns from Stop Controlled Minor Street

For motor vehicles making a left turn, the intersection sight distance along the major street (Dimension B) is given for an intersection of 2-lane streets in Exhibit 3-11. For example, at a design speed of 40 edge of the major street travel lane, the intersection sight distance (Dimension B) is 445 feet. It is recommended that this intersection sight distance (Dimension B) be applied along the major street for left turns. The present layout has a minimum of 450'.

Right Turns from Stop Controlled Minor Street

For motor vehicles making a right turn from the minor street, the intersection sight distances are given in Exhibit 3-11. Here at a design speed of 40 edge of the major street travel lane, the intersection sight distance (Dimension B) is 385 feet. It is recommended that this intersection sight distance (Dimension B) be applied along the major street for right turns. The present layout has a minimum of 400'.

Exhibit 3-11
Sight Triangle Case B
Departure Sight Triangles



Sight Triangle Legs: Case B – Stop Control on Cross Street

Major Street Design Speed (mph)	Length of Sight Triangle Legs (feet)			
	Minor Street for Vehicles Approaching From Right (A_R, feet)	Minor Street for Vehicles Approaching From Left (A_L, feet)	Major Street For Left Turns (B, feet)	Major Street for Right Turns or Through (B, feet)
15	32.5	20.5	170	145
20	32.5	20.5	225	195
25	32.5	20.5	280	240
30	32.5	20.5	335	290
35	32.5	20.5	390	335
40	32.5	20.5	445	385
45	32.5	20.5	500	430
50	32.5	20.5	555	480
55	32.5	20.5	610	530
60	32.5	20.5	665	575
65	32.5	20.5	720	625
70	32.5	20.5	775	670
75	32.5	20.5	830	720

Sight triangle legs shown are for passenger car crossing or turning into a two-lane street, with grades (all approaches) 3 percent or less. For other grades and for other major street widths, recalculate using AASHTO *Green Book* formulas.

Source: *A Policy on Geometric Design of Streets and Highways*, AASHTO, Washington DC, 2004. Chapter 3 Elements of Design

Site Distance analysis Figures SD 1 and 2 are provided in the **Appendix 2B**.

Fire Truck Turning Movements

Figure shows the turning movements for the largest fire truck for the Reading Fire Department. The fire truck can make both turns into and exiting the site. And is able to make the turn at the cul-de-sac. The Town of Reading standard for the paved radius for a cul-de-sac is 40'. The radius provided on the new roadway is 36'.

Soil Boring Logs

Logs 1-10

Also see Sheet C8 for Soil Logs 6 and 8-10

Appendix A

ASB design group LLC

JOB NUMBER : 2012-30 **PAGE:** 1 **OF** 1

FORM 11 - SOIL EVALUATOR FORM

Commonwealth of Massachusetts

SOIL SUITABILITY ASSESSMENT FOR ON-SITE SEWAGE DISPOSAL OR BEST MANAGEMENT PRACTICE

Performed By : Thad Berry **Date of Testing :** 6.18.2013

Witnessed By : **Dig Safe No. :** By Others - Paul's Landscaping

Location : Address or Lot No.	Owner's Name and Address
364 Lowell Street (Route 129)	Jamieson Properties LLC
Reading Ma. 01867	627 Main Street, Suite 1
	Woburn MA. 01801

OFFICE REVIEW

Published Soil Survey : NO ☐ YES ☐ Year Published : See Soils Map Map Scale : See Soils Map

Drainage Class Soil Limitations : Soil Map Unit : See Soils Map

Surficial Geological Report Available: NO ☐ YES ☐ Year Published :

Map Scale : Geological Material (Map Unit) : Landform :

Flood Insurance Rate Map :

Above 500 - Year Flood Boundary ?	NO ☐	YES ☐
Within 500 - Year Flood Boundary ?	NO ☐	YES ☐
Within 100 - Year Flood Boundary ?	NO ■	YES ☐

Wetland :

National Wetland Inventory Map (Map Unit) :

Wetlands Conservancy Program Unit (Map Unit) :

Wetlands Resource Area Delineation : See Sheet C3

Wetlands Resource Area Delineation By : Wetlands and Land Management Inc. - Bill Manuell

Current Water Resource Conditions (USGS) : Month :

Range : Above Normal ☐ Normal ☐ Below Normal ☐

Other References Reviewed/Notes :

☐ New Construction - Septic System

■ Best Management Practice - New Construction

■ Best Management Practice - Residential

☐ Septic System Repair

☐ Best Management Practice - Redevelopment

JOB NUMBER : 2012-30 **PAGE :** 2 1 **OF** 10

FORM 11 - SOIL EVALUATOR FORM

Commonwealth of Massachusetts

Deep Hole Number : 1 Date : 6.18.2013 Weather : Sunny 70˚

Location (identify on plan) : See Sheet C1

Land Use : Residential Slope (%) : See Sheet C1 Surface Stones : See Sheet C1

Vegetation : See Sheet C1 Landform : See Sheet C1 Position on Landscape See Sheet C1

Distance From :

Open Water Body:	See Sheet C1	feet	Drainage Way:	See Sheet C1	feet
Possible Wet Area:	See Sheet C1	feet	Property Line:	See Sheet C1	feet
Drinking Water Well:	See Sheet C1	feet	Other:	See Sheet C1	feet

DEEP HOLE OBSERVATION LOG

Depth from surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other: (Structure, Stones, Boulders, Consistency, % Gravel)
0-12	A	S.L.	10YR 3/2		Roots
12-30	B	L.S.	10YR 5/8		Roots
30-126	C	Sand	2.5Y 7/6		

Receiving Layers : C_1/C_2 Design Class : I

Parent Material (geological) : Outwash Depth to Bedrock (Ledge) : -

Depth to Groundwater : - Standing Water in the Hole : -

Weeping from Pit Face : -

Estimated Seasonal High Ground Water (S.H.W.T.) : S.H.W.T. None @ 126"

☐ New Construction - Septic System ☐ Septic System Repair

■ Best Management Practice - New Construction ☐ Best Management Practice - Redevelopment

■ Best Management Practice - Residential

Notes : Soil Testing for Stormwater Management and Roadway Design

JOB NUMBER : 2012-30 **PAGE :** 2 2 **OF** 10

FORM 11 - SOIL EVALUATOR FORM

Commonwealth of Massachusetts

Deep Hole Number : 2 Date : 6.18.2013 Weather : Sunny 70˚

Location (identify on plan) : See Sheet C1

Land Use : Residential Slope (%) : See Sheet C1 Surface Stones : See Sheet C1

Vegetation : See Sheet C1 Landform : See Sheet C1 Position on Landscape See Sheet C1

Distance From :

Open Water Body:	See Sheet C1	feet	Drainage Way:	See Sheet C1	feet
Possible Wet Area:	See Sheet C1	feet	Property Line:	See Sheet C1	feet
Drinking Water Well:	See Sheet C1	feet	Other:	See Sheet C1	feet

DEEP HOLE OBSERVATION LOG

Depth from surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other: (Structure, Stones, Boulders, Consistency, % Gravel)
0-12	A	S.L.	10YR 3/2		
12-24	B	L.S.	10YR 5/6		Roots
24-72	C1	Coarse Sand	2.5Y 7/6		
72-120	C2	Sand	2.5Y 7/3		

