1 McGRATH HIGHWAY
SOMERVILLE, MA 02143

263 MONSIGNOR O'BRIEN HIGHWAY
CAMBRIDGE, MA 02141

jal Hospitality Design, LLC
10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

SITE LOCATION - AEREAL VIEW OF EXISTING

1 McGRATH HIGHWAY
SOMERVILLE, MA 02143

263 MONSIGNOR O'BRIEN HIGHWAY
CAMBRIDGE, MA 02141

jal Hospitality Design, LLC
10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

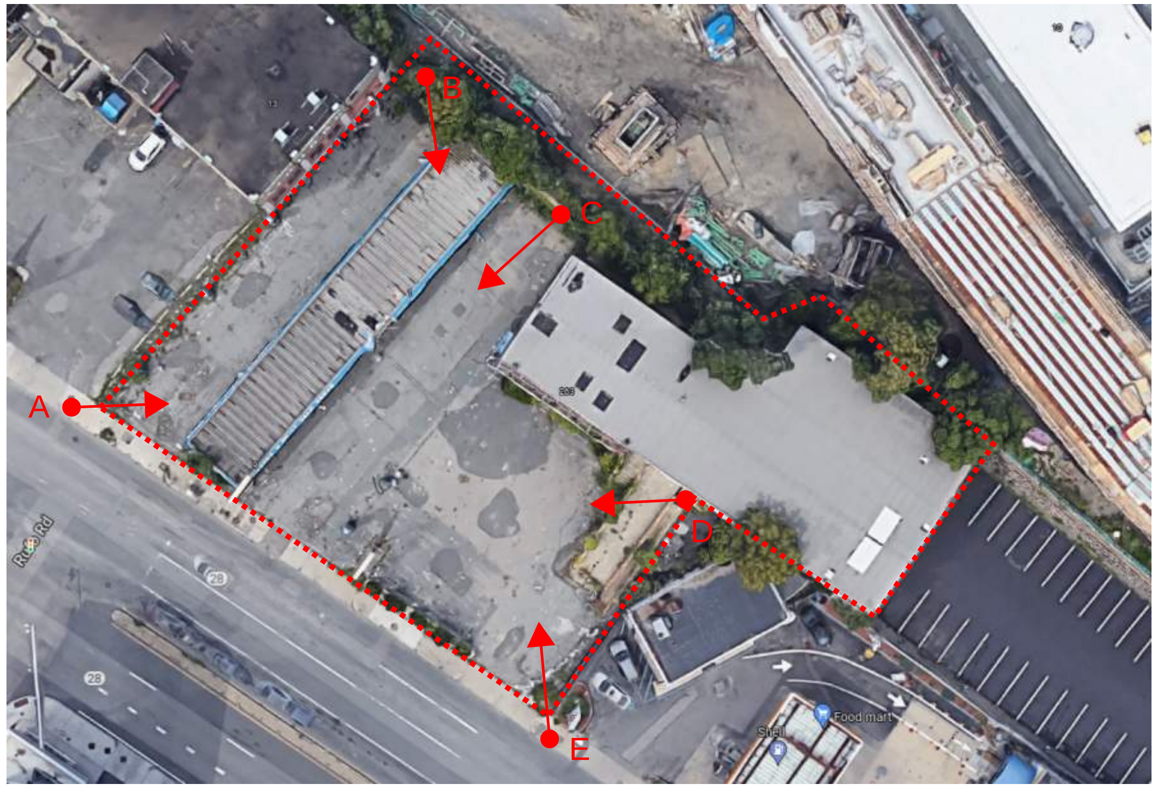
AC HOTEL | ELEMENT	1 McGRATH HIGHWAY, SOMERVILLE, MA 02143 263 MONSIGNOR O'BRIEN HIGHWAY, CAMBRIDGE, MA 02141	SITE LOCATION - BIRDS EYE VIEW OF EXISTING	2021_1105

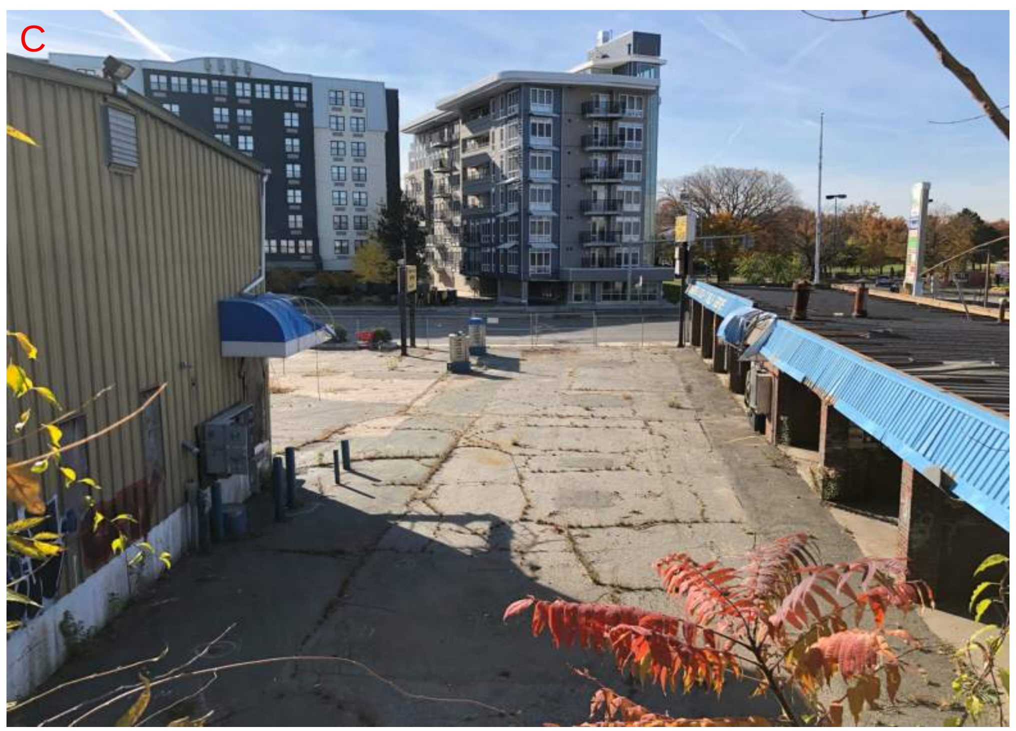
PROPOSED LAB BUILDING SITE AT
15 McGRATH HIGHWAY

1 McGRATH HIGHWAY
SOMERVILLE, MA 02143

263 MONSIGNOR O'BRIEN HIGHWAY
CAMBRIDGE, MA 02141

jal Hospitality Design, LLC
10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155





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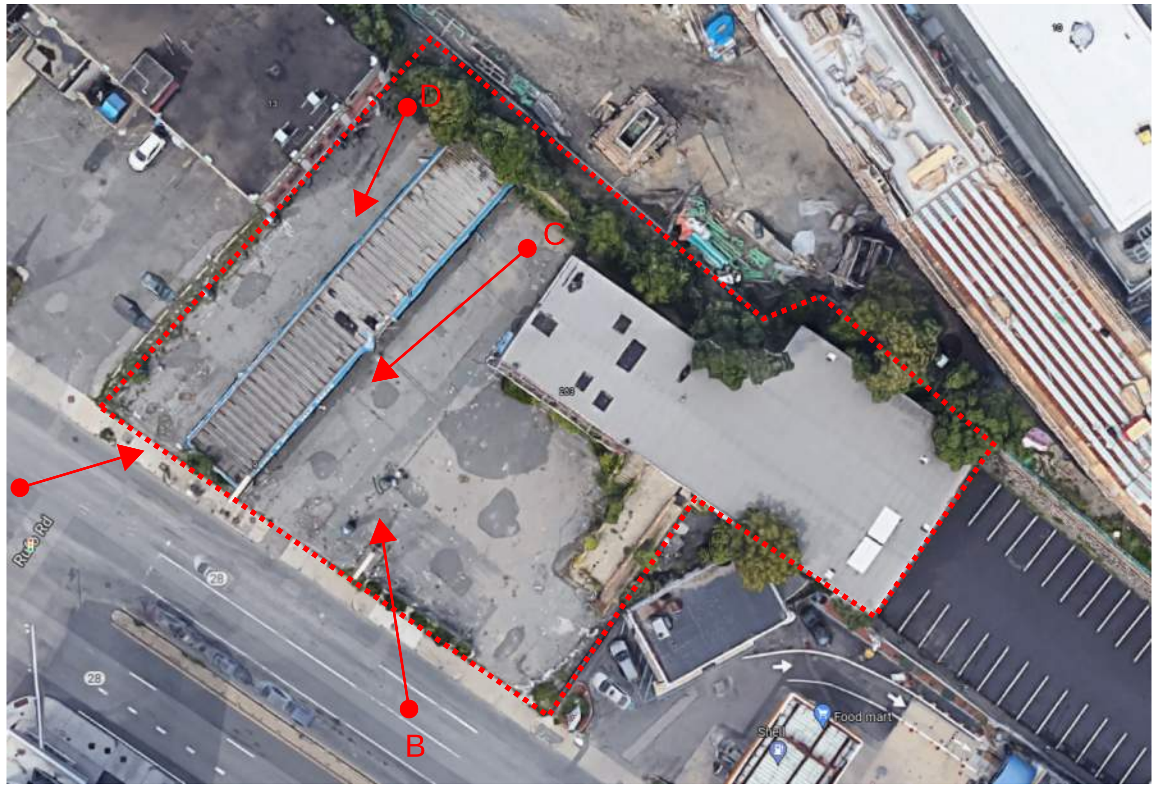
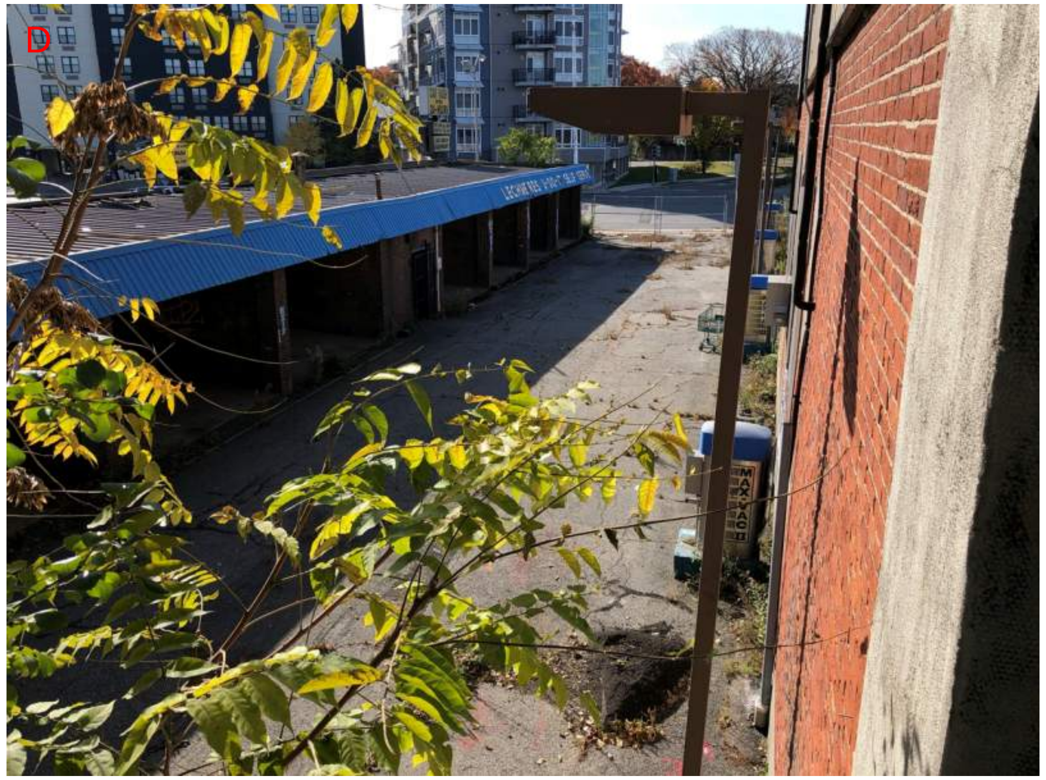


A

B

C

D



SELF SERVICE CAR WASH

* 1 McGRATH HIGHWAY, SOMERVILLE, MA 02143

jal Hospitality Design, LLC

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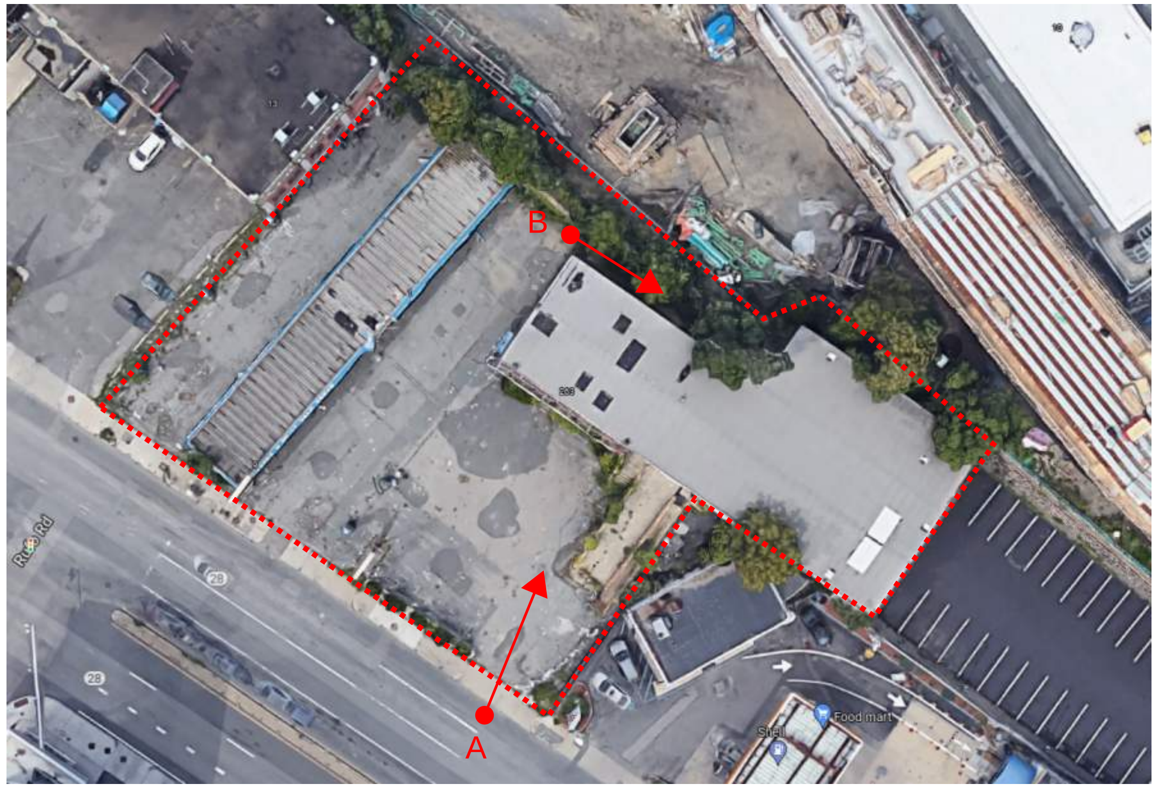
MEDFORD, MA 02155



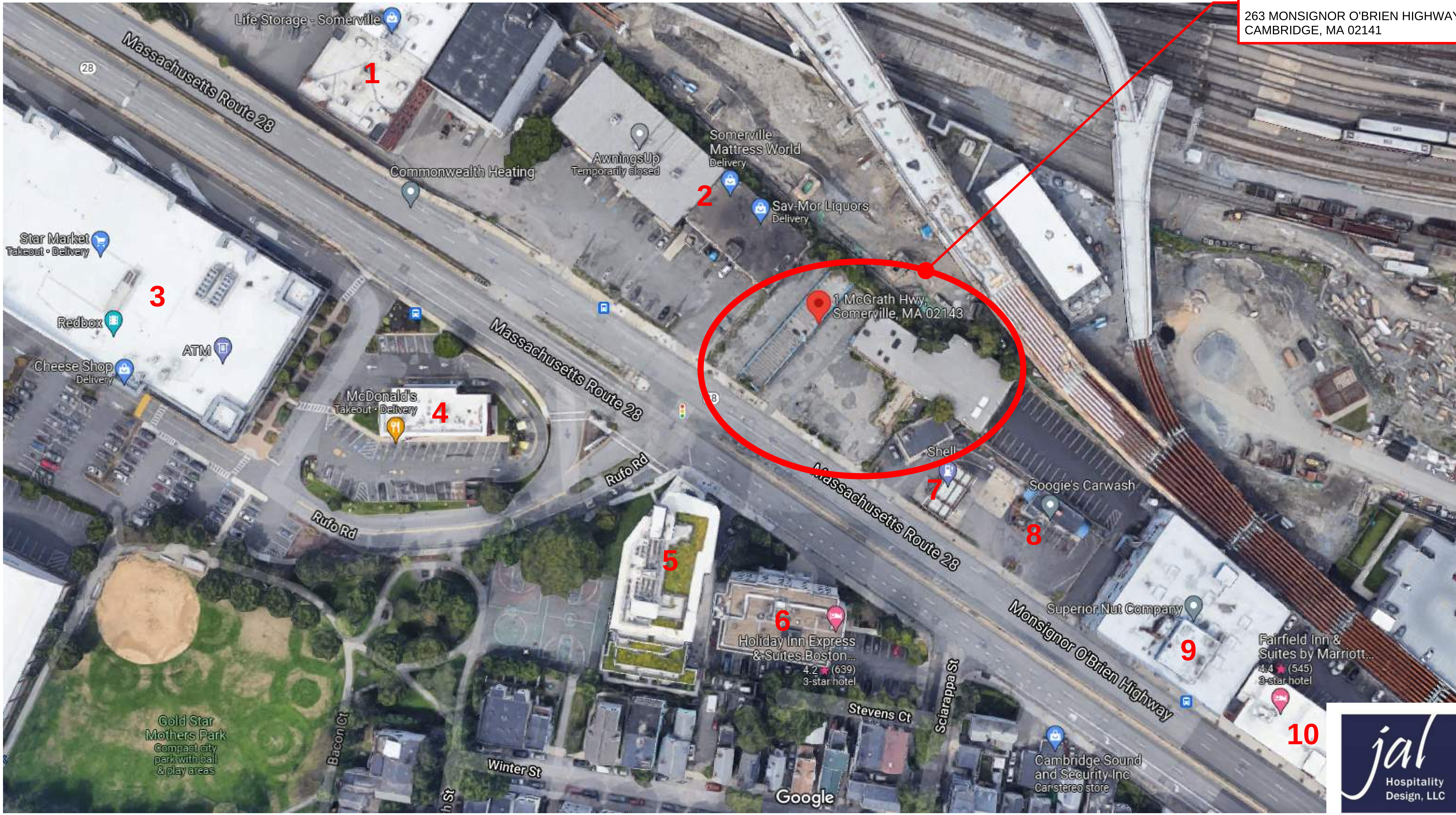
STORAGE

* 263 MONSIGNOR O'BRIEN HIGHWAY, CAMBRIDGE, MA 02141

Hospitality Design, LLC
10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

1 McGRATH HIGHWAY
SOMERVILLE, MA 02143

263 MONSIGNOR O'BRIEN HIGHWAY
CAMBRIDGE, MA 02141



jal Hospitality Design, LLC
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MEDFORD, MA 02155

CAR WASH / STORAGE / MBTA BEHIND

* 1 McGRATH HIGHWAY, SOMERVILLE, MA 02143
* 263 MONSIGNOR O'BRIEN HIGHWAY, CAMBRIDGE, MA 02141

jal Hospitality Design, LLC

10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

LIFE STORAGE

* 51 McGRATH HIGHWAY, SOMERVILLE, MA 02143

jal Hospitality Design, LLC
10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

CONTEXT - SELF STORAGE FACILITY

Sav-Mor Liquor Store

* 15 McGRATH HIGHWAY, SOMERVILLE, MA 02143

* Future Development of 15 McGrath Hwy Owner LLC, a Joint Venture between DLJ Real Estate Capital Partners, Leggat McCall Properties LLC & Laben Realty LLC.

jal Hospitality Design, LLC
10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

STAR MARKET

* 14 McGRATH HIGHWAY, SOMERVILLE, MA 02143

jal Hospitality Design, LLC

10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

MCDONALDS RESTAURANT

* 14 McGRATH HIGHWAY, SOMERVILLE, MA 02143

jal Hospitality Design, LLC

10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

POINT 262 CONDOMINIUM

* 262 MONSIGNOR O'BRIEN
HIGHWAY, CAMBRIDGE, MA 02141

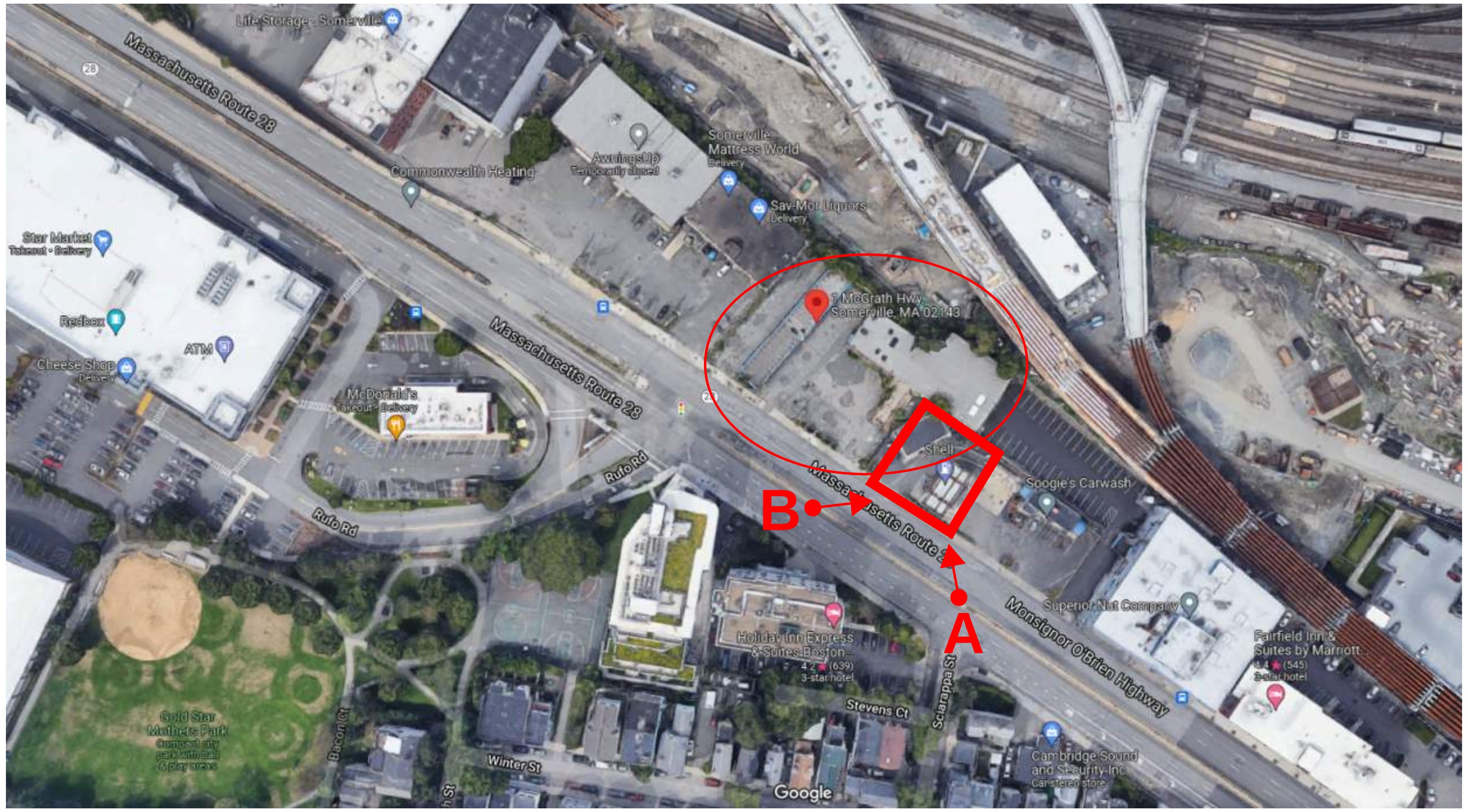
jal Hospitality Design, LLC

10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

HOLIDAY INN EXPRESS & SUITES BOSTON - CAMBRIDGE, an IHG HOTEL

* 250 MONSIGNOR O'BRIEN HIGHWAY, CAMBRIDGE, MA 02141

Hospitality Design, LLC
10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155



SHELL GAS STATION

* 239 MONSIGNOR O'BRIEN HIGHWAY, CAMBRIDGE, MA 02141

10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

SOOGIE'S CARWASH

* 241 MONSIGNOR O'BRIEN HIGHWAY, CAMBRIDGE, MA 02141

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10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

SUPERIOR NUT CO.

* 225 MONSIGNOR O'BRIEN HIGHWAY, CAMBRIDGE, MA 02141

jal Hospitality Design, LLC
10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

FAIRFIELD INN & SUITES by MARRIOTT

* 219 MONSIGNOR O'BRIEN HIGHWAY, CAMBRIDGE, MA 02141

jal Hospitality Design, LLC
10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

ALLEN & MAJOR
ASSOCIATES, INC.

A 199 Room Dual Brand Hotel

1 MCGRATH HIGHWAY, SOMERVILLE, MA
263 MONSIGNOR O'BRIEN HIGHWAY, CAMBRIDGE, MA

STORMWATER COMPLIANCE PERMIT

DATE PREPARED
November 5, 2021

Revised: 09-01-2022

APPLICANT:
Somerbridge Hotel LLC
c/o JAL Hospitality Design, LLC
227 Marginal Street
Chelsea, MA 02150

PREPARED BY:
Allen & Major Associates, Inc.
400 Harvey Road
Manchester, New Hampshire 03103

COMMONWEALTH OF MASSACHUSETTS
MICHAEL A.
MALYNOWSKI
CIVIL
No. 47269
REGISTERED
PROFESSIONAL ENGINEER
9-1-2022

A&M PROJECT NO.: 1362-16

STORMWATER COMPLIANCE PERMIT

WITH STORMWATER MANAGEMENT PLAN/ EROSION AND SEDIMENT CONTROL PLAN / OPERATION AND MAINTENANCE PLAN

A 199 ROOM DUAL BRAND HOTEL –
1 MCGRATH HIGHWAY, SOMERVILLE, MA
263 MONSIGNOR O'BRIEN HIGHWAY, CAMBRIDGE, MA

Applicant:

Somerbridge Hotel, LLC
c/o Jal Hospitality Design, LLC
227 Marginal Street
Chelsea, MA 02150

Prepared By:

Allen & Major Associates, Inc.
400 Harvey Road
Manchester, New Hampshire 03103

A&M Project #1362-16

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(2, 10, 25 & 100 year events)

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(2, 10, 25 & 100 year events)

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Pre-Development Drainage Plan
Post-Development Drainage Plan

SECTION 1.0

PROJECT OVERVIEW

1.0 PROJECT OVERVIEW

EXECUTIVE SUMMARY

The proposed redevelopment project consists of two lots located on McGrath Highway in Somerville and Monsignor O'Brien Highway in Cambridge, MA. Currently, both parcels are occupied by a light commercial buildings which are to be razed. The combination of the two parcels is almost entirely paved. A copy of the existing conditions plan is also included in the site development plans. The Site is located in a mixed use area consisting of a combination of residential, light industrial and commercial properties.

Best management practices (BMP's) are implemented into the project to demonstrate effective methods in stormwater management. These include a closed drainage systems consisting of an underground infiltration system, hooded catch basins, roof leaders, and proprietary separators. All onsite stormwater will be directed through the underground infiltration system, which will overflow to the municipal drainage system in Cambridge during larger storm events.

Drainage Summary:

Design Storm	Peak Discharge (Entire Project)		
	Pre-Development (cfs)	Post-Development (cfs)	Change (cfs)
SP1			
2-year	2.4	1.2	-1.2
10-year	3.9	1.9	-2.0
25-year	4.8	2.3	-2.5
100-year	6.2	5.1	-1.1

SITE LOCATION AND DESCRIPTION

The purpose of this drainage report is to provide a detailed review of the stormwater runoff, both quality and quantity, as it pertains to the existing and proposed developed conditions. The report will show by means of narrative, calculations and exhibits that appropriate best management practices have been used to mitigate the impacts from the proposed development. The report will demonstrate that there is no significant increase in peak rate of runoff from the site at the study point for all design storm events. Further, the report will show that the proposed stormwater management system complies with the water quality standards as presented in the Massachusetts Department of Environmental Protection (MADEP) Stormwater Handbook, the City of Somerville, and the City of Cambridge, MA.

On behalf of the applicant Somerbridge Hotel LLC Allen & Major Associates, Inc. (A&M) is pleased to prepare a stormwater study to illustrate that the project conforms to applicable drainage requirements, that Best Management Practices (BMPs) are in place, and point and non-point source pollution is prevented to the maximum extent possible in accordance with the City of Somerville and Cambridge regulations.

The stormwater flows south to the adjacent street, where it is captured by the existing municipal system. Runoff sheet flows offsite and is then captured by the municipal system within McGrath and Monsignor O'Brien Hwy. The existing 96"x100" municipal combined sewer overflow runs west to east within Monsignor O'Brien Hwy.

The following site drainage improvements are proposed:

- Improve water quality using structural best management practices.
- Incorporate City of Cambridge and DEP Stormwater Management requirements.

The disturbance area is approximately 33,000+/- S.F. for the improvements to the site and associated drainage systems. This disturbance includes operations associated with the construction of the site. According to The Soil Survey of Middlesex County, Massachusetts, Southern Part, the predominate soil of the site is identified by the US Department of Agricultural (USDA) Natural Resources Conservation Service (NRCS) as 603 – Urban Land, Wet Substratum. For the purposes of the drainage analysis the Hydrological Soil Group were based upon the Web Soil Survey data.

Per the FEMA FIRM Map, Community Panel 25017C0577E. (Effective date June 4, 2010), the site falls within a floodplain area labeled ZONE X, which is defined as "areas determined to be outside the 0.2% annual chance floodplain".

METHODOLOGY

The hydrological runoff analysis is based on local and state stormwater management guidelines for the 2, 10, 25 & 100-year design storm using the NRCS unit hydrograph procedure with Type-III, 24-hour storms. The NRCS unit hydrograph procedure was modeled in HydroCAD, which combines the most used capabilities of NRCS TR-20 and TR-55. All runoff from this development is accounted for in the analysis presented.

To calculate hydrographs and runoff quantities, HydroCAD requires a rainfall amount specific to the project site be entered, which is uniformly imposed on the watershed over a 24 hour time period. The mass rainfall is converted to mass runoff by using a Runoff Curve Number (CN). CN's are determined by assessing the site and soil characteristics: vegetation type and condition; amount of impervious areas; and amount of interception and surface storage. The calculated runoff is then transformed into a hydrograph by using unit hydrograph theory and routing procedures that depend on runoff travel time through the individual segments of the watershed. Tabular hydrographs are computed based on Runoff Curve Number (CN), Time of Concentration (Tc), Time of Travel (Tt), Area and Precipitation Input values.

Tabular hydrographs were generated in HydroCAD for the following storm events:

- 2 year event /24 hour duration
- 10 year event /24 hour duration
- 25 year event /24 hour duration
- 100 year event /24 hour duration

Time of Concentration (Tc) for each sub-area was computed based on physical characteristics including Surface Type, Manning's Roughness Coefficient, Flow Length, Two Year/ 24-Hour Rainfall Values, and Gradients of the land. Various storage configurations and volumes are analyzed to adjust flood detention times and the hydrograph so that the downstream peak discharge is reduced approximately to or less than pre-development conditions. The record plans and information were utilized for the above information.

Stormwater flows at the project site were verified for existing and proposed conditions in order to include appropriate storm water Best Management Practices (BMP's) into the facility design to minimize impacts during construction as well as in the completed project. BMP's were selected from the publications *Volume 2, Technical Guide for Compliance with Massachusetts Stormwater Management Standards,* dated January 2008

To characterize existing storm water flows, soil types within the project area were taken from USDA Soil Survey Maps for Middlesex County. On-site Subcatchments were determined from the existing contours plan (see Pre-Development Watershed Plan). NRCS Runoff Curve numbers were developed for each area of generally similar properties within each Subcatchment. The nature of flow, flow length, type of surface (e.g. ground cover), and slope were characterized for each Subcatchment and reach (swale, pipe, etc.) to determine time of concentration and maximum outflow rate.

To determine the proposed drainage conditions, new Subcatchments were identified (see Post-Development Watershed Plan) for areas contributing to each of the proposed structures, pipes, & attenuation areas. The approximate areas of gravel, grass, and other ground cover types were calculated within each Subcatchment. The outflow from these Subcatchments is treated by a variety of BMP's and routed so as to reduce the post-development conditions as practicable.

The Appendix includes calculations for the peak "pre" and "post" development rates of runoff and details along with all supporting calculations, maps, and worksheets for the proposed project.

EXISTING SITE CONDITIONS

The existing site has been analyzed as one on-site sub catchment (EX1) which also incorporates the existing building roof areas. Sub-area EX1 sheet flows through an urban setting consisting mainly of paved parking areas and roadways with minimal green space. Stormwater is mainly collect via sheet flow and directed to the existing closed combined sewer system within McGrath and Monsignor O'Brien Hwy.

The runoff from this watershed was analyzed taking into account the land slope and surface cover. The peak flow rate for these watersheds was calculated for the 2, 10, 25 & 100-year storms.

Analysis Criteria

The analysis criteria used for the hydraulic analysis of the pre-development conditions are as follows:

- Storm Event Frequency: 2, 10, 25 & 100 yrs.
- NRCS Rainfall Distribution: Type III (see Appendix)
- Runoff Coefficients (CN) (see Appendix):
- Rainfall Duration Map for Massachusetts was utilized – (See Appendix).
- NRCS TR-20 Analysis

The pre development peak discharge from the parcel for a 2, 10, 25 & 100-year storm frequency of 24-hour duration is:

Analysis Point	Pre Development								
	Inflow area (sf)	2yr Storm		10yr Storm		25yr Storm		100yr Storm	
		Flow (cfs)	Volume (cf)	Flow (cfs)	Volume (cf)	Flow (cfs)	Volume (cf)	Flow (cfs)	Volume (cf)
SP1	32,806	2.4	7,972	3.9	13,086	4.8	16,303	6.2	21,270

1.1 PROPOSED CONDITIONS

POST DEVELOPMENT

The plans proposed to redevelop an underutilized urban area within the Cities of Somerville and Cambridge, and transform it into a hotel. Since this project is a re-development of an existing, currently operating commercial facility it is not subject to the full extent of DEP's ***Stormwater Management Policy***, although every attempt has been made to feasibly implement all of the Stormwater Standards. The proposed work includes razing the existing underutilized commercial building and constructing a new 6 story hotel with associated parking.

A six-story hotel is proposed for the site. The building will be located on the western portion of the site, close to the roadway, with parking and a public bicycle ramp occupying the remainder of the site. The proposed hotel will have a ground floor footprint of approximately 11,411 sf and a gross floor area of approximately 86,765 sf. (See architectural plans and renderings). The proposed parking area is located adjacent to the hotel and expands throughout the northern portion of the site, totaling 13 parking spaces.

New closed drainage systems will be incorporated within the project and will require a new connection to the existing municipal system.

The construction of these stormwater management systems will also meet or exceed the objectives for effective pollutant removal, water quality and flood control. Stormwater flows from within the site will be treated via a hydrodynamic separator prior to discharge to the existing municipal system.

The post-development offsite discharges will be less than those of the pre-development flows.