Receiving Layers : C_1/C_2 Design Class : I

Parent Material (geological) : Outwash Depth to Bedrock (Ledge) : -

Depth to Groundwater : - Standing Water in the Hole : -

Weeping from Pit Face : -

Estimated Seasonal High Ground Water (S.H.W.T.) : S.H.W.T. None @ 120"

☐ New Construction - Septic System

☐ Septic System Repair

■ Best Management Practice - New Construction

☐ Best Management Practice - Redevelopment

■ Best Management Practice - Residential

Notes : Soil Testing for Stormwater Management and Roadway Design

FORM 11 - SOIL EVALUATOR FORM

Commonwealth of Massachusetts

Deep Hole Number : 3 Date : 6.18.2013 Weather : Sunny 70˚

Location (identify on plan) : See Sheet C1

Land Use : Residential Slope (%) : See Sheet C1 Surface Stones : See Sheet C1

Vegetation : See Sheet C1 Landform : See Sheet C1 Position on Landscape See Sheet C1

Distance From :

Open Water Body:	See Sheet C1	feet	Drainage Way:	See Sheet C1	feet
Possible Wet Area:	See Sheet C1	feet	Property Line:	See Sheet C1	feet
Drinking Water Well:	See Sheet C1	feet	Other:	See Sheet C1	feet

DEEP HOLE OBSERVATION LOG

Depth from surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other: (Structure, Stones, Boulders, Consistency, % Gravel)
0-12	A	S.L.	10YR 3/2		
12-24	B	L.S.	10YR 5/6		Roots
24-108	C	Coarse Sand	2.5Y 7/4		

Receiving Layers : C_1/C_2 Design Class : I

Parent Material (geological) : Outwash Depth to Bedrock (Ledge) : -

Depth to Groundwater : - Standing Water in the Hole : -

Weeping from Pit Face : -

Estimated Seasonal High Ground Water (S.H.W.T.) : S.H.W.T. None @ 108"

☐ New Construction - Septic System

☐ Septic System Repair

■ Best Management Practice - New Construction

☐ Best Management Practice - Redevelopment

■ Best Management Practice - Residential

Notes : Soil Testing for Stormwater Management and Roadway Design

JOB NUMBER : 2012-30 **PAGE :** 2 4 **OF** 10

FORM 11 - SOIL EVALUATOR FORM

Commonwealth of Massachusetts

Deep Hole Number : 4 Date : 6.18.2013 Weather : Sunny 70˚

Location (identify on plan) : See Sheet C1

Land Use : Residential Slope (%) : See Sheet C1 Surface Stones : See Sheet C1

Vegetation : See Sheet C1 Landform : See Sheet C1 Position on Landscape See Sheet C1

Distance From :

Open Water Body:	See Sheet C1	feet	Drainage Way:	See Sheet C1	feet
Possible Wet Area:	See Sheet C1	feet	Property Line:	See Sheet C1	feet
Drinking Water Well:	See Sheet C1	feet	Other:	See Sheet C1	feet

DEEP HOLE OBSERVATION LOG

Depth from surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other: (Structure, Stones, Boulders, Consistency, % Gravel)
0-6	Fill				Leaves
6-18	A	S.L.	10YR 3/2		
18-30	B	L.S.	10YR 5/6		Roots
30-108	C	Coarse Sand	2.5Y 7/4	84"	

Receiving Layers : C_1/C_2 Design Class : I

Parent Material (geological) : Outwash Depth to Bedrock (Ledge) : -

Depth to Groundwater : - Standing Water in the Hole : -

Weeping from Pit Face : -

Estimated Seasonal High Ground Water (S.H.W.T.) : S.H.W.T. None @ 84" 7.5YR 4/6

☐ New Construction - Septic System ☐ Septic System Repair

■ Best Management Practice - New Construction ☐ Best Management Practice - Redevelopment

■ Best Management Practice - Residential

Notes : Soil Testing for Stormwater Management and Roadway Design

FORM 11 - SOIL EVALUATOR FORM

Commonwealth of Massachusetts

Deep Hole Number : 5 Date : 6.18.2013 Weather : Sunny 70˚

Location (identify on plan) : See Sheet C1

Land Use : Residential Slope (%) : See Sheet C1 Surface Stones : See Sheet C1

Vegetation : See Sheet C1 Landform : See Sheet C1 Position on Landscape See Sheet C1

Distance From :

Open Water Body:	See Sheet C1	feet	Drainage Way:	See Sheet C1	feet
Possible Wet Area:	See Sheet C1	feet	Property Line:	See Sheet C1	feet
Drinking Water Well:	See Sheet C1	feet	Other:	See Sheet C1	feet

DEEP HOLE OBSERVATION LOG

Depth from surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other: (Structure, Stones, Boulders, Consistency, % Gravel)
0-12	A	S.L.	10YR 3/2		
12-24	B	L.S.	10YR 5/6		Roots
24-108	C	Coarse Sand	2.5Y 6/6	60"	

Receiving Layers : C_1/C_2 Design Class : I

Parent Material (geological) : Outwash Depth to Bedrock (Ledge) : -

Depth to Groundwater : - Standing Water in the Hole : -

Weeping from Pit Face : 70"

Estimated Seasonal High Ground Water (S.H.W.T.) : S.H.W.T. @ 60" 7.5YR 4/6

☐ New Construction - Septic System ☐ Septic System Repair

■ Best Management Practice - New Construction ☐ Best Management Practice - Redevelopment

■ Best Management Practice - Residential

Notes : Soil Testing for Stormwater Management and Roadway Design

FORM 11 - SOIL EVALUATOR FORM

Commonwealth of Massachusetts

Deep Hole Number : 6 Date : 6.18.2013 Weather : Sunny 70˚

Location (identify on plan) : See Sheet C1

Land Use : Residential Slope (%) : See Sheet C1 Surface Stones : See Sheet C1

Vegetation : See Sheet C1 Landform : See Sheet C1 Position on Landscape See Sheet C1

Distance From :

Open Water Body:	See Sheet C1	feet	Drainage Way:	See Sheet C1	feet
Possible Wet Area:	See Sheet C1	feet	Property Line:	See Sheet C1	feet
Drinking Water Well:	See Sheet C1	feet	Other:	See Sheet C1	feet

DEEP HOLE OBSERVATION LOG

Depth from surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other: (Structure, Stones, Boulders, Consistency, % Gravel)
0-12	Fill				Stone Dust/Ground Pavement
12-108	C1	Coarse Sand	2.5Y 7/6	84"	

Receiving Layers : C_1/C_2 Design Class : I

Parent Material (geological) : Outwash Depth to Bedrock (Ledge) : -

Depth to Groundwater : - Standing Water in the Hole : -

Weeping from Pit Face : -

Estimated Seasonal High Ground Water (S.H.W.T.) : S.H.W.T. @ 84" 7.5YR 4/6

☐ New Construction - Septic System ☐ Septic System Repair

■ Best Management Practice - New Construction ☐ Best Management Practice - Redevelopment

■ Best Management Practice - Residential

Notes : Soil Testing for Stormwater Management and Roadway Design

FORM 11 - SOIL EVALUATOR FORM

Commonwealth of Massachusetts

Deep Hole Number : 7 Date : 6.18.2013 Weather : Sunny 70˚

Location (identify on plan) : See Sheet C1

Land Use : Residential Slope (%) : See Sheet C1 Surface Stones : See Sheet C1

Vegetation : See Sheet C1 Landform : See Sheet C1 Position on Landscape See Sheet C1

Distance From :