ANALYSIS CRITERIA

TR-20 Analysis

The TR-20 Method was utilized to determine the stormwater peak discharge from the parcel. The criteria for this analysis are:

- Storm Event Frequency: 2, 10, 25 & 100 years.
- NRCS Rainfall Distribution: Type III (See Appendix)
- Runoff Coefficients (C_N) (See Appendix):
- Rainfall Duration Map for Massachusetts were utilized (See Appendix)
- The NRCS Method is based upon the NRCS Runoff Equation:

$$Q = \frac{(P - Ia)^2}{(P - Ia) + S}$$

Where:

Q = Runoff in Inches
P = Rainfall in Inches
S = Potential Maximum Retention in Inches
I_a = Initial Abstraction in Inches

Note:

S = 1000/CN – 10
CN = Runoff Curve Number

Computations were executed using the HydroCAD for Windows computer software for storm sewer design and analysis from Applied Microcomputer Systems. This software requires input of the above criteria, the physical characteristics of the proposed storm drainage system – pipe sizes, type, length, gradient, and structure type. The program analyzes the system for discharge flows, available pipe capacity, average pipe velocity, and system flow times. Additional output categories can be user specified.

TR-55 Analysis

The overall site pre- and post-development hydrographs were calculated utilizing the method detailed in Technical Release No. 55 "Urban Hydrology for Small Watersheds" as published by the United States Department of Agriculture Natural Resources Conservation Service, "NRCS", and revised in June of 1986. Tabular hydrographs are computed based on Runoff Curve Number (CN), Time of Concentration (T_C), Time of Travel (T_t), and Area and Precipitation Input values.

The analysis utilized the computerized TR-55 software as included in the HydroCAD package. Tabular hydrographs were generated for the Storm Event Frequency: 2, 10, 25 & 100 years

Time of Concentration (T_C) for each sub-area was computed based on physical characteristics including Surface Type, Manning's Roughness Coefficient, Flow Length, Two Year/ 24-Hour Rainfall Values, and Gradients of the land.

The overall project is designed using proven and accepted methods consisting of a closed drainage systems consisting of deep sump catch basins, paved gutters and roof drains. The analysis point was maintained in both pre and post conditions while the drainage patterns were maintained where possible. The methodology is NRCS; TR-20, Type III rainfalls (2, 10, 25 & 100 year events). This is consistent with local and state requirements. All pertinent calculations represented in the following pages were developed utilizing HydroCAD Stormwater modeling software.

SUMMARY:

The overall drainage area and flow characteristics are the same in the pre and post development conditions. The post development discharge rate for the City's required storm events is the same or less than the current site conditions.

Runoff

The study watershed is approximately 0.75+/- acres that drains toward an analysis point referenced herein as SP1. SP1 is the existing municipal storm drain system within Monsignor O'Brien Highway. The post development peak discharge rates will be less than those encountered during pre development conditions.

The analysis indicates that a 10-year storm contributes approximately 3.4 cfs of runoff to a point offsite, pre-development, and approximately 2.0 cfs post-development. The following matrix summarizes the resulting values of the calculations located in the Appendix:

Analysis Point	Post Development								
	Inflow area (sf)	2yr Storm		10yr Storm		25yr Storm		100yr Storm	
		Flow (cfs)	Volume (cf)	Flow (cfs)	Volume (cf)	Flow (cfs)	Volume (cf)	Flow (cfs)	Volume (cf)
SP1	32,806	1.2	5,024	1.9	9,734	2.3	12,790	5.1	17,579

1.2 EXPLANATION OF DRAINAGE SYSTEM

References:

1. NRCS - ***TR55 (Second Ed., 1986)*** - for runoff curve numbers.
2. NRCS - Rainfall Distribution Maps.
3. NRCS Soils Maps - Middlesex County.
4. DEP – ***Volume 2, Technical Guide for Compliance with Massachusetts Stormwater Management Standards, dated January 2008.***

Stormwater Quality Controls:

1. Street Sweeping. TSS Removal Rate = 5%
2. Catch Basins with Deep Sumps to capture treat and redirect storm water through the site. TSS Removal Rate = 25%
3. Hydrodynamic Separators. TSS Removal Rate = 91.5%

Groundwater Recharge:

Recharge will be provided through the use of a subsurface infiltration system located to the rear of the building.

Stormwater Quantity Controls:

Flooding Standard: The project with its modified surface treatments, landscaping, and closed drainage systems will provide discharges for the 2, 10, 25 & 100-year events at lower than predevelopment rates to the design point.

TSS: The performance standards require a removal of 80% of the Total Suspended Solids (TSS). To achieve this, Best Management Practices (BMP) have been selected to meet this objective. The proposed project can reasonably achieve nearly 91.5% removal rate.

Stormwater Quality: The post-development offsite discharges will be at or below the pre-development flows. The discharge will be controlled with the construction of a closed drainage systems including low impact development (LID) techniques. The closed drainage system will consist of pipe and structures which will convey water to the existing municipal system. The construction of these stormwater management systems will also meet or exceed the objectives for effective pollutant removal, water quality and flood control.

In order to safeguard against oil or gas introduction into the onsite drainage systems, storm water runoff from parking areas and driveways would be collected into catch basins with hoods and deep sumps (see Site Plan Details). Such pretreatment of storm water reduces both suspended solids and oils in the drainage system and is recommended by DEP's *Technical Guide for Compliance with Massachusetts Stormwater Management Standards*. Before being discharged toward the municipal drainage system, the flow rates would be controlled by means of a subsurface detention system. Water quality would then further be treated by means of a proprietary hydrodynamic separator unit designed to filter suspended solids/silt/debris prior to final discharge.

Another safeguard against future intrusion of contaminants into the groundwater is the implementation of an ***Operation & Maintenance Plan***, which would assure proper function of drainage components and reduce TSS entering the system. Further safeguards proposed on the Site Plan to prevent erosion include stabilized construction entrances and loam and seed for permanent stabilization. If all the proposed erosion control devises and procedures are adhered to, then there should be minimal or no damage to neighboring properties from work on this site.

1.3 SITE UTILITIES

Water System:
The proposed domestic and fire water services shall come from the existing 6" main in Monsignor O'Brien Highway. The domestic service shall be a 4" CLDI line and the fire service shall be a 6" CLDI line.

Sewer System:
Kitchen waste shall be piped to an exterior grease trap in the rear of the building. The kitchen waste will then join the remainder of the sanitary waste and flow to the existing 12" municipal sewer in McGrath Highway. All sewer lines shall be 8" SDR 35 PVC pipe.

Gas:
The proposed natural gas service shall connect to the existing gas main in Monsignor O'Brien Highway.

Electricity:
Electrical service is proposed to connect to an existing transformer on northwesterly corner of the site.

Telecommunications/Data:
A concrete encased duct bank shall provide tele/data service from the existing underground utilities in McGrath Highway.

Garbage:
The proposed site design contains a designated enclosed dumpster area towards the rear of the building where all trash shall be stored and collected.

Snow Storage:
Onsite snow storage is limited to perimeter landscape areas. It should be noted that once these areas become inadequate all excess snow shall be taken off site.

SECTION 2.0

STORMWATER MANAGEMENT & WATER QUALITY

2.0 STORM WATER MANAGEMENT & WATER QUALITY CALCULATIONS

PERFORMANCE STANDARDS

The performance standards of the Massachusetts Storm water Management Policy have been implemented as part of the overall storm water management plan for the proposed development. The goal of these standards is to improve water quality and protect the waters of the Commonwealth from adverse impacts due to development. The performance standards are met by implementing appropriate Best Management Practices (BMPs) as outlined in the MADEP Storm water Management Handbook, volumes one and two.

The Massachusetts Department of Environmental Protection has established ten (10) Stormwater Management Standards. A project that meets or exceeds the standards is presumed to satisfy the regulatory requirements regarding stormwater management. The Standards are as follows:

1. *No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*
2. *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.*
3. *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.*
4. *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:*
   a. *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
   b. *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
   c. *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*
   d. *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*
5. *For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated there under at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.*
6. *Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a*

strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2) (a) 1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A is prohibited unless essential to the operation of public water supply.

7. *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*
8. *A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*
9. *A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.*
10. *All illicit discharges to the stormwater management system are prohibited.*

Standard # 1: Untreated Stormwater

The project is designed so that new stormwater conveyances (outfalls/discharges) do not discharge untreated stormwater into, or cause erosion to, wetlands.

Standard #1 is met. There are no new stormwater conveyances discharging untreated stormwater into, or cause erosion to, wetlands.

Standard # 2: Post Development Peak Discharge Rates

The proposed development has been designed so that the post-development peak discharge rates do not exceed the predevelopment peak discharge rates.

Standard #2 is met.

Standard # 3: Groundwater Recharge

The existing annual recharge for the site has been approximated in the proposed condition. There is a proposed subsurface infiltration system designed to meet this requirement. Stormwater runoff from the parking lot and roof of the proposed structure is routed through this infiltration BMP. The proposed Recharge Volume is based on the Static Method per the MA DEP Stormwater Management Standards, Volume 3, Chapter 1.

The on-site soils were classified as type is 603 – Urban Land, wet substratum. Urban land is excavated and filled land. The required recharge volume is calculated as follows:

Total impervious area (taken from HydroCAD model) = 30,011± square feet

Recharge Volume (Rv) = (F) x (Impervious Area)
Where:
Rv = Required Recharge Volume, expressed in cubic feet
F = Target Depth Factor associated with each Hydrologic Soil Group (assumed soil group C)

Impervious Area = proposed pavement, sidewalk, rooftop in square feet

Recharge Volume (Rv) = (F) x (Impervious Area)
= (0.25 inches)*(1/12 inches/ft)*(30,011 square feet)
= (0.021 feet)*(30,011 square feet)
= 625 ft^3

Recharge Provided = Infiltration System Storage Volume of 657 ft^3 below the invert.

657 ft^3 > 625 ft^3 Required

Standard #3 is met.

Standard # 4: TSS Removal

The project has been designed to so that for each drainage area and outfall the 80% TSS removal standard has been met. The TSS removal rates are summarized in the attached appendix. The Proprietary Treatment Devices CDS VortSentry (or approved equal). The manufacturer has documented a TSS removal rate of over 91%.

Standard #4 is met.

The calculations provide the TSS removal rate of the proposed stormwater management system

Stormwater Management BMP	TSS Removal rate	
Street Sweeping	5	%
Hydrodynamic Separator	91.5	%

Average Annual Load	=	1.0	
Street Sweeping	=	5.0	% Removal Rate
		95.0	% TSS Load Remains
TSS Load Remaining	=	95.0	%
Hydrodynamic Separator	=	91.5	% Removal Rate
		8.1	% TSS Load Remains

Percentage of TSS Remaining - Initial TSS Load = Final TSS Removal Rate

8.08 - 100.0 = 91.9 %

For this drainage area, this system as designed will remove an estimated
91.9 % of the annual TSS load and therefore will meet the TSS removal standard.

Standard # 5: Higher potential pollutant loads

Not Applicable. The proposed project is not considered a land use with higher potential pollutant loads.

Standard # 6: Protection of critical areas

Not Applicable. The proposed project does not lie within or discharge to a critical area.

Standard # 7: Redevelopment projects

The spirit and intent of the Stormwater Management Standards on redevelopment projects is to improve existing conditions. Per the Standards, redevelopment projects are defined as development, rehabilitation, expansion and phased projects on previously developed sites, provided the redevelopment results in no net increase in impervious area. As required, this redevelopment project shall incorporate measures that will reduce the peak and total runoff from the site.

As defined in the Massachusetts Stormwater Management Policy, a redevelopment project is only required, to the maximum extent practicable, to meet Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable.

Therefore, this project is considered a redevelopment project and not required to meet the full extent of the Standards, although each Standard has been reasonably meet by incorporating into the design measures to increase water quality, infiltration, and structural BMPs.

Standard # 8: Erosion/sediment control

A Stormwater Pollution Prevention Plan is included in the plan set.

Standard #8 is met.

Standard #9: Operation/maintenance plan

An Operation and Maintenance Plan has been prepared.

Standard #9 is met.

Standard # 10: Illicit Discharges

There is no known illicit discharge from the area or intended to be discharged from the site in the post-development phase. An illicit discharge statement has been provided.

Standard #10 is met.

CITY OF CAMBRIDGE STORMWATER STANDARDS

COMPLIANCE WITH CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS; WASTEWATER AND STORMWATER MANAGEMENT GUIDANCE; VERSION 1, DATED MAY 2008

Standard - City of Cambridge; Pollutants of Concern for Cambridge; Charles River

As listed in the Version 1; *Draft* City of Cambridge Wastewater and Stormwater Management Guidance document, dated May 2008; Table 1-2, the pollutants needing a Total Maximum Daily Load limit, (TMDL) for the Charles River include: metals, nutrients, noxious aquatic plants, oil and grease, organic enrichment / low dissolved oxygen, pathogens, priority organics, taste odor & color, turbidity, and unknown toxicity. As of the date of the Draft Cambridge Wastewater and Stormwater Management Guidance document, two TMDL limits have been set to mitigate these pollutants for Charles River Watershed. The two TMDL's include: Final Phosphorus TMDL for the Lower Charles River Basin & Final Pathogen TMDL for the Charles River Watershed. Considerations for selection of appropriate BMP's on this site included: limited available space, cost and suitability. The selected Best Management Practices (BMP's) during construction and post-construction have been selected to target Phosphorus and Final Pathogen included: use of erosion control measures during construction, street and parking lot sweeping, proper snow removal and deicing, lawn and grounds maintenance, propriety separators (Vortsentry), hooded deep sump catch basins, and underground stormwater infiltration systems.

Standard for pollutants of concern for Charles River is met.

Standard – City of Cambridge: Redevelopment of previously developed sites must meet the Stormwater Management to the maximum extent practicable.
As the project meets the standard of redevelopment and results in no net increase to impervious area it is classified as such. The proposed project meets the City of Cambridge Stormwater Standards to the maximum extent practicable as discussed above in the Compliance with 2008 DEP Standards above. In addition the project has met the standard for Pollutants of Concern for the Charles River.

Standard for redevelopment is met.

Standard - Per the Guidance Document, the City of Cambridge requires that the peak rate of the proposed 25-year storm be mitigated to the rate of the pre-redevelopment 2-year event.

The analysis indicates that the post-development peak flow during a 25-year storm will equal the pre-development peak flow of a 2-year storm event. The following matrix summarizes the resulting values of the calculations located in the Appendix:

Design Storm	Pre-Development (cfs)	Design Storm	Post-Development (cfs)
SP1		SP1	
2-year	2.4	25-year	2.3

Standard for mitigation of 25-year storm is met.

GREEN COMMUNITIES PERFORMANCE STANDARD (3.4 SURFACE WATER MANAGEMENT)

The performance standard of the **Green Communities Criteria 2008** *3.4 Surface Water Management* has been implemented as part of the overall stormwater management plan for the proposed redevelopment. The goal of this standard is to reduce storm-water runoff through design and management techniques, increase onsite filtration, prevents pollutants from entering waterways and reduces soil erosion. Water storage and nutrient collection processes reduce the need for irrigation and contribute to forming a healthier ecological community within the landscape.

The Standard is as follows:

3.4 Capture, retain, infiltrate and/or harvest the first one-half inch of rainfall in a 24-hour period.

COMPLIANCE WITH 3.4 SURFACE WATER MANAGEMENT

Standard 3.4 – Infiltrate first one-half inch of rainfall

The proposed infiltration will occur at the underground infiltration system which will have been designed to capture and infiltrate the first one-half inch of rainfall in a 24-hour period

Proposed Impervious Area = 14,836 s.f. (within Cambridge)

Volume to Recharge = (Impervious Area)*(one-half inch of rainfall)
= (14,836)*(0.5 inches)*(1/12 inches per foot)
= 618 CF

Recharge Provided = Infiltration System #1 has volume of 657± CF below the invert.

657 CF > 618 CF Required

Standard 3.4 is met.

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.

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

COMMONWEALTH OF MASSACHUSETTS
MICHAEL A. MALYNOWSKI
CIVIL
No. 47269
REGISTERED PROFESSIONAL ENGINEER
8-6-19

Michael Malynowski

Signature and Date

Checklist

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

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☒ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of “country drainage” versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe): ______________________

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist (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 (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 (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist (continued)

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

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

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

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

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

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

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

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

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

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.

SECTION 3.0

OPERATION AND MAINTENANCE PLAN

3.0 OPERATION AND MAINTENANCE PLAN

The stormwater management system (SMS) for this project is owned by Somerbridge Hotel LLC, they shall be legally responsible for Long-term operation and maintenance for this SMS as outlined in this Operation and Maintenance (O&M) Plan. Should ownership of the SMS change the succeeding owner will be presented with this O&M Plan and supporting attachments at or before legal conveyance of ownership. Somerbridge Hotel LLC has established this O&M plan to ensure on-going compliance with local and state policies and regulations.

In the event that the SMS will be operated and maintained by an entity other than the sole owner of the lot upon which the stormwater management facilities are placed, the applicant shall provide a plan and easement deed that provides a right of access for the legal entity to be able to perform said operation and maintenance functions. In the event the SMS will serve multiple lots/owners, the applicant shall also provide 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 entire SMS.

Somerbridge Hotel LLC will be responsible for maintenance, inspections, record keeping, and reporting of permanent stormwater management measures. In addition the maintenance staff will need to be familiar with the operation and maintenance of the stormwater systems onsite. As necessary, maintenance personnel will need to be trained by either the specific manufacturers of the equipment or attend ongoing training seminars to learn proper operations and maintenance. See attached Source Control Fact Sheets from the City of Cambridge Best Management Practices Appendix for suggested practices and maintenance considerations. See drainage report narrative for overview of stormwater's path through the on-site BMP's,

POST CONSTRUCTION

In accordance with the Stormwater Compliance Permit, the owner will also be required to submit a post-construction Operations and Maintenance Plan to the City of Cambridge DPW. Prior to substantial completion or receipt of a signed Certificate of Occupancy, the initial Post-Construction Operations and Maintenance Plan will be reviewed by the Cambridge DPW and must be updated and finalized. The updated / finalized O&M Plan will become the first update of the plan. A copy of the O&M plan must remain onsite at all times by the owner. Inspection and maintenance logs must be maintained and if the DPW request review must be submitted. Administrative or clerical updates to the Operations and Maintenance Plan can be made at any time and should be placed in reverse chronological order in a section called O&M Plan Updates prior to Section 1. No BMP or site changes can be made without prior approval and recertification by the Cambridge DPW. At a minimum and annual update is required.

Documentation:
A maintenance log will be kept (i.e. report) summarizing inspections, maintenance, and any corrective actions taken. The log will include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean-out of any sediments or debris, the location where the sediment and debris was disposed after removal will be indicated. The log will be made accessible to department staff and a copy provided to the department upon request.

OPERATIONS AND MAINTENANCE POST-DEVELOPMENT ACTIVITIES

1. Paved Areas – Paved areas should be swept as part of the routine site maintenance. Pavement sweeping is an excellent source control for sedimentation to the existing drainage system and is typically performed in the spring of each year following the snow melt.

2. Salt for de-icing on the paved areas during the winter months shall be limited to the minimum amount practicable. Sand containing the minimum amount of calcium chloride (or approved equivalent) needed for handling may be applied as part of the routine winter maintenance activities.

3. Catch Basins and Outlet Structure - Grates and deep sumps shall be inspected and cleaned four times per year for the first three years and then twice yearly thereafter. Catch basins and outlet structure shall be inspected following heavy rainfalls to verify that the inlet openings are not clogged by debris. Debris shall be removed from the grates and disposed of properly. Material removed from structures shall be disposed of in accordance with all applicable regulations.

4. All sediments removed from site drainage facilities shall be disposed of properly, and in accordance with applicable local and state regulations.

5. All vegetated areas on the site shall be stabilized and maintained to control erosion. Any disturbed areas shall be re-seeded as soon as practicable.

6. Work within any drainage structures shall be performed in accordance with the latest OSHA regulations, and only by individuals with appropriate OSHA certification.

7. Maintenance Responsibilities - All post-construction maintenance activities shall be documented and kept on file and made available to the proper city authorities upon request.

8. Contech CDS water quality units are to be maintained according to manufacturer standards and Inspection and Maintenance Manual, see appendix.

9. Subsurface Detention System – Sediment cleanout in accordance with Operations and Maintenance Plan

Guideline No. BWR G2015-01 has outlined recommended guidelines for site selection; site preparation and maintenance; and emergency snow disposal for selecting effective snow disposal sites. It will be the snow removal contractor responsibility to follow these guidelines and all applicable laws and regulations. The snow removal contractor will be instructed to minimize the amount of deicing and abrasive agents used during snow storm events.

O&M ACCESS AND SAFETY:

Per the City of Cambridge DPW:

- Access to ALL Stormwater management systems should be safe and efficient
- All egress and ingress routes should be maintained to design standard below:
  - Access routes should be inspected and maintained
  - Obstacles preventing maintenance personnel and / or equipment access should e removed
  - Walkways should be clear of obstructions and maintained to design standards
- Roadways should be maintained to accommodate the size and weight of vehicles that use the roadways
- Gravel or ground cover should be added if erosion occurs (for example, as a result of vehicle or pedestrian traffic)
- All fences should be maintained to preserve their functionality and appearance
- Collapsed fences should be restore to an upright position
- Jagged edges and damaged fences should be repaired or replaced

Inspection and Maintenance Frequency and Corrective Measures:
In accordance with MADEP Stormwater Handbook: Volume 2, Chapter 2; the following areas, facilities, and measures will be inspected and the identified deficiencies will be corrected. Clean-out must include the removal and legal disposal of any accumulated sediments, trash, and debris. In any and all cases, operations, inspections, and maintenance activities shall utilize best practical measures to avoid and minimize impacts to wetland resource areas outside the foot print of the SMS.

Structural Pretreatment BMPs:

Regular maintenance of these BMPs is especially critical because they typically receive the highest concentration of suspended solids during the first flush of a storm event.

Deep Sump Catch Basins:
Inspect catch basins 2 times per year (specifically after foliage and snow season) to ensure that the catch basins are working in their intended fashion and that they are free of debris. Structures will be skimmed of floatable debris at each inspection and sediment will be removed when or before sump is determined to be 50% full. If the basin outlet is designed with a hood to trap floatable materials (i.e. Snout), check to ensure watertight seal is working.

Proprietary Separators (VortSentry unit): These structures will be maintained in strict accordance with manufacturer's recommend schedule and practices but at a minimum be inspected monthly and cleaned out twice a year as stated above. (See Appendix for recommended practices in VortSentry Manual).

Infiltration & Detention BMPs:

Stormwater Infiltration & Detention Facilities:
Maintenance of upstream pre-treatment measures is critically important to the function of infiltration BMPs. Pre-treatment BMPs should be inspected for sediment and floatables accumulation and maintained at least twice per year (every other month recommended) and after every major storm event.

Infiltration System:
The infiltration structures will be inspected within 72 hours of each half-inch storm event to ensure it is draining properly, for the first three months following construction. Trash, debris, and visible sediment should be removed. Inspection can be accomplished by using the inspection ports and/or access structure for underground systems.

Other BMPs and Accessories:

Roadways and Parking Surfaces:
Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably in the spring. Accumulations on pavement may be removed by pavement sweeping. Accumulations of sand along road shoulders may be removed by grading excess sand to the pavement edge and removing it manually or by a front-end loader.

LANDSCAPE MANAGEMENT PLAN

It should be recognized that this is a general guideline towards achieving high quality and well groomed landscaped areas. The grounds staff / landscape contractor must recognize the shortcomings of a general maintenance program such as this, and modify and/or augment it based on weekly, monthly, and yearly observations. In order to assure the highest quality conditions, the staff must also recognize and appreciate the need to be aware of the constantly changing conditions of the landscaping and be able to respond to them on a proactive basis.

Fertilizer
Maintenance practices should be aimed at reducing environmental, mechanical and pest stresses to promote healthy and vigorous growth. When necessary, pest outbreaks should be treated with the most sensitive control measure available. Synthetic chemical controls should be used only as a last resort to organic and biological control methods. Fertilizer, synthetic chemical controls and pest management applications (when necessary) should be performed only by licensed applicators in accordance with the manufacturer's label instructions when environmental conditions are conducive to controlled product application.

Only slow-release organic fertilizers should be used in the landscaped areas to limit the amount of nutrients that could enter downstream resource areas. Fertilization of developed areas on site will be performed within manufacturers labeling instructions and shall not exceed an NPK ration of 1:1:1 (i.e. Triple 10 fertilizer mix), considered a low nitrogen mixture. Additionally, the fertilizer will include a slow release element.

Suggested Aeration Program
In-season aeration of lawn areas is good cultural practice, and is recommended whenever feasible. It should be accomplished with a solid thin tine aeration method to reduce disruption to the use of the area. The depth of solid tine aeration is similar to core type, but should be performed when the soil is somewhat drier for a greater overall effect.

Depending on the intensity of use, it can be expected that all landscaped lawn areas will need aeration to reduce compaction at least once per year. The first operation should occur in late May following the spring season. Methods of reducing compaction will vary based on the nature of the compaction. Compaction on newly established landscaped areas is generally limited to the top 2-3" and can be alleviated using hollow core or thin tine aeration methods.

The spring aeration should consist of two passes at opposite directions with 1/4" hollow core tines penetrating 3-5" into the soil profile. Aeration should occur when the soil is moist but not saturated. The cores should be shattered in place and dragged or swept back into the turf to control thatch. If desired the cores may also be removed and the area top-dressed with sand or sandy loam. If the area drains on average too slowly, the topdressing should contain a higher percentage of sand. If it is draining on average too quickly, the top dressing should contain a higher percentage of soil and organic matter.

<u>Landscape Maintenance Program Practices:</u>

Lawn
- Mow a minimum of once a week in spring, to a height of 2" to 2 1/2" high. Mowing should be frequent enough so that no more than 1/3 of grass blade is removed at each mowing. The top growth supports the roots; the shorter the grass is cut, the less the roots will grow. Short cutting also dries out the soil and encourages weeds to germinate.
- Mow approximately once every two weeks from July 1st to August 15th depending on lawn growth.
- Mow on a ten-day cycle in fall, when growth is stimulated by cooler nights and increased moisture.
- Do not remove grass clippings after mowing.

- Keep mower blades sharp to prevent ragged cuts on grass leaves, which cause a brownish appearance and increase the chance for disease to enter a leaf.

Shrubs

- Mulch not more than 3" depth with shredded pine or fir bark.
- Hand prune annually, immediately after blooming, to remove 1/3 of the above-ground biomass (older stems). Stem removals to occur within 6" of the ground to open up shrub and maintain two-year wood (the blooming wood).
- Fertilize with ½ lb. slow-release fertilizer (see above section on Fertilizer) every second year.
- Hand prune evergreen shrubs only as needed to remove dead and damaged wood and to maintain the naturalistic form of the shrub. Never mechanically shear evergreen shrubs.

Trees

- Provide aftercare for new tree plantings for the first three years.
- Do not fertilize trees, it artificially stimulates them (unless tree health warrants).
- Water once a week for the first year; twice a month the second, once a month the third year.
- Prune trees on a four-year cycle.

<u>Attachments:</u>

Section 3.5: Mosquito Control Plan Reference: MA Stormwater Handbook; Volume 2, Chapter 5.

Both aboveground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance, and treatment with larvicides can minimize this potential. The 2008 technical specifications for BMPs set forth in Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook also concur with this practice by requiring that all stormwater practices designed to drain do so within 72 hours.

Section 3.6 CMP Infiltration Maintenance

Section 3.7: CMP Detention Maintenance

Section 3.8: VortSentry Maintenance

Section 3.9: City of Cambridge Source Control Fact Sheets for:

Street and Parking Lot Sweeping, Snow Removal and Deicing, Lawn and Grounds Maintenance, Materials and Waste Management

Section 3.10: Operations & Maintenance Schedule

Section 3.11: Operations and Maintenance Log Form

Based on site specific stormwater management system asset list. At a minimum, fields should be provided for: Date, weather conditions, inspector, BMP condition, sediment, debris, erosion, inspection comments, etc.

Section 3.12: Operations & Maintenance Updates Log

Section 3.13: Spill Prevention During Construction and Post Construction

Chapter 5
Miscellaneous Stormwater Topics

Mosquito Control in Stormwater Management Practices

Both aboveground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance and treatment with larvicides can minimize this potential.

EPA recommends that stormwater treatment practices dewater within 3 days (72 hours) to reduce the number of mosquitoes that mature to adults, since the aquatic stage of many mosquito species is 7 to 10 days. Massachusetts has had a 72-hour dewatering rule in its Stormwater Management Standards since 1996. The 2008 technical specifications for BMPs set forth in Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook also concur with this practice by requiring that all stormwater practices designed to drain do so within 72 hours.

Some stormwater practices are designed to include permanent wet pools. These practices – if maintained properly – can limit mosquito breeding by providing habitat for mosquito predators. Additional measures that can be taken to reduce mosquito populations include increasing water circulation, attracting mosquito predators by adding suitable habitat, and applying larvicides.

The Massachusetts State Reclamation and Mosquito Control Board (SRMCB), through the Massachusetts Mosquito Control Districts, can undertake further mosquito control actions specifically for the purpose of mosquito control pursuant to Massachusetts General Law Chapter 252. The Mosquito Control Board, http://www.mass.gov/agr/mosquito/, describes mosquito control methods and is in the process of developing guidance documents that describe Best Management Practices for mosquito control projects.

The SRMCB and Mosquito Control Districts are not responsible for operating and maintaining stormwater BMPs to reduce mosquito populations. The owners of property that construct the stormwater BMPs or municipalities that "accept" them through local subdivision approval are responsible for their maintenance.[1] The SRMCB is composed of officials from MassDEP, Department of Agricultural Resources, and Department of Conservation and Recreation. The nine (9) Mosquito Control Districts overseen by the SRMCB are located throughout Massachusetts, covering 176 municipalities.

<u>Construction Period Best Management Practices for Mosquito Control</u>

To minimize mosquito breeding during construction, it is essential that the following actions be taken to minimize the creation of standing pools by taking the following actions:

- ***Minimize Land Disturbance:*** Minimizing land disturbance reduces the likelihood of mosquito breeding by reducing silt in runoff that will cause construction period controls to clog and retain standing pools of water for more than 72 hours.
- ***Catch Basin inlets:*** Inspect and refresh filter fabric, hay bales, filter socks or stone dams on a regular basis to ensure that any stormwater ponded at the inlet drains within 8 hours after precipitation stops. Shorter periods may be necessary to avoid hydroplaning in roads

[1] MassDEP and MassHighway understand that the numerous stormwater BMPs along state highways pose a unique challenge. To address this challenge, the 2004 MassHighway Stormwater Handbook will provide additional information on appropriate operation and maintenance practices for mosquito control when the Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards..

caused by water ponded at the catch basin inlet. Treat catch basin sumps with larvicides such as *Bacillus sphaericus* (*Bs*) using a licensed pesticide applicator.

- ***Check Dams:*** If temporary check dams are used during the construction period to lag peak rate of runoff or pond runoff for exfiltration, inspect and repair the check dams on a regular basis to ensure that any stormwater ponded behind the check dam drains within 72 hours.
- ***Design construction period sediment traps*** to dewater within 72 hours after precipitation. Because these traps are subject to high silt loads and tend to clog, treat them with the larvicide *Bs* after it rains from June through October, until the first frost occurs.
- ***Construction period open conveyances:*** When temporary manmade ditches are used for channelizing construction period runoff, inspect them on a regular basis to remove any accumulated sediment to restore flow capacity to the temporary ditch.
- ***Revegetating Disturbed Surfaces:*** Revegetating disturbed surfaces reduces sediment in runoff that will cause construction period controls to clog and retain standing pools of water for greater than 72 hours.
- ***Sediment fences/hay bale barriers:*** When inspections find standing pools of water beyond the 24-hour period after a storm, take action to restore barrier to its normal function.

<u>Post-Construction Stormwater Treatment Practices</u>

- Mosquito control begins with the environmentally sensitive site design. Environmentally sensitive site design that minimizes impervious surfaces reduces the amount of stormwater runoff. Disconnecting runoff using the LID Site Design credits outlined in the Massachusetts Stormwater Handbook reduces the amount of stormwater that must be conveyed to a treatment practice. Utilizing green roofs minimizes runoff from smaller storms. Storage media must be designed to dewater within 72 hours after precipitation.
- Mosquito control continues with the selection of structural stormwater BMPs that are unlikely to become breeding grounds for mosquitoes, such as:
    - ***Bioretention Areas/Rain Gardens/Sand Filter:*** These practices tend not to result in mosquito breeding. If any level spreaders, weirs or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
    - ***Infiltration Trenches:*** This practice tends not to result in mosquito breeding. If any level spreaders, weirs, or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
- Another mosquito control strategy is to select BMPs that can become habitats for mosquito predators, such as:
    - ***Constructed Stormwater Wetlands:*** Habitat features can be incorporated in constructed stormwater wetlands to attract dragonflies, amphibians, turtles, birds, bats, and other natural predators of mosquitoes.
    - ***Wet Basins:*** Wet basins can be designed to incorporate fish habitat features, such as deep pools. Introduce fish in consultation with Massachusetts Division of Fisheries and Wildlife. Vegetation within wet basins designed as fish habitat must be properly managed to ensure that vegetation does not overtake the habitat. Proper design to ensure that no low circulation or “dead” zones are created may reduce the potential for mosquito breeding. Introducing bubblers may increase water circulation in the wet basin.

Effective mosquito controls require proponents to design structural BMPs to prevent ponding and facilitate maintenance and, if necessary, the application of larvicides. Examples of such design practices include the following:

- ***Basins:*** Provide perimeter access around wet basins, extended dry detention basins and dry detention basins for both larviciding and routine maintenance. Control vegetation to ensure that access pathways stay open.
- ***BMPs without a permanent pool of water:*** All structural BMPs that do not rely on a permanent pool of water must drain and completely dewater within 72 hours after precipitation. This includes dry detention basins, extended dry detention basins, infiltration basins, and dry water quality swales. Use underdrains at extended dry detention basins to drain the small pools that form due to accumulation of silts. Wallace indicates that extended dry extended detention basins may breed more mosquitoes than wet basins. It is, therefore, imperative to design outlets from extended dry detention basins to completely dewater within the 72-hour period.
- ***Energy Dissipators and Flow Spreaders:*** Currier and Moeller, 2000 indicate that shallow recesses in energy dissipators and flow spreaders trap water where mosquitoes breed. Set the riprap in grout to reduce the shallow recesses and minimize mosquito breeding.
- ***Outlet control structures:*** Debris trapped in small orifices or on trash racks of outlet control structures such as multiple stage outlet risers may clog the orifices or the trash rack, causing a standing pool of water. Optimize the orifice size or trash rack mesh size to provide required peak rate attenuation/water quality detention/retention time while minimizing clogging.
- ***Rain Barrels and Cisterns:*** Seal lids to reduce the likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over inlets. The cistern system should be designed to ensure that all collected water is drained into it within 72 hours.
- ***Subsurface Structures, Deep Sump Catch Basins, Oil Grit Separators, and Leaching Catch Basins:*** Seal all manhole covers to reduce likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over the outlet (CALTRANS 2004).

The Operation and Maintenance Plan should provide for mosquito prevention and control.