Open Water Body:	See Sheet C1 feet	Drainage Way:	See Sheet C1 feet
Possible Wet Area:	See Sheet C1 feet	Property Line:	See Sheet C1 feet
Drinking Water Well:	See Sheet C1 feet	Other:	See Sheet C1 feet

DEEP HOLE OBSERVATION LOG

Depth from surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other: (Structure, Stones, Boulders, Consistency, % Gravel)
0-18	Fill				Stone Dust/Driveway Pack
18-36	C1	Sand	10YR 7/8	30"	
36-120	C2	Sand	2.5Y 7/3		

Receiving Layers : C_1/C_2 Design Class : I

Parent Material (geological) : Outwash Depth to Bedrock (Ledge) : -

Depth to Groundwater : - Standing Water in the Hole : 72"

Weeping from Pit Face : 48"

Estimated Seasonal High Ground Water (S.H.W.T.) : S.H.W.T. @ 30" 7.5YR 4/6

☐ New Construction - Septic System

☐ Septic System Repair

■ Best Management Practice - New Construction

☐ Best Management Practice - Redevelopment

■ Best Management Practice - Residential

Notes : Soil Testing for Stormwater Management and Roadway Design

FORM 11 - SOIL EVALUATOR FORM

Commonwealth of Massachusetts

Deep Hole Number : 8 Date : 6.18.2013 Weather : Sunny 70˚

Location (identify on plan) : See Sheet C1

Land Use : Residential Slope (%) : See Sheet C1 Surface Stones : See Sheet C1

Vegetation : See Sheet C1 Landform : See Sheet C1 Position on Landscape See Sheet C1

Distance From :

Open Water Body:	See Sheet C1	feet	Drainage Way:	See Sheet C1	feet
Possible Wet Area:	See Sheet C1	feet	Property Line:	See Sheet C1	feet
Drinking Water Well:	See Sheet C1	feet	Other:	See Sheet C1	feet

DEEP HOLE OBSERVATION LOG

Depth from surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other: (Structure, Stones, Boulders, Consistency, % Gravel)
0-60	Fill	Fill			Leaves/Organics
60-120	C	Fine Sand	2.5Y 7/6		

Receiving Layers : C_1/C_2 Design Class : I

Parent Material (geological) : Outwash Depth to Bedrock (Ledge) : -

Depth to Groundwater : - Standing Water in the Hole : -

Weeping from Pit Face : 60"

Estimated Seasonal High Ground Water (S.H.W.T.) : S.H.W.T. @ 60 " - Weeping/Disturbed Soil Horizon

☐ New Construction - Septic System ☐ Septic System Repair

☐ Best Management Practice - New Construction ☐ Best Management Practice - Redevelopment

☐ Best Management Practice - Residential

Notes : Soil Testing for Stormwater Management and Roadway Design

JOB NUMBER : 2012-30 **PAGE :** 2 9 **OF** 10

FORM 11 - SOIL EVALUATOR FORM

Commonwealth of Massachusetts

Deep Hole Number : 9 Date : 6.18.2013 Weather : Sunny 70˚

Location (identify on plan) : See Sheet C1

Land Use : Residential Slope (%) : See Sheet C1 Surface Stones : See Sheet C1

Vegetation : See Sheet C1 Landform : See Sheet C1 Position on Landscape See Sheet C1

Distance From :

Open Water Body:	See Sheet C1	feet	Drainage Way:	See Sheet C1	feet
Possible Wet Area:	See Sheet C1	feet	Property Line:	See Sheet C1	feet
Drinking Water Well:	See Sheet C1	feet	Other:	See Sheet C1	feet

DEEP HOLE OBSERVATION LOG

Depth from surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other: (Structure, Stones, Boulders, Consistency, % Gravel)
0-6	Fill	Fill			Ground Pavement
6-12	A	S.L.	10YR 3/2		
12-18	B	L.S.	10YR 5/8		
18-108	C	Sand	2.5Y 7/6	60"	

Receiving Layers : C_1/C_2 Design Class : I

Parent Material (geological) : Outwash Depth to Bedrock (Ledge) : -

Depth to Groundwater : - Standing Water in the Hole : -

Weeping from Pit Face : 84"

Estimated Seasonal High Ground Water (S.H.W.T.) : S.H.W.T. @ 60" 7.5YR 4/6

☐ New Construction - Septic System

☐ Septic System Repair

■ Best Management Practice - New Construction

☐ Best Management Practice - Redevelopment

■ Best Management Practice - Residential

Notes : Soil Testing for Stormwater Management and Roadway Design

FORM 11 - SOIL EVALUATOR FORM

Commonwealth of Massachusetts

Deep Hole Number : 10 Date : 6.18.2013 Weather : Sunny 70˚

Location (identify on plan) : See Sheet C1

Land Use : Residential Slope (%) : See Sheet C1 Surface Stones : See Sheet C1

Vegetation : See Sheet C1 Landform : See Sheet C1 Position on Landscape See Sheet C1

Distance From :

Open Water Body:	See Sheet C1	feet	Drainage Way:	See Sheet C1	feet
Possible Wet Area:	See Sheet C1	feet	Property Line:	See Sheet C1	feet
Drinking Water Well:	See Sheet C1	feet	Other:	See Sheet C1	feet

DEEP HOLE OBSERVATION LOG

Depth from surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other: (Structure, Stones, Boulders, Consistency, % Gravel)
0-12	A	S.L.	10YR 3/2		Roots
12-96	C	Sand	2.5Y 7/6	66"	

Receiving Layers : C_1/C_2 Design Class : I

Parent Material (geological) : Outwash Depth to Bedrock (Ledge) : -

Depth to Groundwater : - Standing Water in the Hole : -

Weeping from Pit Face : 78"

Estimated Seasonal High Ground Water (S.H.W.T.) : S.H.W.T. @ 66" 7.5YR 4/6

☐ New Construction - Septic System

☐ Septic System Repair

■ Best Management Practice - New Construction

☐ Best Management Practice - Redevelopment

■ Best Management Practice - Residential

Notes : Soil Testing for Stormwater Management and Roadway Design

ASB design group LLC

JOB NUMBER : 2012-30 **PAGE :** 3 1 **OF** 1

FORM 11 - SOIL EVALUATOR FORM

Commonwealth of Massachusetts

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Test Hole Number : 1-10

Method Used :

- ☐ Depth observed standing in observation hole _____ inches
- ☐ Depth weeping standing in observation hole _____ inches
- ☐ Depth to soil mottles See Soil Logs 1-10 inches
- ☐ Groundwater adjustment _____ inches

Index Well Number : _____ Date : _____ Index Well Level : _____

Adjustment Factor : _____ Adjusted Ground Water : _____

Depth of Naturally Occurring Pervious Material

Does at least four (4) feet of naturally occuring pervious material exist in the observed deep holes proposed for the soil absorption system ? N/A If not, what is the depth of naturally occurring pervious material ? N/A

Certification

I certify that on **May 1996** I have passed the examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise, and experience as described in 310 CMR 15.017.