- ***Check dams:*** Inspect permanent check dams on the schedule set forth in the O&M Plan. Inspect check dams 72 hours after storms for standing water ponding behind the dam. Take corrective action if standing water is found.
- ***Cisterns:*** Apply *Bs* larvicide in the cistern if any evidence of mosquitoes is found. The Operation and Maintenance Plan shall specify how often larvicides should be applied to waters in the cistern.
- ***Water quality swales:*** Remove and properly dispose of any accumulated sediment as scheduled in the Operation and Maintenance Plan.
- ***Larvicide Treatment:*** The Operation and Maintenance Plan must include measures to minimize mosquito breeding, including larviciding.
- The party identified in the Operation and Maintenance Plan as responsible for maintenance shall see that larvicides are applied as necessary to the following stormwater treatment practices: catch basins, oil/grit separators, wet basins, wet water quality swales, dry extended detention basins, infiltration basins, and constructed stormwater wetlands. The Operation and Maintenance Plan must ensure that all larvicides are applied by a licensed pesticide applicator and in compliance with all pesticide label requirements.
- The Operation and Maintenance Plan should identify the appropriate larvicide and the time and method of application. For example, *Bacillus sphaericus (Bs*), the preferred

larvicide for stormwater BMPs, should be hand-broadcast.[2] Alternatively, Altosid, a Methopren product, may be used. Because some practices are designed to dewater between storms, such as dry extended detention and infiltration basins, the Operation and Maintenance Plan should provide that larviciding must be conducted during or immediately after wet weather, when the detention or infiltration basin has a standing pool of water, unless a product is used that can withstand extended dry periods.

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[2] *Bacillus thuringienis israelensis* or *Bti* is usually applied by helicopter to wetlands and floodplains

URBANGREEN™

CMP Detention and Infiltration Inspection and Maintenance Guide

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Maintenance

Underground storm water detention and retention systems should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size or configuration of the system.

Inspection

Inspection is the key to effective maintenance and is easily performed. Contech Engineered Solutions recommends ongoing quarterly inspections of the accumulated sediment. Sediment deposition and transport may vary from year to year and quarterly inspections will help insure that systems are cleaned out at the appropriate time. Inspections should be performed more often in the winter months in climates where sanding operations may lead to rapid accumulations, or in equipment washdown areas. It is very useful to keep a record of each inspection. A sample inspection log is included for your use.

Systems should be cleaned when inspection reveals that accumulated sediment or trash is clogging the discharge orifice. Contech suggests that all systems be designed with an access/inspection manhole situated at or near the inlet and the outlet orifice. Should it be necessary to get inside the system to perform maintenance activities, all appropriate precautions regarding confined space entry and OSHA regulations should be followed.

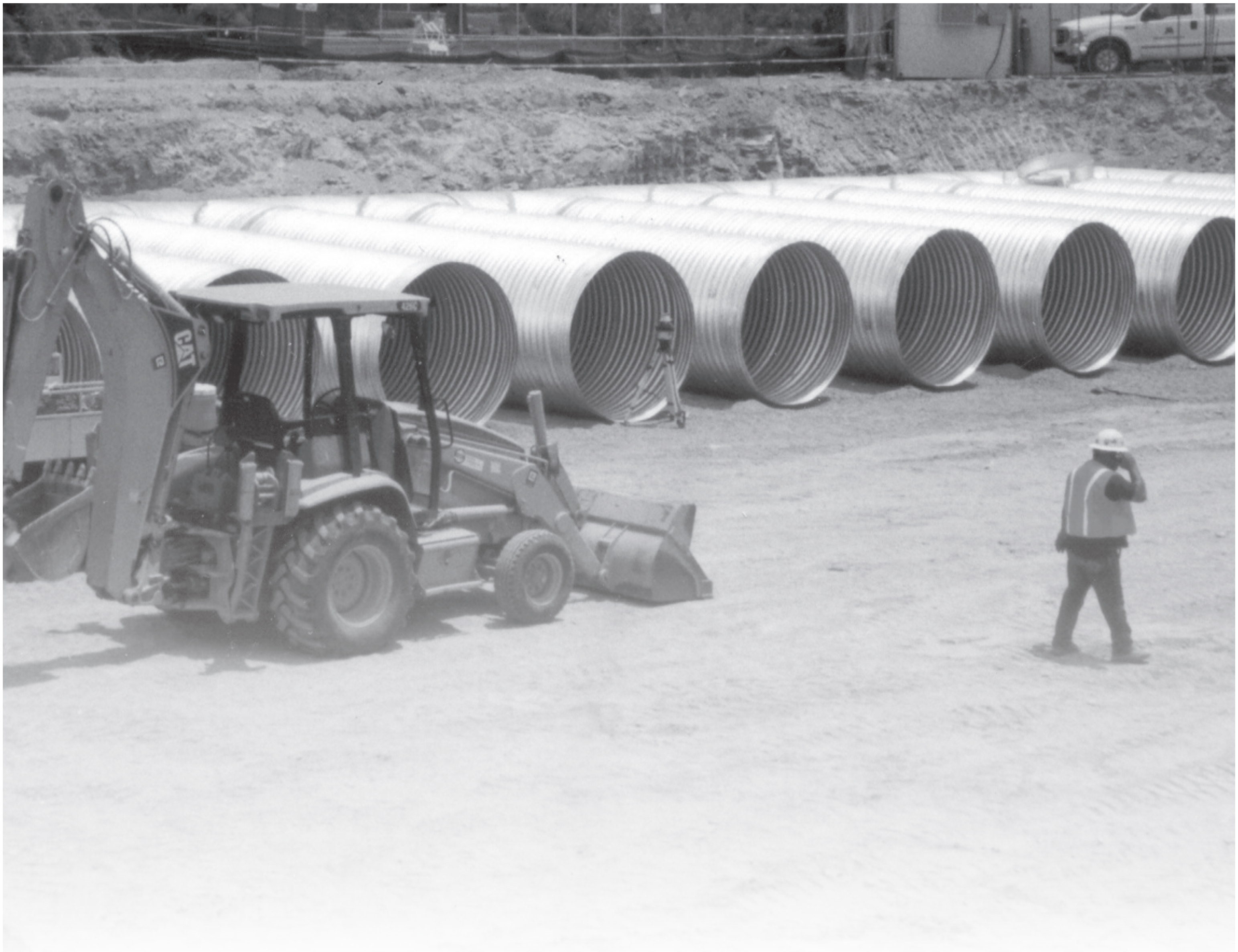
Cleaning

Maintaining an underground detention or retention system is easiest when there is no flow entering the system. For this reason, it is a good idea to schedule the cleanout during dry weather.

Accumulated sediment and trash can typically be evacuated through the manhole over the outlet orifice. If maintenance is not performed as recommended, sediment and trash may accumulate in front of the outlet orifice. Manhole covers should be securely seated following cleaning activities.

Inspection & Maintenance Log Sample Template

_____ " Diameter System			Location:		
Date	Depth of Sediment	Accumulated Trash	Maintenance Performed	Maintenance Personnel	Comments



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- Site-specific design support is available from our engineers.

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VortSentry® HS Maintenance Guide

VortSentry® HS Maintenance

The VortSentry HS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit, i.e., unstable soils or heavy winter sanding will cause the treatment chamber to fill more quickly, but regular sweeping will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant deposition and transport may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall) however more frequent inspections may be necessary in equipment washdown areas and in climates where winter sanding operations may lead to rapid accumulations of a large volume of sediment. It is useful and often required as part of a permit to keep a record of each inspection. A simple inspection and maintenance log form for doing so is available for download at www.contechstormwater.com.

The VortSentry HS should be cleaned when the sediment has accumulated to a depth of two feet in the treatment chamber. This determination can be made by taking two measurements with a stadia rod or similar measuring device; one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the distance given in Table 1, the VortSentry HS should be maintained to ensure effective treatment.

Cleaning

Cleaning of the VortSentry HS should be done during dry weather conditions when no flow is entering the system. Cleanout of the VortSentry HS with a vacuum truck is generally the most effective and convenient method of excavating pollutants from the system. Simply remove the manhole cover and insert the vacuum hose into the sump. All pollutants can be removed from this one access point from the surface with no requirements for Confined Space Entry.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use adsorbent pads, which solidify the oils. These are usually much easier to remove from the unit individually, and less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Floating trash can be netted out if you wish to separate it from the other pollutants.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure proper safety precautions. If anyone physically enters the unit, Confined Space Entry procedures need to be followed.

Disposal of all material removed from the VortSentry HS should be done is accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

VortSentry HS Model	Diameter		Distance Between Water Surface and Top of Storage Sump		Sediment Storage		Oil Spill Storage	
	in	m	ft	m	yd^3	m^3	gal	liter
HS36	36	0.9	3.6	1.1	0.5	0.4	83	314
HS48	48	1.2	4.7	1.4	0.9	0.7	158	598
HS60	60	1.5	6	1.8	1.5	1.1	258	978
HS72	72	1.8	7.1	2.2	2.1	1.6	372	1409
HS84	84	2.1	8.4	2.6	2.9	2.2	649	2458
HS96	96	2.4	9.5	2.9	3.7	2.8	845	3199

Table 1: VortSentry HS Maintenance Indicators and Sediment Storage Capacities.

VortSentry HS Inspection & Maintenance Log

VortSentry HS Model:____ Location:____

Date	Water depth to shipment[1]	Floatable layer thickness[2]	Describe maintenance performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the distance given in Table 1, the system should be cleaned out. Note: To avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

1. SOURCE CONTROLS

1.1. Street and Parking Lot Sweeping

DESCRIPTION

Street and parking lot sweeping includes self-propelled equipment to remove sediment from paved surfaces that can enter storm drains or receiving waters. Sweeping is most effective for removing coarse particles, leaves, and trash. Regularly sweeping reduces catch basin cleaning.

SUGGESTED PRACTICES

- Schedule – every roadway and parking lot swept quarterly.
- Use vacuum sweepers instead of mechanical sweepers where possible.
- Any visible sediment should be swept up (including sand/salt mixtures and granular material).
- Control the number of points where vehicles leave the facilities to allow sweeping to be focused on certain areas in parking lots.
- Sweep up the smallest particles feasible.
- Sweep in pattern to keep spilled material from being pushed into catch basins.
- Before sweeping, manually rake sand from any turf areas onto surfaces to be swept.
- Use hand-held tools to assist with mechanical sweeping.
- If possible, recycle fall leaf sweepings by composting.

MAINTENANCE CONSIDERATIONS

Adjust broom frequently to maximize efficiency of sweeping operations. After sweeping is finished, properly dispose of sweeper wastes. Do not use kick brooms or sweeper attachments that tend to spread dirt. When unloading sweeper, make sure there is no dust or sediment release. Maintain a log and schedule of sweeping activities conducted. Information recorded should include mileage, amount of sweepings removed, and heavily sedimented catch basins, and date of sweeping activities. By recording heavily sedimented areas, prioritizations can be made to sweep these areas or clean catch

TARGETED CONSTITUENTS

- Bacteria (NR)
- Metals (M)
- Nutrients (M)
- Oil and Grease (H)
- Organics (M)
- Oxygen Demand (M)
- Sediment (H)
- Trash (H)

Estimated Removal Efficiencies Key	
(H) High	(L) Low
(M) Moderate	(NR) Not Removed

APPLICABILITY

- Mandatory for all facilities. All roadways and parking lots should be swept.

basins more frequently.

INSPECTION CONSIDERATIONS

Inspect sweeping equipment regularly to make sure it has been properly maintained. Regularly inspect streets and parking lots for debris. Regularly inspect catch basins for debris. Adjust sweeping frequency with debris levels.

STREET SWEEPING IN CAMBRIDGE

- Vacuum sweeping is the preferred method of sweeping.
- All parking lots and roadways must be swept quarterly.
- For information on Cambridge's municipal sweeping program, please visit: http://www.cambridgema.gov/TheWorks/services/strClng.html

1.2. Snow Removal and Deicing

DESCRIPTION

Proper snow management in terms of stockpiling and removal can prevent or minimize runoff and pollutant loading impacts. Snow piles can contain trash, nutrients, sediments, salt, sand, and vehicle pollutants that can be carried directly into surface waters during snowmelt. DPW's policy is to strictly use salt for deicing, though a few municipal facilities do use sand/salt mixtures. Proper road salt and facility applications storage is necessary to prevent contamination to surface and groundwater supplies. Salts are very soluble – once in contact with water, there is no way to remove salt. The major reasons for keeping salt covered and controlling use are that salt: kills vegetation, corrodes infrastructure, blocks storm drains and infiltration systems, increases sedimentation to streams and rivers, and small quantities (5% road salt) contain phosphorus, nitrogen, copper, and cyanide.

SUGGESTED PRACTICES

The City's policy restricts stockpiling of snow. During extreme conditions when stockpiling is necessary, the following practices should be applied:

    - Do not stockpile snow near or within direct drainage to surface waters.
    - Do not stockpile snow in wooded areas, around trees, or in vegetated buffer zones due to sediment and salt damage to vegetation.
    - Stockpile snow in pervious areas where it can slowly infiltrate.

- During plowing activities on pervious surfaces, blading (plow lowers blade below ground surface level and plows the upper layers of soil in addition to overlying snow) should be avoided to prevent erosion.
- Storage facilities for salt and sand/salt mixtures should be covered structures on impervious surfaces.
- Drainage should be diverted away from storage facility.
- Sand/salt handling should be done within storage facility.
- Storage facilities should not be located in a water supply watershed or within 1-percent annual chance floodplain.
- Disposal of sand/salt mixtures should not be done near or in wetlands, surface waters, or well locations and drinking water supplies.
- Establish a low salt area near any water bodies or residential areas.

TARGETED CONSTITUENTS

- Bacteria (NR)
- Metals (H)
- Nutrients (H)
- Oil and Grease (M)
- Organics (H)
- Oxygen Demand (H)
- Sediment (H)
- Trash (H)

Estimated Removal Efficiencies Key	
(H) High	(L) Low
(M) Moderate	(NR) Not Removed

APPLICABILITY

- Mandatory for all facilities.

- When feasible, use higher percentage of sand in sand/salt mixture.
- Regulate the amount of road salt applied to prevent over-salting of motorways and increasing runoff concentrations. Vary the amount of salt applied to reflect site-specific characteristics such as road width and design, traffic concentration, and proximity to surface waters.
- Provide calibration devices for spreaders in trucks to aid maintenance workers in the proper application of road salts.
- Establish air temperature and snow depth conditions favorable for successful use of salt.
- Use alternative materials, such as sand or gravel, in especially sensitive areas or use alternative products such as Magic Salt.
- Removal practices include street cleaning and catch basin cleaning.

MAINTENANCE CONSIDERATIONS

Contain sediments as snow melts and remove every Spring from snow storage areas. This includes sweeping roadways and parking lots or other impervious areas. During plowing activities, avoid blocking drainage structures including catch basins, swales, and channels. Service trucks and calibrate spreaders regularly to ensure accurate, efficient distribution of salt. Educate and train operators on hazards of over-salting to roads and environment at the beginning of the snow season as part of meetings with supervisors and drivers. Repair salt storage structure leaks.

INSPECTION CONSIDERATIONS

Check snow piles for debris that could be windblown. Inspect salt storage structure for leaks on a regular basis including Fall and Spring. Inspect salt application equipment including calibration equipment and spreaders. Inspect salt regularly for lumping or water contamination. Inspect surface areas for evidence of runoff – salt stains in ground near and around the salt storage structure, loading area, or downslope. Inspect for excessive amounts of salt on roads.

SNOW REMOVAL IN CAMBRIDGE

- Use of sand is prohibited unless approved by DPW as a part of the Land Disturbance Permit.
- Snow stockpiling is restricted.
- For information on Cambridge's municipal snow practices, please visit: http://www.cambridgema.gov/TheWorks/services/snow.html

1.3. Lawn and Grounds Maintenance

DESCRIPTION

Nutrient loads generated by suburban lawns as well as municipal properties can be significant, and recent research has shown that lawns produce more surface runoff than previously thought. Pesticide runoff can contribute pollutants that contaminate drinking water supplies and are toxic to both humans and aquatic organisms.

SUGGESTED PRACTICES

- Eliminate or minimize the use of chemicals (insecticide, herbicide, fertilizer).
- Do not apply any chemicals (insecticide, herbicide, or fertilizer) directly to surface waters, unless the application is approved and permitted by the MA DEP.
- Use mulch or other erosion control measures on exposed soils.
- Coordinate application of chemicals with irrigation schedules to prevent pesticides washing away and to minimize non-stormwater discharges.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the stormwater drainage system.
- Use hand or mechanical weeding where practical.
- Employ mowing techniques to maintain a healthy lawn and minimize chemical use – no more than 1" of lawn should be removed from each mowing (grasses kept at 2.5" to 3.0" high are more heat resistant than close-cropped grass). Keep mower blades sharp and leave clippings in place after mowing.
- Water plants in the early morning.
- Follow manufacturers' recommendations and label directions for fertilizers and pesticides.
- Do not apply insecticides within 100 ft. of surface waters such as lakes, ponds, wetlands, and streams.
- Use less toxic pesticides that will do the job whenever possible and use the minimum amount needed. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected and apply pesticides only when wind speeds are low.
- Do not mix or prepare pesticides for application near storm drains.

TARGETED CONSTITUENTS

- Bacteria (M)
- Metals (M)
- Nutrients (H)
- Oil and Grease (M)
- Organics (M)
- Oxygen Demand (H)
- Sediment (H)
- Trash (H)

Estimated Removal Efficiencies Key	
(H) High	(L) Low
(M) Moderate	(NR) Not Removed

APPLICABILITY

- Facilities with open space and vegetated areas.

- Calibrate fertilizer distributors to avoid excessive application.
- Work fertilizers into the soil rather than dumping or broadcasting them onto the surfaces.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste. Dispose of empty pesticide containers according to the instructions on the container label.
- Implement storage requirements for pesticide products with guidance from the local fire department and the Massachusetts Department of Agricultural Resources. Provide secondary containment for pesticides.
- Compost or mulch yard waste. Use yard waste as mulch and topsoil.
- Sweep up yard debris instead of hosing down.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Do not leave yard waste in the street or sweep into storm drains or surface waters.

MAINTENANCE CONSIDERATIONS

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately. Do not hose down the area to a storm drain. Keep mower blades sharp.

INSPECTION CONSIDERATIONS

Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed. Inspect and remove accumulated debris from grounds. Routinely monitor lawns to identify problems during their early stages. Identify nutrient/water needs of plats. Inspect for problems by testing soils.

LAWN AND GROUNDS MAINTENANCE IN CAMBRIDGE

- Eliminate or minimize use of chemicals.
- Never wash clippings or yard waste into storm drains.
- For information on Cambridge's municipal grounds maintenance, please visit: http://www.cambridgema.gov/TheWorks/departments/parks/parkMaint.html

1.4. Materials and Waste Management

DESCRIPTION

Materials management entails the selection of the individual product, the correct use and storage of the product, and the proper disposal of associated waste(s). It is important to be responsible with common chemicals and solvents including paints, cleaners, and automotive products to reduce contamination to stormwater runoff. Improper storage and handling of solid wastes can allow toxic compounds, oils and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff.

SUGGESTED PRACTICES

- Identify all hazardous and non-hazardous substances by reviewing purchase orders and conducting a walk-through of facility.
- Compile Material Safety Data Sheets (MSDS) for all chemicals. These should be readily accessible to all facility employees.
- Label all containers of significant materials that include cleaners, fuels, and other hazards.
- Identify handling, storage, and disposal requirements of all chemicals.
- Use environmentally friendly or non-hazardous substitutes when appropriate that include but not limited to $H_2Orange_2$, Orange Thunder, and Simple Green®.
- Keep hazardous materials and waste off the ground.
- All drums and containers should be in good condition and properly labeled.
- Loose materials including any gravel piles should be covered or placed in shelter.
- Trash storage bins, dumpsters, and disposal areas should be clean and free of debris, especially those located near catch basins.
- Dumpsters should be maintained in good condition and securely closed at all times.
- Clean up equipment and materials.
- Dispose of wastes within local, state, and federal laws. This includes Section 8.24 of the City Ordinance.
- Temporary trash storage should be inspected weekly before being taken to the local privately owned transfer station.
- Debris piles including sweepings, construction, and wood debris

TARGETED CONSTITUENTS

- Bacteria (M)
- Metals (H)
- Nutrients (H)
- Oil and Grease (M)
- Organics (M)
- Oxygen Demand (M)
- Sediment (H)
- Trash (H)

Estimated Removal Efficiencies Key	
(H) High	(L) Low
(M) Moderate	(NR) Not Removed

APPLICABILITY

- Mandatory for all facilities.

should be inspected weekly before removed off site.

- Cover storage containers with leak proof lids or keep inside.
- Cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater runon and runoff with a berm.
- Sweep and clean the storage area regularly. If it is paved, do not hose down the area to a storm drain.
- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means.
- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer; do not discharge wash water to the street or storm drain.
- Post “No Littering” signs and enforce anti-litter laws.
- Provide a sufficient number of litter receptacles for the facility.

MAINTENANCE CONSIDERATIONS

Repair or replace any leaking/defective containers, and replace labels as necessary. Maintain caps and/or covers on containers. Maintain aisle space for inspection of products/wastes. Routinely clean work spaces and properly collect/dispose of waste. Routinely maintain and inspect vehicles and equipment. Regularly and when new products enter the facility, train employees on proper use, storage, disposal, and safety concern. MSDS should be reviewed and readily accessible in a central facility location. Review any Spill Prevention Control and Countermeasure (SPCC) Plan.

INSPECTION CONSIDERATIONS

Inspect floor drains to verify that they are sealed or directed to the sanitary sewer and not the stormwater drainage system. Regularly inspect material storage areas (inside and outside) to verify items are not exposed to precipitation. Regularly inspect stormwater discharge locations and onsite stormwater drainage infrastructure regularly for evidence of blockages and contaminants. Inspect waste management areas for leaking containers or spills.

MATERIALS AND WASTE MANAGEMENT IN CAMBRIDGE

- Keep materials and wastes covered or inside.
- Have spill prevention and response plans in place.
- Always dispose of wastes properly within local, state, and federal laws.
- For information on Cambridge’s municipal waste management and recycling programs, please visit: http://www.cambridgema.gov/TheWorks/services/recycling.html

OPERATION & MAINTENANCE PLAN SCHEDULE

Party Responsible for O & M Plan: Somerbridge Hotel, LLC
Project: 199 Room Dual Brand Hotel
Address: 1 McGrath Highway. - Somerville, MA

Date:
Address:
Main Phone Number:
O&M Main Point of Contact:

Structure or Task	Maintenance Activity	Schedule/Notes	Inspection Performed Date:	Inspection Performed By:	Inspection Results
Street Sweeping	Sweep, power broom or vacuum paved areas.	Sweep paved areas as needed, but not less than four times annually.			
Deep Sump Catch Basins(s)	Clam shell or vacuum sumps	Inspect at least annually. Clean when sediment is 6" deep, but never allow sediment to exceed 60% of sump volume.			

Storm Water Management System

Proprietary Device	See the VortSentry Maintenance package for the inspection and cleaning procedure.	Inspect at least four times annually as well as following storms exceeding 1" of rainfall. Clean when sediment is 6" Deep. Submit information that confirms that all water quality inlets sediments have been disposed in accordance with state and local requirements			
Subsurface Infiltration / Detention Systems	Cleaning and removal of debris after major storm events Sediment cleanout.	Perform as necessary, but not less than four times annually as well as after every storm exceeding 1" of rainfall. Remove sediment when basin is thoroughly dry.			
Outlet Control Structure(s)	Vacuum.	Periodic cleaning of Outlet Control Structures as needed.			
Mosquito Control	CB management targeted larviciding treatment to CB's and all storm drains to control mosquitoes in their aquatic stages.	Surveillance is a non chemical inspection method that involves classification of mosquito breeding sites, larval presents, and survey.			
Snow Storage	Debris shall be cleared from the site and properly disposed of at the end of the snow season, but shall be cleared no later than May 15.	Avoid dumping snow removal over catch basins, in detention ponds, sediment forebays, rivers, wetlands, and flood plain. (See Site Plan for appropriate locations)			

Notes: 1. Per City of Cambridge DPW, this O&M Plan Schedule must be maintained by the owner and remain in onsite office at all times. This schedule must be submitted to the Cambridge DPW for review upon request.

2. Per City of Cambridge DPW, owner must keep the past 7 years of maintenance and inspection records on site.

A 199 ROOM DUAL BRAND HOTEL
1 MCGRATH HIGHWAY, SOMERVILLE, MA
263 MONSIGNOR O'BRIEN HIGHWAY, CAMBRIDGE, MA

MAINTENANCE LOG FORM

INSPECTOR:________________________

DATE MAINTENANCE PERFORMED:___________________________

INSPECTOR'S QUALIFICATIONS:____

____

____

MAINTENANCE LOG

TYPE OF MAINTENANCE PERFORMED	DATE SINCE LAST MAINTENANCE	STAFF MEMBER OR CONTRACTOR WHO PERFORMED MAINTENANCE	CONDITION	ISSUE RESOLVED (YES/NO)

FOLLOW-UP REQUIRED:

____

____

TO BE PERFORMED BY:_____________________ ON OR BEFORE:________________________

NOTES:

1. Attach copies of maintenance work orders.
2. Per City of Cambridge DPW, this O&M Plan Schedule must be maintained by owner: Somerbridge Hotel, LLC and remain onsite at all times. This schedule must be submitted to the Somerville and Cambridge DPW for review upon request.
3. Per the City of Cambridge DPW, owner must keep a minimum of the past 7 years of inspections / operations and maintenance records onsite.

A 199 ROOM DUAL BRAND HOTEL
1 MCGRATH HIGHWAY, SOMERVILLE, MA
263 MONSIGNOR O'BRIEN HIGHWAY, CAMBRIDGE, MA

OPERATIONS AND MAINTENANCE UPDATES LOG

Per the Cambridge DPW: Administrative or clerical updates to the Operations and Maintenance Plan can be made at any time and should be placed in reverse chronological order (most recent on top) in a Section called O&M Plan Updates. No BMP or site changes can be made without prior approval and recertification by the Cambridge DPW. At a minimum an annual update is required.

DATE OF UPDATE TO OPERATIONS AND MAINTENANCE PLAN:________________________

DATE OF LAST UPDATE TO PLAN:___________________________

SECTIONS OUT OF DATE AND UPDATES NEEDED:

Contact Information for Site Personnel: ____

Information on BMP's including Source Controls: ____________________________________

Records of Previous Inspections: ____

REVIEW OF MAINTENANCE LOGS:

Comparison to maintenance schedule: ____
(Note Inspections)

EMPLOYEE AND CONTRACTOR TRAINING:

New employees / Contractor training events____

Refresher training events for existing staff /contractors_________________________________

ANNUAL SITE INSPECTION AND UPDATE:

Overall condition of site and any exceptional circumstances (ex: sediment deposition, erosion, compromised BMP's, flooding)____

Inspection results including exceptions noted and corrective actions needed____

Overall evaluation of the effectiveness of the O&M plan. Note effectiveness or provide DPW with a proposed revised plan for approval____

NOTES:

1. Per City of Cambridge DPW, this O&M Plan Schedule must be maintained by owner: Somerbridge Hotel, LLC and remain onsite at all times. This schedule must be submitted to the Somerville and Cambridge DPW for review upon request.
2. Per the City of Cambridge DPW, owner must keep a minimum of the past 7 years of inspections / operations and maintenance records onsite.

Spill Prevention Plan During Construction & Post Construction

FACILITY ADDRESS & PROJECT INFORMATION:
Project: A 199 Room Dual Brand Hotel
1 McGrath Highway, Somerville, MA
263 Monsignor O'Brien Highway, Cambridge, MA

The proposed redevelopment project consists of two lots located on McGrath Highway in Somerville, MA and on Monsignor O'Brien Highway in Cambridge, MA. Currently both of the parcels are occupied by light commercial buildings which are to be razed. The remainder of the lots consist of at grade off street parking. The combination of the two parcels is almost entirely paved. A six-story hotel is proposed for the site. The building will be located on the western portion of the site, close to the roadway, with parking and a public bicycle ramp occupying the remainder of the site. The proposed hotel will have a ground floor footprint of approximately 11,411sf and a gross floor area of approximately 86,765 sf. (See architectural plans and renderings). The proposed parking area is located adjacent to the hotel and expands throughout the northern portion of the site, totaling 13 parking spaces.

Attached Plans:

See attached plans entitled "Proposed Grading & Drainage Plan" for grades, and location of drainage BMP's.
See attached plans entitled "Stormwater Pollution Prevention Plan" for construction BMP's.

CONSTRUCTION MATERIAL INVENTORY FOR SPILL PREVENTION PLAN
The following materials are expected to be onsite during and post- construction:

- Detergents
- Paints
- Tar
- Fertilizers / Herbicides
- Petroleum based products
- Cleaning solvents
- Roofing materials
- Adhesives
- Lubricants
- Construction equipment / vehicle fuels

SPILL RESPONSE AND REPORTING PROCEDURES:

Minor Spills
-Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.
-Use absorbent materials on small spills rather than hosing down or burying the spill.
-Absorbent materials should be promptly removed and disposed of properly.
-Follow the practice below for a minor spill:
-Contain the spread of the spill.
-Recover spilled materials.
-Clean the contaminated area and properly dispose of contaminated materials.

Semi-Significant Spills
-Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.
-Spills should be cleaned up immediately:
- Contain spread of the spill.
- Notify the project foreman immediately.

- If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
- If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
- If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

Significant/Hazardous Spills

-For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps should be taken:
- Notify the local emergency response by dialing 911. In addition to 911, the contractor will notify the proper city, state, and federal officials. It is the contractor's responsibility to have all emergency phone numbers at the construction site.
- Notification should first be made by telephone and followed up with a written report.
- The services of a spills contractor or a Haz-Mat team should be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staffs have arrived at the job site.

General Spill Information / Procedures

The majority of the spill hazards would likely occur within the buildings and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids or liquid fuels located outside of the buildings. These exterior spill hazards have the potential to enter the stormwater drainage system and are to be addressed as follows:

1. Spill Hazards of pesticides, paints, and solvents shall be remediated using the Manufacturers recommended spill cleanup protocol.

2. Vehicle fluids and liquid fuel spill shall be remediated according to the local and state regulations governing fuel spills.

3. The construction manager / site superintendent shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust pans, mops, rags, gloves, absorptive material, sand, sawdust, plastic and metal trash containers.

4. Use a rag for small spills on paved surfaces, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be properly disposed of as hazardous waste.

5. All spills shall be cleaned up immediately after discovery.

6. Spills of toxic or hazardous material shall be reported, regardless of size, to the Massachusetts Department of Environmental Protection at 888-304-1133.

7. Spills should be covered and protected from stormwater runoff during rainfall to the extent that it doesn’t compromise clean up activities.

8. Do not bury or wash spills with water.

9. Should a spill occur, the pollution prevention plan will be adjusted by the construction manager to include measures to prevent another spill of a similar nature. A description of the spill, along with the causes and cleanup measures will be included in the updated pollution prevention plan.

10. Manufacturers’ recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies.

11. The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.

12. Once a spill has occurred containment areas should be identified to prevent the spill from spreading further and also entering the storm drainage system.

13. The Site Superintendent responsible for the day-to-day site operation will be the spill prevention and cleanup coordinator during construction. Post-construction the owner Cambridge Housing Authority will be responsible for spill prevention and cleanup coordinator.

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CONTACT INFORMATION

Owner: Somerbridge Hotel, LLC
c/o JAL Hospitality Design, LLC
10 Cabot Road, Suite 209
Medford, MA 02155
Phone – 603-518-2132

Emergency Contact Information:

o Somerbridge Hotel, LLC (owner/operator)	Phone (603) 518-2132
o Somerville Public Works	Phone (617) 666-3311
o Somerville Fire Department (non-emergency business line)	Phone (617) 623-1700
o Cambridge Public Works	Phone (617) 349-4800
o Cambridge Public Works (24 Hour Emergency Service)	Phone (617) 349-4860
o Cambridge Fire Department (non-emergency business line)	Phone (617) 349-4900
o Massachusetts General Hospital (MGH)	
55 Fruit Street	
Boston, MA 02114	
Main Switchboard line	Phone (617) 726-2000
Department of Emergency Medicine	Phone (617) 724-4100
For Emergencies	911

SPILL PREVENTION

Material Management Practices

The following are the material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff.

The following good housekeeping practices will be followed onsite during the construction project:

- An effort will be made to store only the amount of material required to do the job.
- All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
- Products will be kept in their original containers with the original manufacturer's label.
- Substances will not be mixed with one another unless recommended by the manufacturer.
- Whenever possible, all of a product will be used up before disposing of the container.
- Manufacturer's recommendations for proper use and disposal will be followed.
- Store hazardous materials and wastes in covered containers and protect from vandalism.
- Train employees in spill prevention and cleanup.
- Place proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location.
- The site superintendent will inspect daily to ensure proper use and disposal of materials onsite.
- To protect all storm drains in the event of a spill some structural methods to consider include:

  Containment diking--Containment dikes are temporary or permanent earth or concrete berms or retaining walls that are designed to hold spills. Diking can be used at any facility, but is most common for controlling large spills or releases from liquid storage and transfer areas. Diking can provide one of the best protective measures against the contamination of storm water because it surrounds the area of concern and keeps spilled materials separated from the storm water outside of the diked area.

Curbing--Similar to containment diking, a curb is a barrier that surrounds an area of concern. Unlike diking, curbing is unable to contain large spills and is usually implemented on a small-scale basis. However, curbing is common at many facilities and in small areas where liquids are handled and transferred.

Collection basins--Collection basins are temporary structures during construction in which large spills is contained and stored before cleanup or treatment. Collection basins are designed to receive spills, leaks, etc., and to prevent pollutants from being released into the environment. Unlike containment dikes, collection basins can receive and contain materials from many locations across a facility.

GOOD HOUSEKEEPING & MATERIAL HANDLING PROCEDURES:

The following product specific practices will be followed onsite:

Waste Materials
All waste materials will be collected and stored in a secure metal dumpster(s) rented from a local waste company which is a licensed solid waste management company. The dumpster(s) will meet all local and any Massachusetts solid waste management regulations. All trash and construction debris from the site will be deposited in the dumpster(s), which will be emptied on call, and the trash will be hauled to a licensed disposal area. No construction waste materials will be buried onsite. All personnel will be instructed regarding the correct procedure for waste disposal. Notices stating these practices will be posted in the office trailer and the site superintendent, who manages the day-to-day site operations, will be responsible for seeing that these procedures are followed.

Hazardous Waste & Products
All hazardous waste materials will be disposed of in the manner specified by local or State regulation or by the manufacturer. Site personnel will be instructed in these practices and Site Superintendent, the individual who manages the day-to-day site operations, will be responsible for seeing that these procedures are followed during construction and the owner will be responsible post-construction.

These practices are used to reduce the risks associated with hazardous materials:

- Products will be kept in the original containers unless they are not re-sealable.
- Original labels and material safety data will be retained; they contain important product information.
- If surplus product must be disposed of, manufacturers or local and State recommended methods for proper disposal will be followed.

Petroleum Products:
All onsite vehicles will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage. Petroleum products will be stored in tightly sealed containers that are clearly labeled. Any asphalt substances used on site will be applied according to the manufacturer's recommendations.

Fertilizers / Herbicides:
Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to storm water. Storage will be in a covered area. The contents of any partially used bag of fertilizer will be transferred to a sealable, covered plastic bin to avoid spills.

Paints / Solvents/ Adhesives:
All containers will be tightly sealed and stored when not in use. Excess material will not be discharged to the storm sewer system but will be properly disposed of according to manufacturer's instruction or local and State regulations.

SECTION 4.0

EROSION AND SEDIMENT CONTROL PLAN

EROSION AND SEDIMENT CONTROL PLAN (INCLUDING O&M PLAN FOR TEMPORARY BMP'S)

See drainage report narrative for nature and purpose of land disturbing activity, existing conditions, off-site land disturbing activities, soils information, and best management practice descriptions (BMP's). With regard to construction dewatering activities, the contractor will be responsible for following the applicable local, state, and federal laws. With regard to construction dewatering activities, if dewatering is necessary the contractor will be responsible for dewatering onsite, filing local City of Cambridge Permit if necessary, and dewatering cannot discharge to either onsite catch basins or offsite drainage.