Signature:

Thad Berry P.E. Date : 10-Sep-13

Comments/Notes

- ☐ New Construction - Septic System
- ☐ Septic System Repair
- ☐ Best Management Practice - New Construction
- ☐ Best Management Practice - Redevelopment
- ☐ Best Management Practice - Residential

Appendix B

Figures

TSS Removal Work Sheets 1 and 2

Stormwater Check List

Home Owners Rain Garden Guide

Soil Map—Middlesex County, Massachusetts
(Figure 2A)

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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: http://websoilsurvey.nrcs.usda.gov
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 13, Dec 17, 2013

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

Date(s) aerial images were photographed: Mar 30, 2011—May 1, 2011

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

Map Unit Legend

Middlesex County, Massachusetts (MA017)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
256A	Deerfield loamy sand, 0 to 3 percent slopes	1.3	16.3%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	6.5	83.7%
Totals for Area of Interest		**7.8**	**100.0%**

Hydrologic Soil Group—Middlesex County, Massachusetts
(Figure 2B)

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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: http://websoilsurvey.nrcs.usda.gov
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 13, Dec 17, 2013

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

Date(s) aerial images were photographed: Mar 30, 2011—May 1, 2011

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

Hydrologic Soil Group— Summary by Map Unit — Middlesex County, Massachusetts (MA017)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
256A	Deerfield loamy sand, 0 to 3 percent slopes	B	1.4	18.1%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	6.5	81.9%
Totals for Area of Interest			**8.0**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NORTH

RAINFALL DISTRIBUTION

TYPE I

TYPE IA

TYPE II

TYPE III

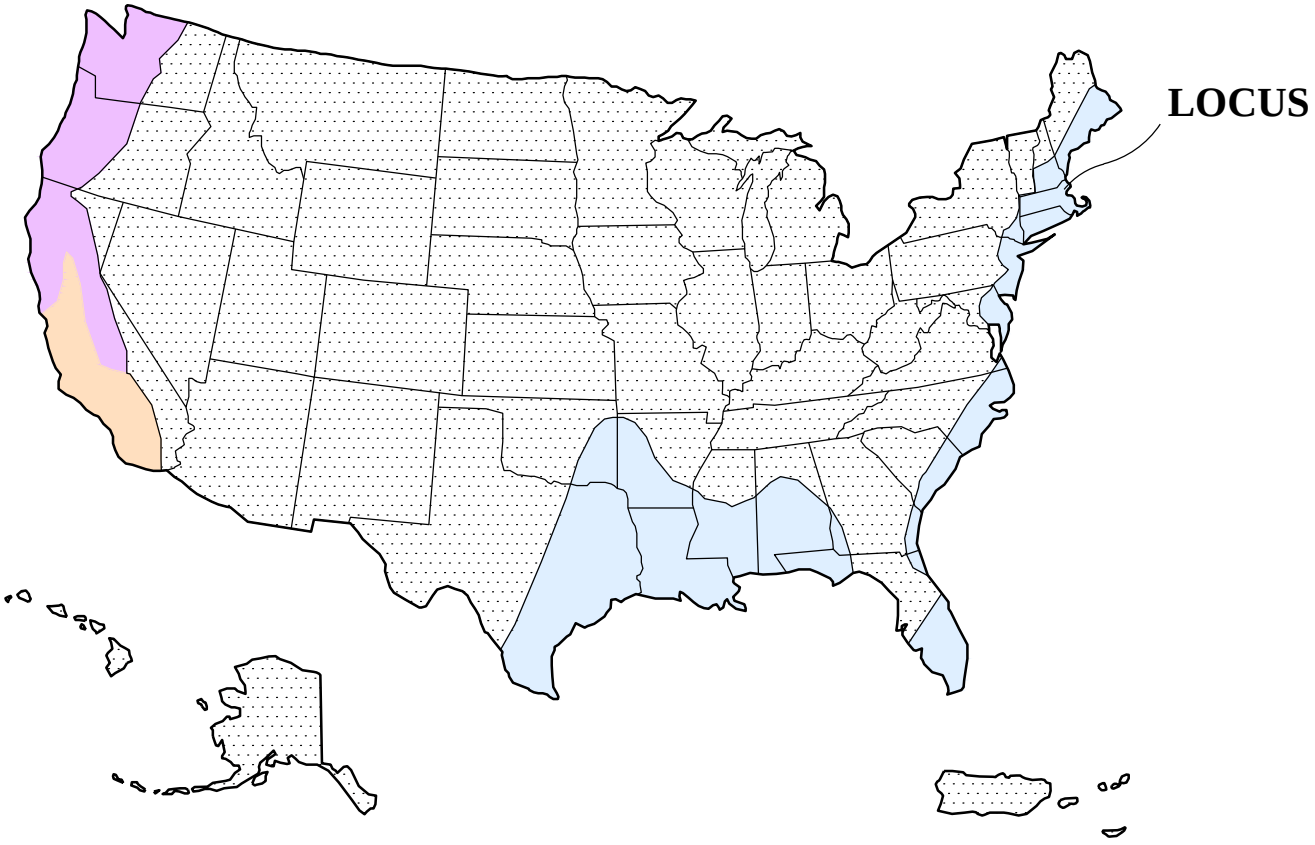
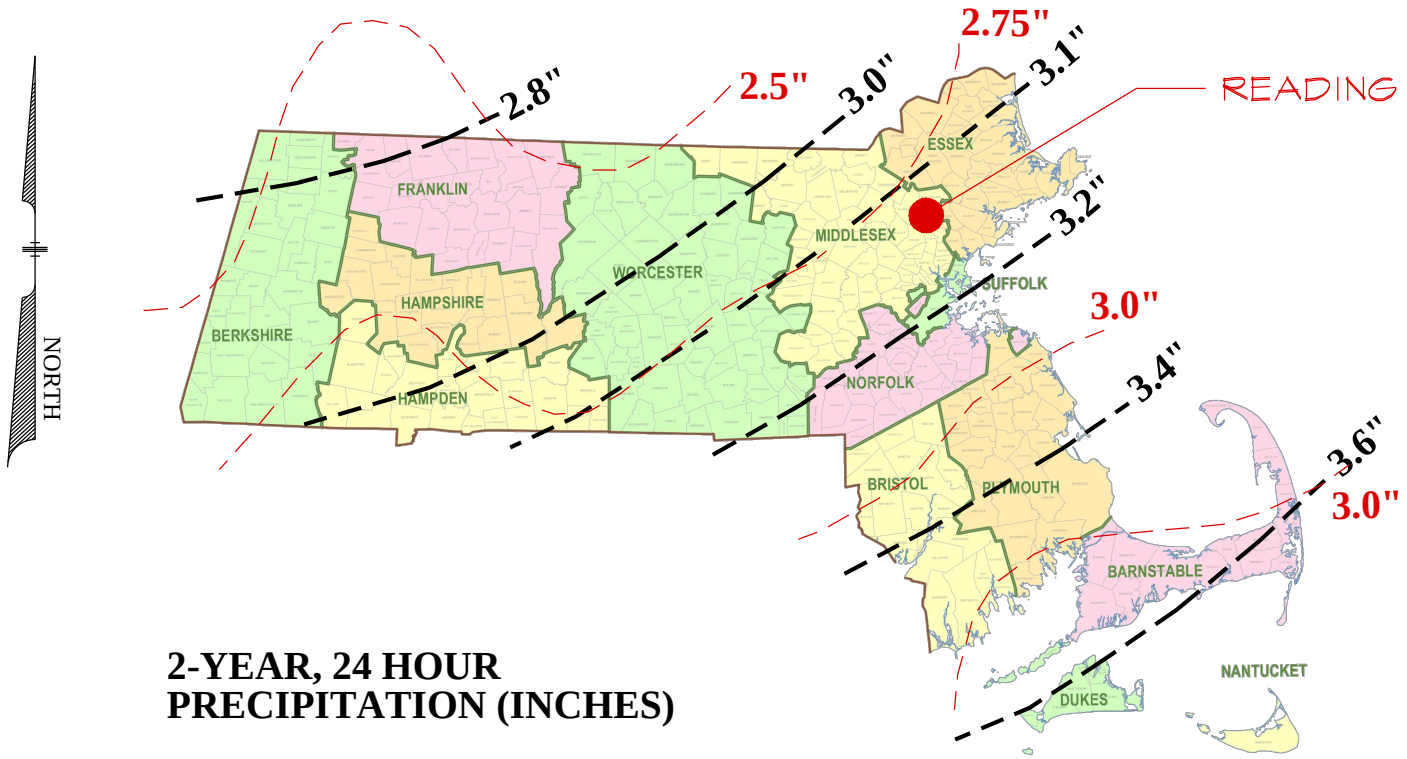