Allen & Major Associates, Inc. (A&M) has prepared the following Construction Period Pollution Prevention Plan for the proposed stormwater management system at 263 Monsignor O'Brien Highway, Cambridge, Massachusetts and 1 McGrath Highway, Somerville MA.

The site contractor is responsible for the operation and maintenance of the stormwater management system during construction. The property owner (or the assignee) is responsible for the permanent maintenance of the stormwater management system.

Basic Information

Proponent:	Somerbridge Hotel, LLC
Address:	10 Cabot Road, Suite 209
City:	Medford, MA 02155
Phone:	603-518-2132

SECTION 1 CONSTRUCTION ACTIVITIES

1. Install the haybales, silt fence and construction fencing as shown on the enclosed Erosion and Sediment Control Plan.

2. Site access shall be achieved only from the designated construction entrance.

3. All erosion control measures shall be inspected weekly and after all rainfall events, and shall be maintained, repaired or replaced as required or at the direction of the owner's engineer or the City Engineer.

4. Sediment accumulation up-gradient of the haybales and silt fence greater than 6" in depth shall be removed and disposed of in accordance with all applicable regulations.

5. If it appears that sediment is exiting the site, silt sacks shall be installed in all catch basins adjacent to the site. Sediment accumulation on all adjacent catch basin inlets shall be removed and the silt sack replaced if torn or damaged.

6. Silt control shall be installed prior to construction and shall be adequate to maintain sediment on site. Any modifications to silt controls shown on the approved plans as a result of actual field conditions or construction practices shall be installed in accordance with BMP (best management practices) per the E.P.A. 1992 "stormwater management for construction activities" manual. Any such modifications shall be installed as approved by the engineer.

7. The contractor shall conduct inspections after each rainfall event in addition to weekly inspections & maintaining a log. See attached sheet entitled "Operations and Maintenance Plan Log During Construction"

8. Areas of exposed soil undergoing construction that will not be covered and or finished graded within 7 days of exposure shall be anchored with temporary erosion control measures within 7 days of disturbance. Temporary erosion control measures shall include erosion control mesh, netting or mulch as directed by the owner's representative and shown on the design plans. If mulch is used, hay or hay mulch shall be applied at the rate of 2 bales per 1,000 square feet. Application area shall be sufficiently covered with mulch to avoid any visible soil exposure. Mulch shall be kept moist to avoid loss due to wind. Mulch and netting shall be applied in the base of all grassed waterways and in vegetative slopes which exceed 15% and disturbed areas within 100 feet of wetlands or streams.

9. If disturbed areas do not receive final seeding by September 15 of the construction year, then all disturbed areas shall be seeded with a winter cover crop at the rate of 3 lbs per 1,000 square feet. Winter seeding shall be covered with erosion control mesh (mulch and netting). Heavy grade mats shall be used in the base of all grassed waterways on vegetated slopes in excess of 15%, and any disturbed areas within 100 feet of wetlands or streams. Mulch and netting shall also be provided for additional winter protection.

10. Soil and fill stockpiles expected to remain in place for less than 90 days shall be covered with hay and mulch (at 100lbs/1,000 sf), or with an anchored tarp within 7 days or prior to any rainfall. Soil and fill stockpiles expected to remain in place for 90 days or more shall be seeded with winter rye (for fall seeding at 3lb/1,000 sf) or oats (for summer seeding at 2lb/1,000 sf) and then covered with hay mulch (at 100lb/1,000 sf) or an anchored tarp within 7 days or prior to any rainfall. Loam shall be stockpiled at locations designated by the owner and engineer.

11. All filter barriers, silt sacks, and erosion control berms shall be installed according to the erosion control plan. These shall be maintained during construction to remove sediment from runoff water. All the filter barriers and erosion control berms shall be inspected after any rainfall or runoff event, maintained and cleaned until all areas have at least 85-90% vigorous perennial cover of grasses.

12. Parking lot areas shall be periodically swept or washed to avoid tracking mud, dust or debris from the construction area. If any sediment or construction debris is tracked onto adjacent public or private roadways, contractor to clean at the end of each day.

13. A watering truck will be used to periodically sprinkle construction areas in order to keep the level of dust to a minimum (as required).

14. The contractor shall use extreme caution to avoid allowing sediments to enter the storm drain system during construction. Catch basin inlets shall also be protected during construction by the use of hay bale barriers around each inlet. Silt sacks shall be installed in all existing basins. Inlet protection may be removed only after finished areas are paved and the vegetated slopes are established with at least 85-90% of vigorous perennial growth.

15. Revegetation measures shall commence immediately upon the completion of construction.

16. Loam will be spread over disturbed areas and smoothed to a uniform surface per specifications. Loam shall be free of soil, clay lumps, stones and other objects over 1 inch in diameter, and without weeds, roots or other deleterious material.

17. Erosion control mesh shall be applied in accordance with the plans over all finished seeded areas as specified on the design plans.

18. All hay bale and filter fabric shall remain in place until seedings have become 85-90% established and then removed within 10 days.

19. At the owner's discretion additional erosion control measures may be required to maintain stability of earthworks and finished graded areas. The contractor, at his expense, will be responsible for providing and installing any additional measures as specified by the owner. This includes but is not limited to requests by MADEP and the municipality, as authorized by the owner.

20. Inspections and monitoring maintenance measures shall be applied as needed during the entire construction cycle. Weekly inspections shall be held through the duration of construction activity. Weekly inspection reports shall be maintained in the contractor's field office. In addition to the normal weekly inspections, the contractor shall perform an inspection of all erosion control measures after each rainfall or runoff event, and perform the necessary repairs.

21. If any evidence of sedimentation is observed in the inlets, the contractor shall, at his own expense, provide a plan to the engineer to remove any accumulated sediment in these areas. The contractor shall also immediately provide additional on site erosion and sedimentation control measures to prevent further degradation of the area.

22. Following the temporary or final seedings, the contractor shall inspect the work area bimonthly to ensure the areas have a minimum of 85-90% vegetated vigorous growth. Reseeding shall be carried out by the contractor with follow up inspections in the even of any failures until vegetation is adequately established.

23. The contractor shall comply with the General and Erosion Notes as shown on the Site Development Plans and Specifications.

Operation and Maintenance Plan Log During Construction

Project: A 199 Room Dual Brand Hotel
Address: 1 McGrath Hwy, Somerville, MA
263 Monsignor O'Brien Hwy, Cambridge, MA

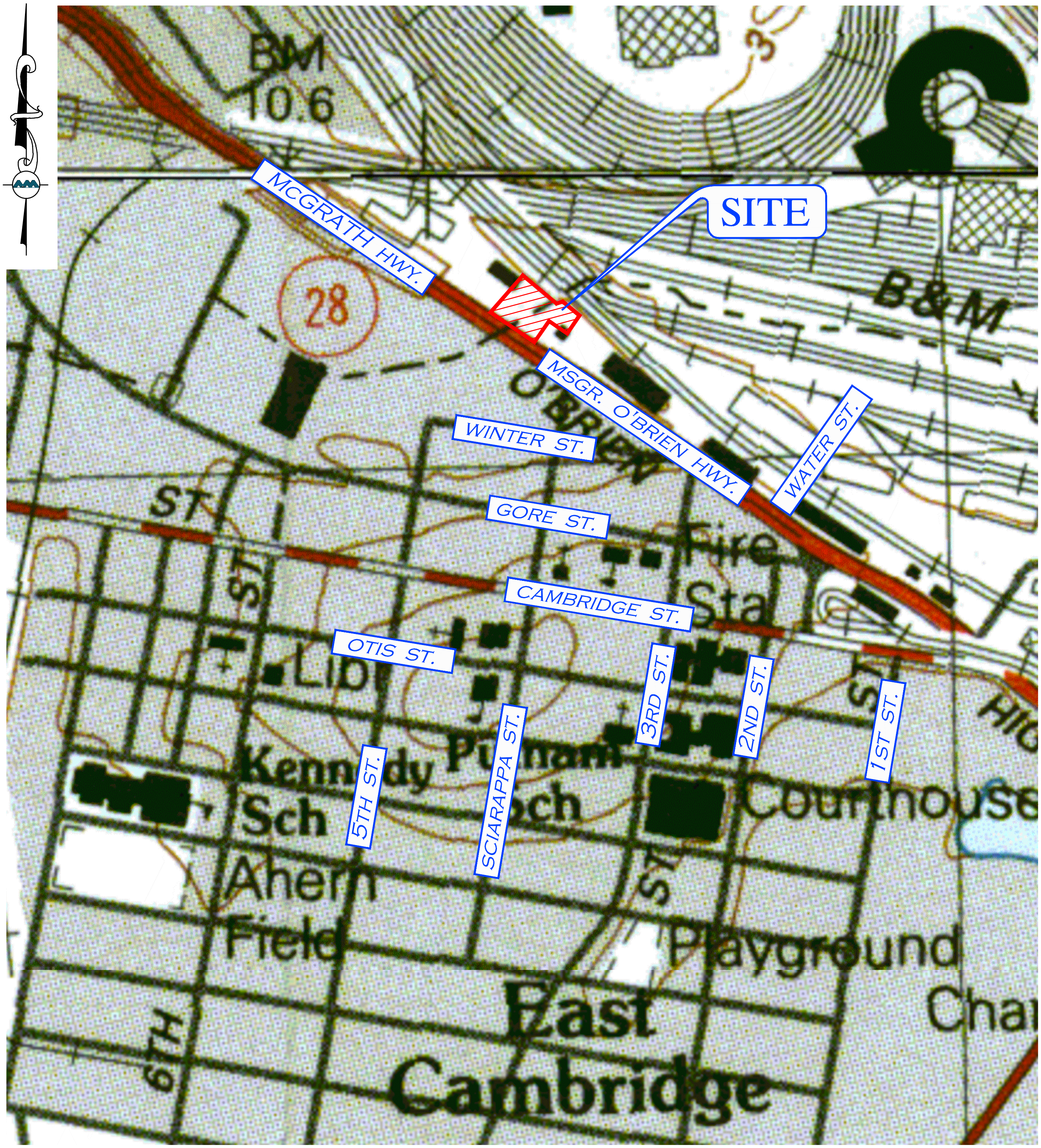
Company Responsible for O&M During Construction: ____________________
Individual responsible for Inspections & Log: ____________________
Erosion Control Inspection Qualifications: ____________________
Address: ____________________
Phone (24 Hour Contact Number): ____________________

Erosion Control Measures	Weekly Inspection Schedule/or After Rainfall	Inspection Performed		Method	Notes/Remarks
		Date	By:		
Temporary Tree Protection				Review temporary tree protection fencing and trunk protection. Verify no machinery or construction materials are stored within the fenced area. Repair any damaged fencing. Document any damage to tree. Contact client's construction representative with any tree trunk or root damage.	
Hay bales & Silt Fence				Sediment accumulation up-gradient of the hay bales and silt fence sediment control greater than 6" in depth shall be removed and disposed of in accordance with all applicable regulations	
Stone barrier and Silt Sacks at Catch Basins				When the sediment is exiting the site, and as shown on the plan, silt sacks shall be installed in all catch basins adjacent to the site. Sediment accumulation on all catch basin inlets shall be removed and the silt sack replaced if torn or damaged. Remove silt and replace damage silt sacks at each catch basin.	
Construction Entrance				When silt is accumulating in the construction entrance, then the construction entrance shall be cleaned and stone replaced as necessary.	

Note: Operation and maintenance plan log shall be documented by contractor and kept within onsite construction office. Upon request, log and operation and maintenance files shall be made available to the City, State, and Federal authorities.

APPENDIX A

FIGURES AND SUPPORT DOCUMENTATION



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PREPARED BY:

ALLEN & MAJOR ASSOCIATES, INC.
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environmental consulting ♦ landscape architecture
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MANCHESTER, NH 03103
TEL: (603) 627-5500 FAX: (603) 627-5501
WOBURN, MA ♦ LAKEVILLE, MA ♦ MANCHESTER, NH

PROJECT:

199 ROOM DUAL BRAND HOTEL
1 McGRATH HIGHWAY, SOMERVILLE, MA
263 MONSIGNOR O'BRIEN HIGHWAY
CAMBRIDGE, MA

LOCUS/USGS MAP

PROJECT NO.	1362-16	DATE:	09-01-22
SCALE:	1"=500'	SHEET REF:	Figures
DESIGNED BY:	SM	CHECKED BY:	MAM

APPLICANT/OWNER: SOMERBRIDGE HOTEL LLC

FIGURE No.
FIG-1

R:\Projects\1362-16\Civil\Drawings\Current\1362-16_Figures.dwg

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PROJECT:

199 ROOM DUAL BRAND HOTEL
1 McGRATH HIGHWAY, SOMERVILLE, MA
263 MONSIGNOR O'BRIEN HIGHWAY
CAMBRIDGE, MA

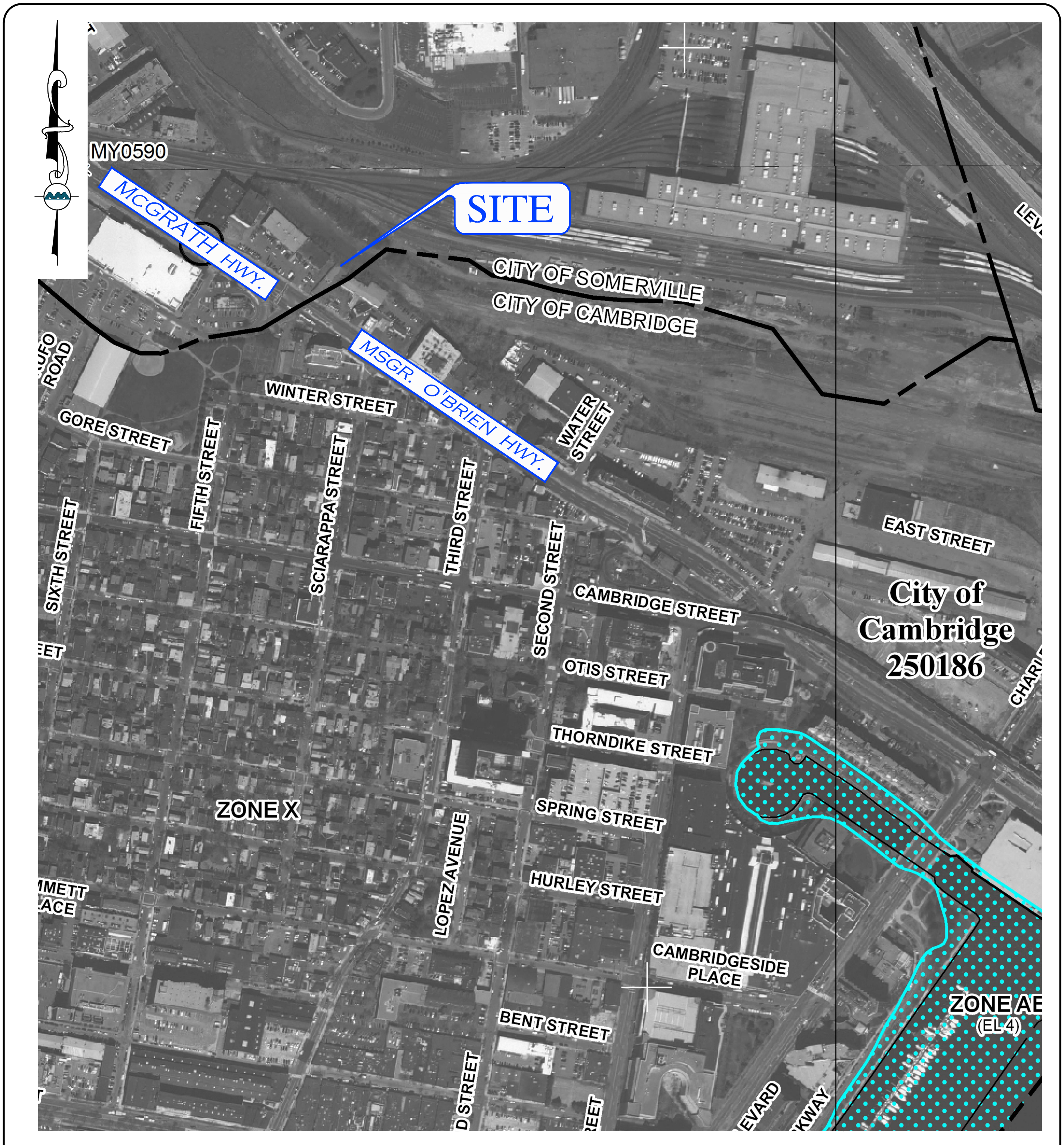
COLOR ORTHOGRAPHIC

PROJECT NO.	1362-16	DATE:	09-01-22
SCALE:	1' = 150'	SHEET REF:	Figures
DESIGNED BY:	SM	CHECKED BY:	MAM

APPLICANT/OWNER: SOMERBRIDGE HOTEL LLC

FIGURE No.

FIG-2



R:\Projects\1362-16\Civil\Drawings\Current\1362-16_Figures.dwg

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PROJECT:

199 ROOM DUAL BRAND HOTEL
1 McGRATH HIGHWAY, SOMERVILLE, MA
263 MONSIGNOR O'BRIEN HIGHWAY
CAMBRIDGE, MA

FLOOD INSURANCE RATE MAP

PROJECT NO.	1362-16	DATE:	09-01-22
SCALE:	1' = 500'	SHEET REF:	Figures
DESIGNED BY:	SM	CHECKED BY:	MAM

APPLICANT/OWNER: SOMERBRIDGE HOTEL LLC

FIGURE No.

FIG-3

R:\Projects\1362-16\Civil\Drawings\Current\1362-16_Figures.dwg

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PROJECT:

199 ROOM DUAL BRAND HOTEL

1 McGRATH HIGHWAY, SOMERVILLE, MA
263 MONSIGNOR O'BRIEN HIGHWAY
CAMBRIDGE, MA

WETLAND MAP

PROJECT NO.	1362-16	DATE:	09-01-22
SCALE:	1' =750'	SHEET REF:	Figures
DESIGNED BY:	SM	CHECKED BY:	MAM

APPLICANT/OWNER: SOMERBRIDGE HOTEL LLC

FIGURE No.