FIGURE 3
RAINFALL DISTRIBUTION MAP

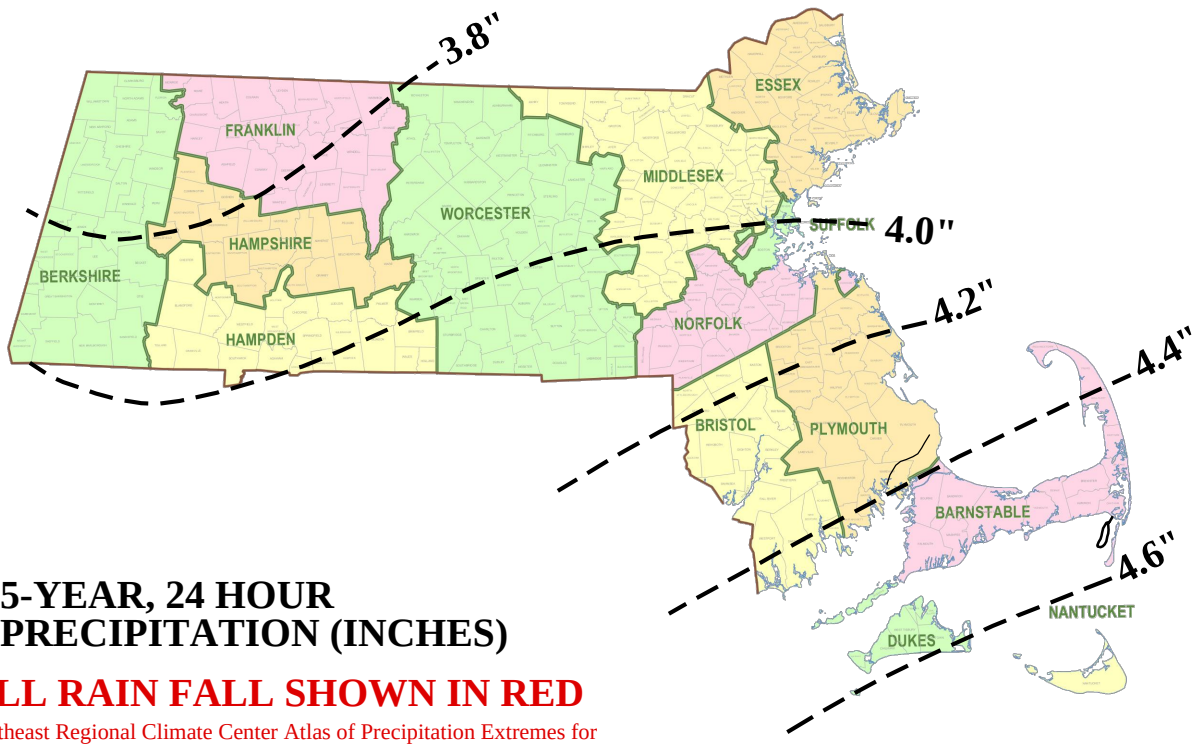
LYLE ESTATES
364 LOWELL STREET - ROUTE 129
READING MA. 01867

ASB design group LLC
363 BOSTON STREET - ROUTE 1
TOPSFIELD, MA. 01984
978-500-8419

STATE:	MASSACHUSETTS
CITY/TOWN:	READING
TYPE:	III
DATE:	APRIL 2016



2-YEAR, 24 HOUR PRECIPITATION (INCHES)



5-YEAR, 24 HOUR PRECIPITATION (INCHES)

CORNELL RAIN FALL SHOWN IN RED

SOURCE: Northeast Regional Climate Center Atlas of Precipitation Extremes for Northeastern United States and Southeastern Canada, by Daniel S. Wilks and Richard P. Cember, Cornell University, NY, Publication No. RR 93-5, September 1993

FIGURE 4

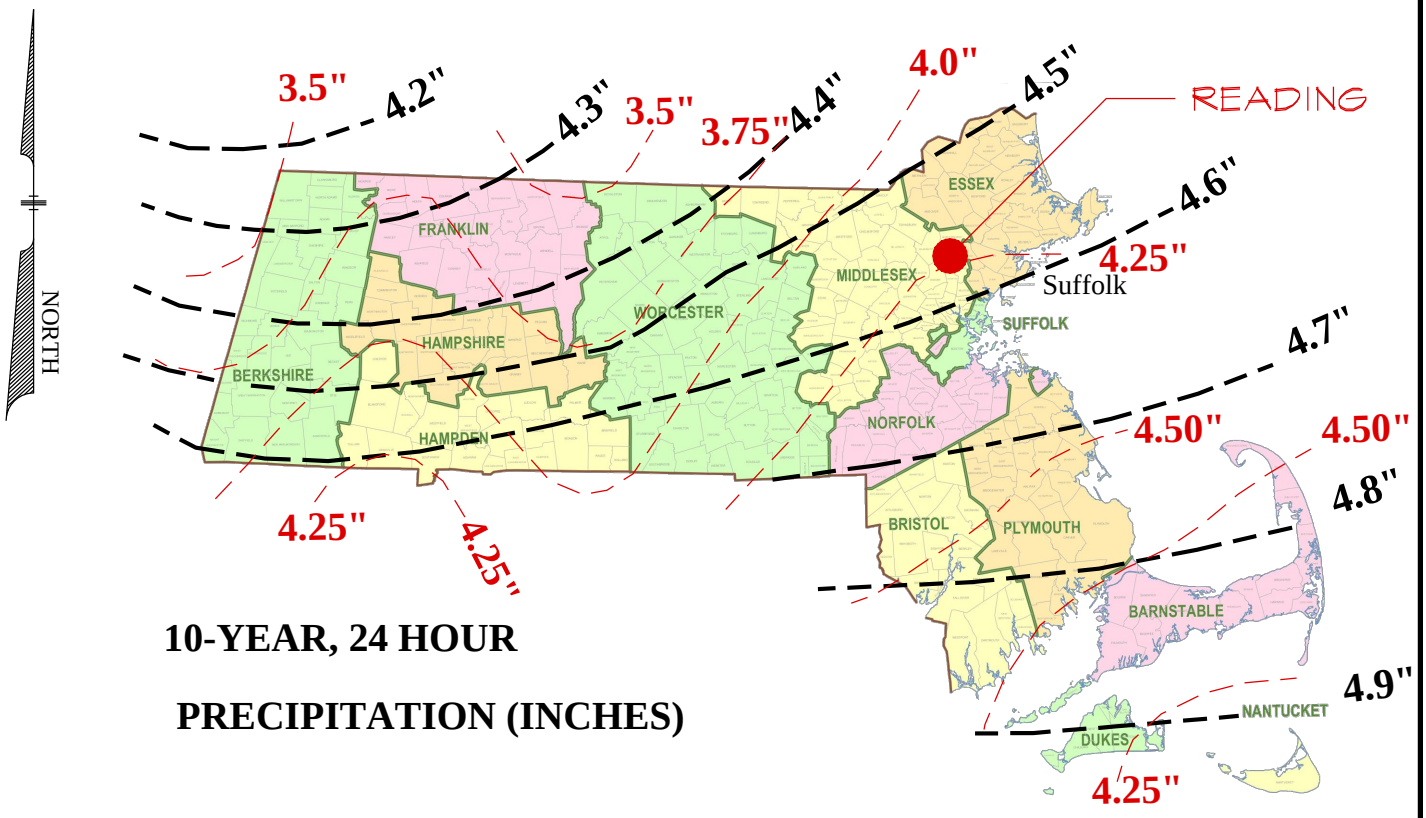
RAINFALL DATA MAPS

SHEET 1 OF 3

LYLE ESTATES
364 LOWELL STREET - ROUTE 129
READING MA. 01867

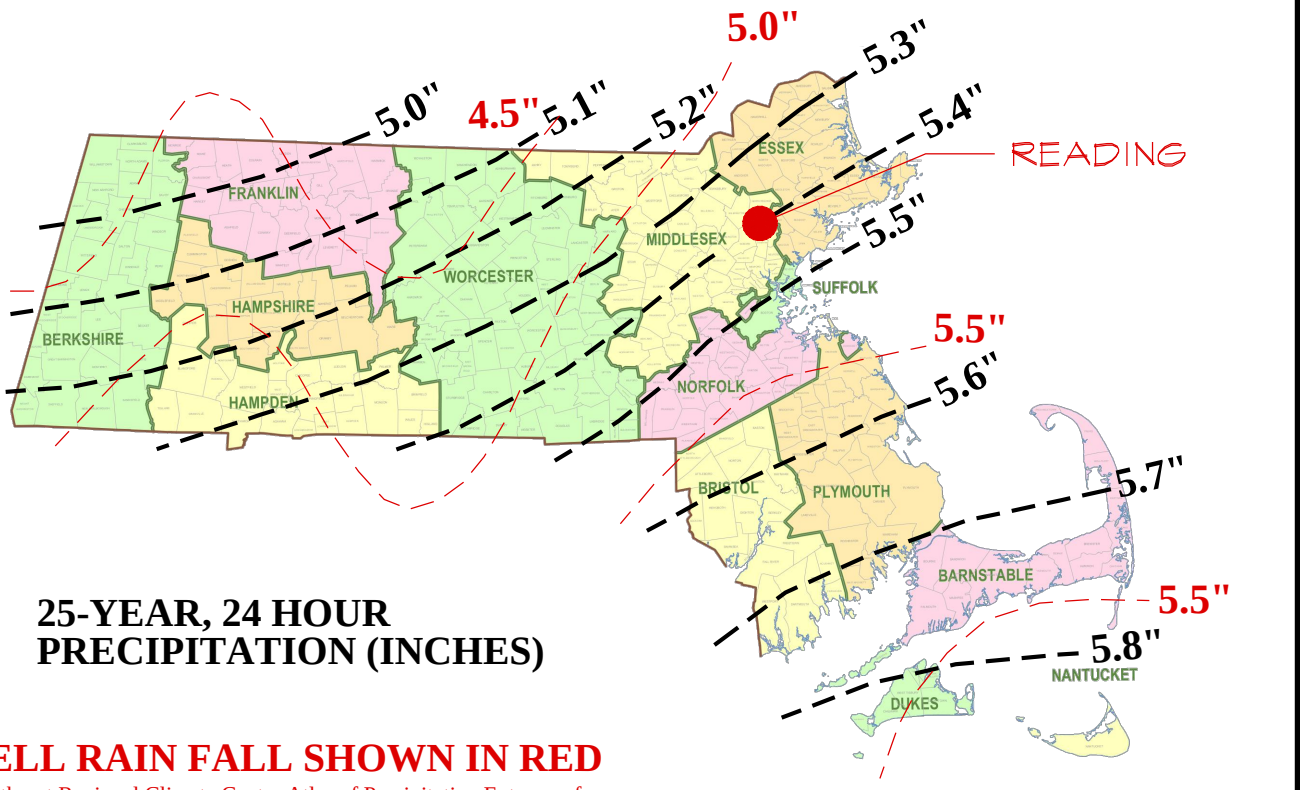
ASB design group LLC
363 BOSTON STREET - ROUTE 1
TOPSFIELD, MA. 01984
978-500-8419

STATE:	MASSACHUSETTS
CITY/TOWN:	READING
STORM:	2- and 5-YEAR
DATE:	APRIL 2016



10-YEAR, 24 HOUR

PRECIPITATION (INCHES)



25-YEAR, 24 HOUR
PRECIPITATION (INCHES)

CORNELL RAIN FALL SHOWN IN RED

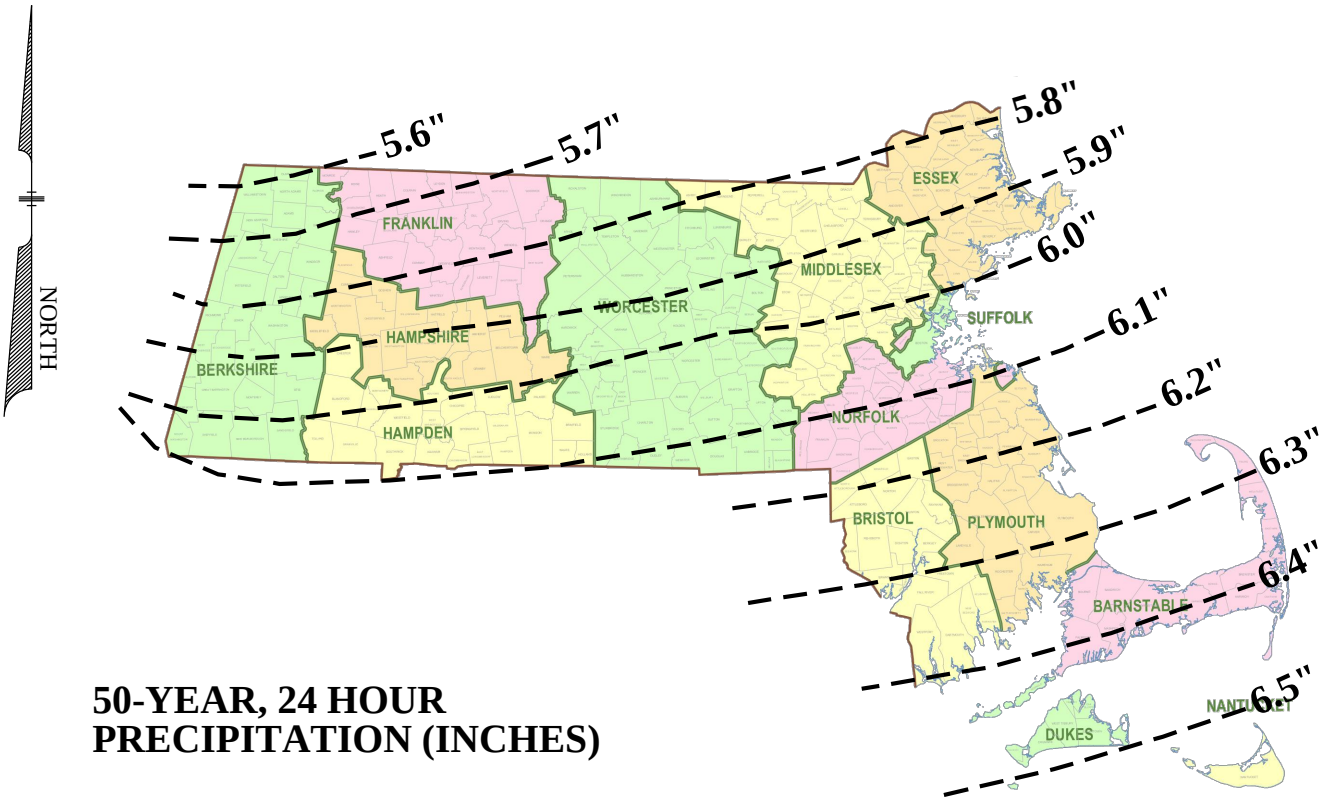
SOURCE: Northeast Regional Climate Center Atlas of Precipitation Extremes for Northeastern United States and Southeastern Canada, by Daniel S. Wilks and Richard P. Cember, Cornell University, NY, Publication No. RR 93-5, September 1993

FIGURE 4
RAINFALL DATA MAPS
SHEET 2 OF 3

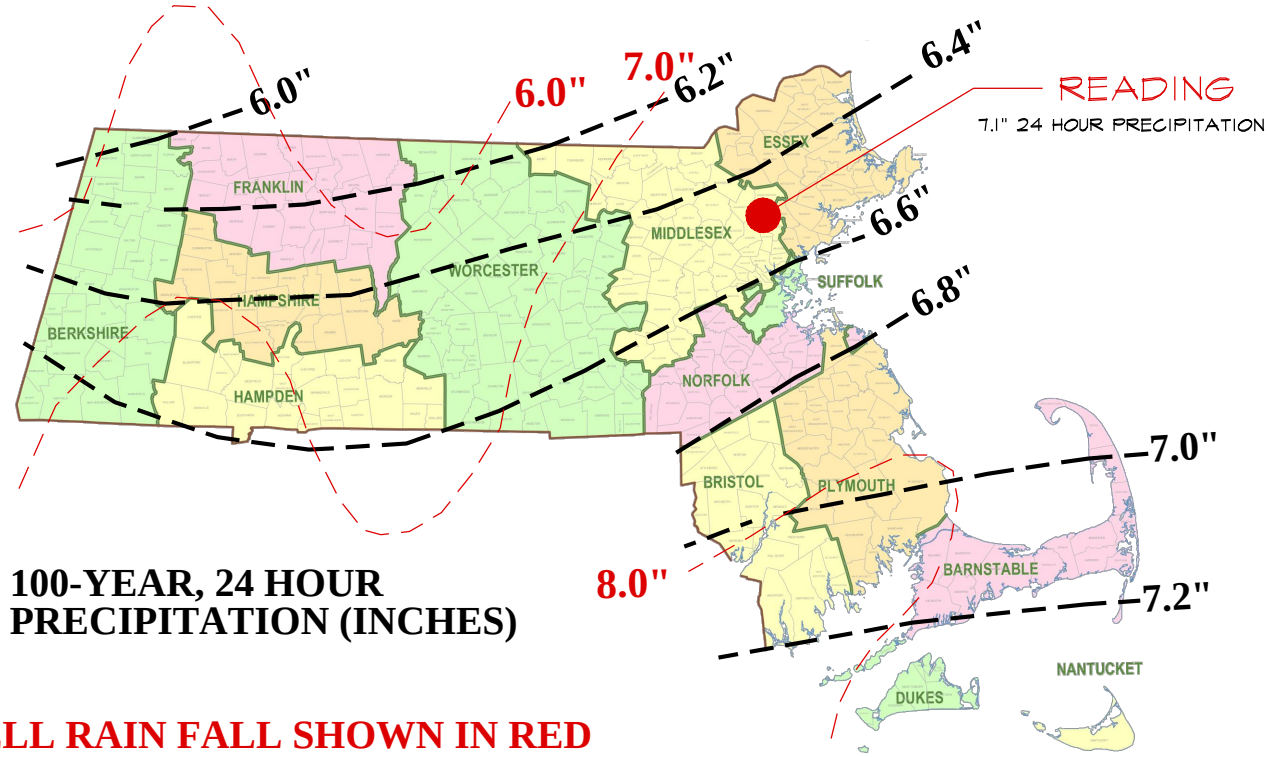
LYLE ESTATES
364 LOWELL STREET - ROUTE 129
READING MA. 01867

ASB design group LLC
363 BOSTON STREET - ROUTE 1
TOPSFIELD, MA. 01984
978-500-8419

STATE:	MASSACHUSETTS
CITY/TOWN:	READING
STORM:	10- and 25-YEAR
DATE:	APRIL 2016



50-YEAR, 24 HOUR PRECIPITATION (INCHES)



100-YEAR, 24 HOUR PRECIPITATION (INCHES)

CORNELL RAIN FALL SHOWN IN RED

SOURCE: Northeast Regional Climate Center Atlas of Precipitation Extremes for Northeastern United States and Southeastern Canada, by Daniel S. Wilks and Richard P. Cember, Cornell University, NY, Publication No. RR 93-5, September 1993

FIGURE 4
RAINFALL DATA MAPS
SHEET 3 OF 3

LYLE ESTATES
364 LOWELL STREET - ROUTE 129
READING MA. 01867

ASB design group LLC
363 BOSTON STREET - ROUTE 1
TOPSFIELD, MA. 01984
978-500-8419

STATE:	MASSACHUSETTS
CITY/TOWN:	READING
STORM:	50- and 100-YEAR
DATE:	APRIL 2016

ASB design group LLC

TSS Work Sheet # 1

LOCATION: 364 LOWELL STREET - ROUTE 129 READING MA. JOB #: 2012-30

TSS Removal Calculation Worksheet

A BMP	B TSS Removal Rate (%)	C Starting TSS Load *	D Amount Removed (*B* x *C*)	E Remaining Load (*C* - *D*)
Depp Sump Catch Basin	25.0%	**1.00**	0.25	0.75
Infiltration Basin with Vegetated Forbay	80.0%	0.75	0.60	0.15
		0.15	0.00	0.15
		0.15	0.00	0.15
		0.15	0.00	0.15
Total TSS Removal =			**85.0%**	

Project: LYLE ESTATES

Prepared By: **ASB** design group LLC

Date: April 1, 2016

Comments: Treatment Train - flow to Proposed Catch Basins 1 and 2 then discharge to Infiltration Basin with Vegetated Forbay. See TSS Work Sheet #2 for 44% TSS removal - soils with rapid infiltration.

* equals remaining load from previous BMP (*E*) that enters this BMP

ASB design group LLC

TSS Work Sheet # 2

LOCATION: 364 LOWELL STREET - ROUTE 129 READING MA. JOB #: 2012-30

TSS Removal Calculation Worksheet

A BMP	B TSS Removal Rate (%)	C Starting TSS Load *	D Amount Removed (*B* x *C*)	E Remaining Load (*C* - *D*)
Depp Sump Catch Basin	25.0%	**1.00**	0.25	0.75
Vegetated Forbay	25.0%	0.75	0.19	0.56
		0.56	0.00	0.56
		0.56	0.00	0.56
		0.56	0.00	0.56
Total TSS Removal =			**44.0%**	

Project: LYLE ESTATES

Prepared By: ASB design group LLC

Date: April 1, 2016

Comments: Treatment Train - flow to Proposed Catch Basins 1 and 2 then discharge to Infiltration Basin with Vegetated Forbay for 44% TSS removal - soils with rapid infiltration.

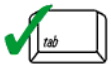
* equals remaining load from previous BMP (*E*) that enters this BMP

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.

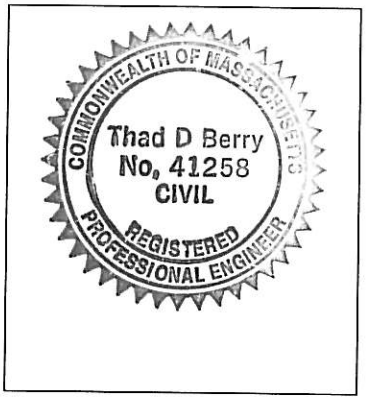
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

Registered Professional Engineer Block and Signature



Thad D Berry 4/14/2016

Signature and Date

Thad D Berry

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.

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

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

What is A Rain Garden

A rain garden is a shallow depression that allows rain and snowmelt to seep naturally into the ground by capturing runoff from rooftops and driveways. Most importantly, rain gardens help preserve nearby streams and ponds by reducing the amount of polluted runoff and filtering pollutants.

Why Do We Need a Rain Garden

Stormwater runoff from residential areas often contains excess lawn and garden fertilizers, pesticides and herbicides, oil, yard wastes, sediment and animal wastes which cause water pollution.

Rain gardens fill with stormwater and allow the water to slowly filter into the ground. They also help prevent stream bank erosion and lower the risk of local flooding.

What Plants Are In Our Rain Garden

Highbush Blueberry *(Vaccinium corymbosum)*
Winterberry *(Ilex verticillata)*
River Birch *(Betula nigra)*
Red Osier Dogwood *(Cornus serecia)*

There is room for more plantings if you desire. We suggest that you choose native, non-invasive species. *See Design Details for LID BMP 1-5 as outlined below.*

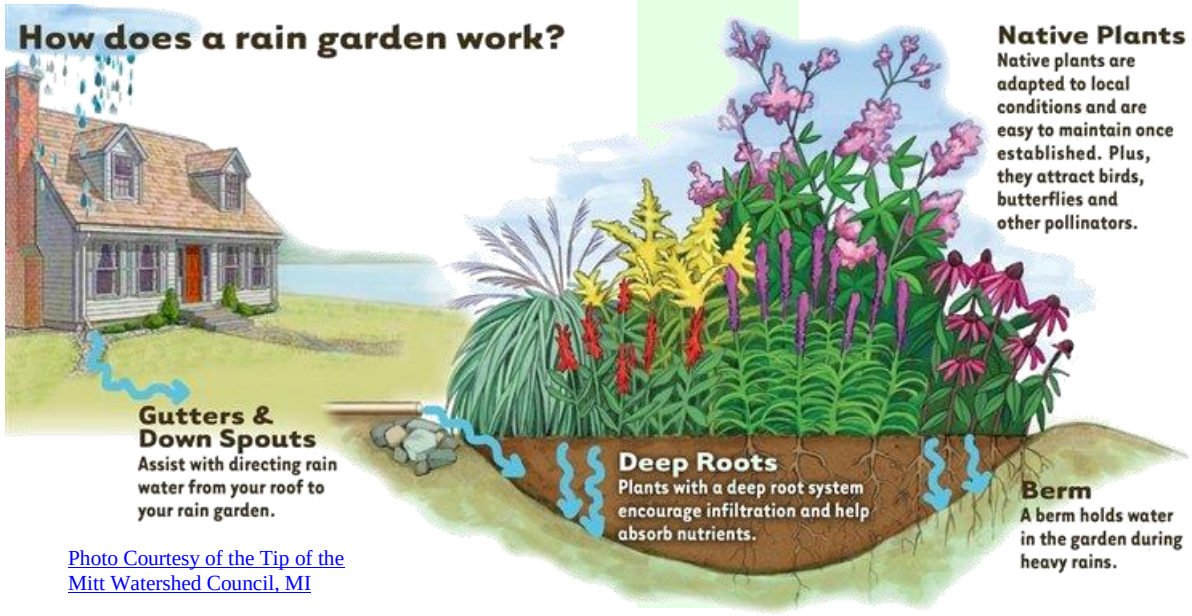


Photo Courtesy of the Tip of the Mitt Watershed Council, MI

Other Varieties That are Attractive and Appropriate

New England Aster *(Aster novae-angliae)*
Tussock Sedge *(Carex stricta)*
Joe Pye Weed *(Eupatorium maculatum)**
Turtlehead *(Chelone glabra)**
Boneset *(Eupatorium)*
Blueflag Iris *(Iris versicolor)*
Soft Rush *(Juncus effuses)*
Switchgrass *(Panicum virgatum)**
Beebalm *(Monarda)*
Coneflower *(Echinacea)*
Cardinal Flower *(Lobelia cardinalis)**
Ostrich Fern *(Matteuccia struthiopteris)**
Sensitive Fern *(Onoclea sensibilis)*
Meadow Sweet *(Spiraea latifolia)*
Steeplebush *(Spiraea tomentosa)*
High Bush Cranberry *(Viburnum trilobum)*

What Activities Should Be Avoided In A Rain Garden

Do not fertilize your rain garden. Water runoff carries many nutrients and fertilizes the rain garden regularly. Place the shoveled snow next to the garden so it will be absorbed into the rain garden when it melts instead of shoveling it into the garden. Locate the rain garden away from direct road salt discharge and of course, do not add soil within the rain garden.

What Possible Problems Might Need Attention

If your rain garden overflows, the berm could erode. Fill any erosion on the berm with well-packed soil or sod. A second rain garden can be added down slope if this becomes a problem.

What is The Proper Maintenance of a Rain Garden

After planting, you will want to pull weeds out of your rain garden until the mature plants crowd them out. For the first year, your rain garden will require monthly weeding during the growing season. It is only necessary to weed one time per year in the following years. Shrubs will need to be pruned annually. It may be necessary to water several times per week during extreme dry spells.

Design Detail LID BMP 1-5

Do the sandy soils on Lots 2-4 the planting list can be more extensive (always native plants). The sandy soils allow the stormwater runoff to quickly infiltrate into the soils. Also, due to the high infiltration rate for these soils the sites generally do not generate a large quantity of stormwater runoff both in Peak Rate (cubic feet per second) and volume (cubic feet).

For LID BMP's with this type of soil condition plants that can with stand long periods of dry conditions are preferred. Your local nursery will be able to assist you in your plant selection.

The first year a 4" layer of pine bark mulch is placed within the limits of the LID BMP. The homeowner should maintain a 4" depth. This may require having additional mulch be placed from time to time. Each spring aerate the mulch by hand and remove any weeds. At this time check to see if addition mulch is required. This would typically only require about ½" of new mulch.

Lots 2-3, Lyle Estates. Reading, MA

Here is your Rain Garden Guide

Inside you will find the answers to common questions such as:

- What is a Rain Garden
- What plants are in our rain garden
- How to maintain the rain garden
- Why do we need rain gardens