FIG-4

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Middlesex County, Massachusetts

October 15, 2015

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,210 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 15, 30, 60, 90

Feet: 0, 50, 100, 200, 300

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

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 14, Sep 19, 2014

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

Date(s) aerial images were photographed: Aug 10, 2014—Aug 11, 2014

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

Map Unit Legend

Middlesex County, Massachusetts (MA017)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
603	Urban land, wet substratum	2.6	100.0%
Totals for Area of Interest		**2.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Middlesex County, Massachusetts

603—Urban land, wet substratum

Map Unit Setting

National map unit symbol: 9951
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land over alluvium and/or marine deposits

Minor Components

Udorthents, loamy

Percent of map unit: 10 percent

Rock outcrop

Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

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TEST BORING LOG

MILLER ENGINEERING & TESTING, INC.
100 Sheffield Road - Manchester, NH 03103
Ph. (603) 668-6016 - Fax: (603) 668-8641

Project:	Hotel Somerbridge, Somerville, MA	**Sheet**	1 **of** 2
Project No:	15.152.NH	**Boring No:**	B-1
Date Start:	07-06-15	**Location:**	See Plan
Date End:	07-09-15	**Approx. Surface Elev:**	

	CASING	SAMPLER	GROUNDWATER OBSERVATIONS			
			Date	**Depth**	**Casing At**	**Stabilization Period**
Type	HSA	SS	07-06-15	13.5'	19.	Upon Completion
Size	2-1/4" ID	1-3/8" ID				
Hammer		140 lbs.				
Fall		30"				

Depth/ Elev.	Cas bl/ft	Sample No.	Depth Range	Pen.	Rec.	Blows 0-6"	Blows 6-12"	Blows 12-18"	Blows 18-24"	Strata Change	Sample Description	Notes
0		-	0.0-0.2	2.5	2	5					-: 2.5" Asphalt	
		S-1	0.1-0.6	6							S-1: Brown, fine to coarse sand, little gravel, trace silt (FILL)	
		S-1A	1.0-2.5	18	11		6	6	14		S-1A: Dark brown, fine to coarse sand, some silt, little gravel (pieces of brick in sample) (construction debris) (FILL)	
		S-2	2.5-4.5	24	11	25	16	11	12		S-2: Dark brown, fine to coarse sand, some silt, little gravel (pieces of brick in sample) (construction debris) (FILL)	
5		S-3	4.5-6.5	24	16	6	6	8	10		S-3: Gray, fine to medium sand, some clay and silt, little gravel (FILL)	
10		S-4	9.0-11.0	24	9	2	3	2	4		S-4: Gray, fine to medium sand, some clay and silt, little gravel (FILL)	
15		S-5	14.0-16.0	24	8	4	3	2	6		S-5: Gray, fine to medium sand, some clay and silt, little gravel (FILL)	
20		S-6	19.0-21.0	24	10	13	19	18	12		S-6: Wet, gray, fine to medium sand, trace silt	(1)
25		S-7	24.0-26.0	24	8	16	14	10	11		S-7: Wet, gray, fine to medium sand and silt, little gravel	(2)
30		S-8	29.0-31.0	24	13	13	16	19	21		S-8: Wet, gray, fine to medium sand and silt, little gravel	

Driller: S. Hollabaugh
Helper: B. Carger
Inspector: T. Young

COHESIVE CONSISTENCY (Blows/Foot)	COHESIONLESS (Blows/Foot)	PROPORTIONS USED
0-2 VERY SOFT	0-4 VERY LOOSE	TRACE: 0-10%
2-4 SOFT	4-10 LOOSE	LITTLE: 10-20%
4-8 MEDIUM STIFF	10-30 MEDIUM DENSE	SOME: 20-35%
8-15 STIFF	30-50 DENSE	AND: 35-50%
15-30 HARD	50+ VERY DENSE	

NOTES: (1) Approximately 2' of blow in when placing the spoon into the auger. Had issues with taking spoon out of the auger after sampling.
(2) Moved auger over approximately 3' and augered past the sand layer.

REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL.
WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS.
FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

TEST BORING LOG

MILLER ENGINEERING & TESTING, INC.
100 Sheffield Road - Manchester, NH 03103
Ph. (603) 668-6016 - Fax: (603) 668-8641

Project: Hotel Somerbridge, Somerville, MA
Project No.: 15.152.NH
Date Start: 07-06-15
Date End: 07-09-15

Boring No: B-1
Location: See Plan
Approx. Surface Elev:

	CASING	SAMPLER
Type	HSA	SS
Size	2-1/4" ID	1-3/8" ID
Hammer		140 lbs.
Fall		30"

GROUNDWATER OBSERVATIONS

Date	Depth	Casing At	Stabilization Period
07-06-15	13.5'	19.	Upon Completion

Depth/ Elev.	Cas bl/ft	Sample No.	Depth Range	Pen.	Rec.	Blows 0-6"	Blows 6-12"	Blows 12-18"	Blows 18-24"	Strata Change	Sample Description	Notes
35		S-9	34.0-36.0	24	13	23	28	36	26		S-9: Weathered rock	
											BORING TERMINATED AT 36 ft	
40												
45												
50												
55												
60												

Driller: S. Hollabaugh
Helper: B. Carger
Inspector: T. Young

COHESIVE CONSISTENCY (Blows/Foot)
0-2 VERY SOFT
2-4 SOFT
4-8 MEDIUM STIFF
8-15 STIFF
15-30 HARD

COHESIONLESS (Blows/Foot)
0-4 VERY LOOSE
4-10 LOOSE
10-30 MEDIUM DENSE
30-50 DENSE
50+ VERY DENSE

PROPORTIONS USED
TRACE: 0-10%
LITTLE: 10-20%
SOME: 20-35%
AND: 35-50%

NOTES: (1) Approximately 2' of blow in when placing the spoon into the auger. Had issues with taking spoon out of the auger after sampling.
(2) Moved auger over approximately 3' and augered past the sand layer.

REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL.
WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS.
FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

TEST BORING LOG

MILLER ENGINEERING & TESTING, INC.
100 Sheffield Road - Manchester, NH 03103
Ph. (603) 668-6016 - Fax: (603) 668-8641

Project: Hotel Somerbridge, Somerville, MA
Project No: 15.152.NH
Date Start: 07-06-15
Date End: 07-06-15

Boring No: B-2
Location: See Plan
Approx. Surface Elev:

	CASING	SAMPLER	GROUNDWATER OBSERVATIONS Date	Depth	Casing At	Stabilization Period
Type	HSA	SS	07-06-15	10.9'	49'	Upon Completion
Size	2-1/4" ID	1-3/8" ID				
Hammer		140 lbs.				
Fall		30"				

Depth/ Elev.	Cas bl/ft	SAMPLE Sample No.	Depth Range	Pen.	Rec.	BLOWS 0-6"	6-12"	12-18"	18-24"	Strata Change	Sample Description	Notes
0		-	0.0-0.2	2.5							-: 2.5" Asphalt	
		S-1	0.5-2.5	24	13	7	16	23	22		S-1: Black, fine to coarse sand, some silt, little gravel (pieces of brick in sample) (construction debris) (FILL)	
		S-2	2.5-4.5	24	8	17	11	11	7		S-2: Black, fine to coarse sand, some silt, little gravel (pieces of brick in sample) (construction debris) (slight fuel odor) (FILL)	
5		S-3	4.5-6.5	24	10	9	9	3	3		S-3: Wet, black, fine to coarse sand, some silt, little gravel (pieces of asphalt in sample) (construction debris) (slight fuel odor) (FILL)	
		S-4	6.5-8.5	24	4	3	2	1	2		S-4: Wet, black, fine to coarse sand, some silt, little gravel (pieces of asphalt in sample) (construction debris) (fuel odor) (FILL)	
10		S-5	9.0-11.0	24	11	2	3	3	3		S-5: Wet, gray, silty clay (fuel odor) (FILL)	
15		S-6	14.0-16.0	24	6	1	1	2	2		S-6: Wet, dark gray, clayey silt (organic matter)	
20		S-7	19.0-21.0	24	24		1/12"	1	2		S-7: Wet, dark gray, clayey silt, organic wood fibers (sea shells) (sand lenses)	
25		S-8	24.0-26.0	24	11	3	6	7	10		S-8: Gray, silty clay (blocky and desiccated)	
30		S-9	29.0-31.0	24	0	7	16	23	23		S-9: No recovery	(1)

Driller: S. Hollabaugh
Helper: B. Carger
Inspector: T. Young

COHESIVE CONSISTENCY (Blows/Foot)
0-2 VERY SOFT
2-4 SOFT
4-8 MEDIUM STIFF
8-15 STIFF
15-30 HARD

COHESIONLESS (Blows/Foot)
0-4 VERY LOOSE
4-10 LOOSE
10-30 MEDIUM DENSE
30-50 DENSE
50+ VERY DENSE

PROPORTIONS USED
TRACE: 0-10%
LITTLE: 10-20%
SOME: 20-35%
AND: 35-50%

NOTES: (1) Possibly pushed stone; more difficulty drilling below 29'.
(2) The bottom 9" of the sample stayed in the hole.

REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL.
WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS.
FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

TEST BORING LOG

MILLER ENGINEERING & TESTING, INC.
100 Sheffield Road - Manchester, NH 03103
Ph. (603) 668-6016 - Fax: (603) 668-8641

Project: Hotel Somerbridge, Somerville, MA
Project No.: 15.152.NH
Date Start: 07-06-15
Date End: 07-06-15

Sheet 2 **of** 2
Boring No: B-2
Location: See Plan
Approx. Surface Elev:

	CASING	SAMPLER
Type	HSA	SS
Size	2-1/4" ID	1-3/8" ID
Hammer		140 lbs.
Fall		30"

GROUNDWATER OBSERVATIONS

Date	Depth	Casing At	Stabilization Period
07-06-15	10.9'	49'	Upon Completion

Depth/ Elev.	Cas bl/ft	Sample No.	Depth Range	Pen.	Rec.	Blows 0-6"	Blows 6-12"	Blows 12-18"	Blows 18-24"	Strata Change	Sample Description	Notes
		S-10	34.0-34.4	5	0	50/5"					S-10: No recovery	
35												
		S-11	39.0-41.0	24	24	29	39	32	38		S-11: Wet, gray, silty clay, little gravel and coarse sand	(2)
40												
		S-12	44.0-46.0	24	9	8	9	16	16		S-12: Gray, clayey silt, trace medium to coarse sand (blocky)	
45												
		S-13	49.0-51.0	24	9	16	29	31	38		S-13: Gray, silty clay, trace medium to coarse sand (blocky)	
50												
											BORING TERMINATED AT 51 ft	
55												
60												

Driller: S. Hollabaugh
Helper: B. Carger
Inspector: T. Young

COHESIVE CONSISTENCY (Blows/Foot)	COHESIONLESS (Blows/Foot)	PROPORTIONS USED
0-2 VERY SOFT	0-4 VERY LOOSE	TRACE: 0-10%
2-4 SOFT	4-10 LOOSE	LITTLE: 10-20%
4-8 MEDIUM STIFF	10-30 MEDIUM DENSE	SOME: 20-35%
8-15 STIFF	30-50 DENSE	AND: 35-50%
15-30 HARD	50+ VERY DENSE	

NOTES: (1) Possibly pushed stone; more difficulty drilling below 29'.
(2) The bottom 9" of the sample stayed in the hole.

REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL.
WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS.
FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

TEST BORING LOG

MILLER ENGINEERING & TESTING, INC.
100 Sheffield Road - Manchester, NH 03103
Ph. (603) 668-6016 - Fax: (603) 668-8641

Project:	Hotel Somerbridge Somerville, MA	**Sheet**	1 **of** 2
Project No:	15.152.NH	**Boring No:**	B-3
Date Start:	07-06-15	**Location:**	See Plan
Date End:	07-07-15	**Approx. Surface Elev:**	

	CASING	SAMPLER	GROUNDWATER OBSERVATIONS Date	Depth	Casing At	Stabilization Period
Type	HSA	SS	07-07-15	14'	14'	Upon Completion
Size	2-1/4" ID	1-3/8" ID				
Hammer		140 lbs.				
Fall		30"				

Depth/ Elev.	Cas bl/ft	SAMPLE Sample No.	Depth Range	Pen.	Rec.	BLOWS 0-6"	6-12"	12-18"	18-24"	Strata Change	Sample Description	Notes
		-	0.0-0.2	2.5							-: 2.5" Asphalt	
		S-1	0.5-1.0	6	3	6					S-1: Brown, fine to coarse sand, little gravel, trace silt (FILL)	
		S-1A	1.0-2.5	18	3		6	2	3		S-1A: Dark brown, fine to coarse sand, some silt, little gravel (pieces of concrete in sample) (construction debris) (FILL)	
		S-2	2.5-4.5	24	12	3	3	4	3		S-2: Dark brown, fine to coarse sand, some silt, little gravel (pieces of concrete in sample) (construction debris) (FILL)	
		S-3	4.5-6.5	24	10	3	2	3	6		S-3: Dark brown, fine to coarse sand, some silt, little gravel (pieces of coal and concrete in sample) (construction debris) (FILL)	
		S-4	6.5-8.5	24	13	7	7	9	6		S-4: Brown/orange, fine to medium sand, some silt, little gravel (FILL)	
		S-5	9.0-11.0	24	17	6	6	7	6		S-5: Brown/orange, fine to medium sand, some silt, little gravel (FILL)	
		S-6	14.0-16.0	24	10	2	5	4	5		S-6: Wet, brown/orange, fine to medium sand, some silt, little gravel (FILL)	
		S-7	19.0-21.0	24	17	9	9	11	9		S-7: Wet, dark brown, fine to medium sand, little silt	(1)
		S-8	24.0-26.0	24	20	5	8	10	10		S-8: Gray, silty clay (desiccated)	
		S-9	29.0-31.0	24	12	11	27	40	23		S-9: Wet, gray, fine to medium sand, some silty clay, little gravel	

Driller: S. Hollabaugh
Helper: B. Carger
Inspector: T. Young

COHESIVE CONSISTENCY (Blows/Foot)
0-2 VERY SOFT
2-4 SOFT
4-8 MEDIUM STIFF
8-15 STIFF
15-30 HARD

COHESIONLESS (Blows/Foot)
0-4 VERY LOOSE
4-10 LOOSE
10-30 MEDIUM DENSE
30-50 DENSE
50+ VERY DENSE

PROPORTIONS USED
TRACE: 0-10%
LITTLE: 10-20%
SOME: 20-35%
AND: 35-50%

NOTES: (1) Change in drilling at approximately 17-18'. The drilling felt more gravelly.

REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL. WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

TEST BORING LOG

MILLER ENGINEERING & TESTING, INC.
100 Sheffield Road - Manchester, NH 03103
Ph. (603) 668-6016 - Fax: (603) 668-8641

Project:	Hotel Somerbridge, Somerville, MA	**Sheet**	2 **of** 2
Project No.:	15.152.NH	**Boring No:**	B-3
Date Start:	07-06-15	**Location:**	See Plan
Date End:	07-07-15	**Approx. Surface Elev:**	

	CASING	SAMPLER	GROUNDWATER OBSERVATIONS Date	Depth	Casing At	Stabilization Period
Type	HSA	SS	07-07-15	14'	14'	Upon Completion
Size	2-1/4" ID	1-3/8" ID				
Hammer		140 lbs.				
Fall		30"				

Depth/ Elev.	Cas bl/ft	Sample No.	Depth Range	Pen.	Rec.	Blows 0-6"	Blows 6-12"	Blows 12-18"	Blows 18-24"	Strata Change	Sample Description	Notes
35		S-10	34.0-36.0	24	14	7	10	16	21		S-10: Wet, gray, silty clay, trace gravel and fine to medium sand	
40		S-11	39.0-40.9	23	13	16	27	50/5"			S-11: Wet, gray, silty clay, some gravel, little fine to medium sand	
45		S-12	44.0-44.3	3	3	50/3"					S-12: Gray weathered rock	
50		S-13	49.0-49.2	2	2	50/2"					S-13: Gray weathered rock BORING TERMINATED AT 49.2 ft	
55												
60												

Driller: S. Hollabaugh
Helper: B. Carger
Inspector: T. Young

COHESIVE CONSISTENCY (Blows/Foot)
0-2 VERY SOFT
2-4 SOFT
4-8 MEDIUM STIFF
8-15 STIFF
15-30 HARD

COHESIONLESS (Blows/Foot)
0-4 VERY LOOSE
4-10 LOOSE
10-30 MEDIUM DENSE
30-50 DENSE
50+ VERY DENSE

PROPORTIONS USED
TRACE: 0-10%
LITTLE: 10-20%
SOME: 20-35%
AND: 35-50%

NOTES: (1) Change in drilling at approximately 17-18'. The drilling felt more gravelly.

REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL. WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

TEST BORING LOG

MILLER ENGINEERING & TESTING, INC.
100 Sheffield Road - Manchester, NH 03103
Ph. (603) 668-6016 - Fax: (603) 668-8641

Project:	Hotel Somerbridge Somerville, MA	**Sheet** 1 **of** 2	**Boring No:** B-4
Project No:	15.152.NH	**Location:**	See Plan
Date Start:	07-07-15		
Date End:	07-08-15	**Approx. Surface Elev:**	

	CASING	SAMPLER	GROUNDWATER OBSERVATIONS			
			Date	**Depth**	**Casing At**	**Stabilization Period**
Type	HSA	SS	07-08-15	10.5'	49'	Upon Completion
Size	2-1/4" ID	1-3/8" ID				
Hammer		140 lbs.				
Fall		30"				

Depth/ Elev.	Cas bl/ft	Sample No.	Depth Range	Pen.	Rec.	Blows 0-6"	Blows 6-12"	Blows 12-18"	Blows 18-24"	Strata Change	Sample Description	Notes
0		-	0.0-0.2	2.25							-: 2.5" Asphalt	
		S-1	0.5-2.5	24	14	9	6	12	19		S-1: Black, fine to coarse sand, some silt, little gravel (pieces of brick and concrete in sample) (construction debris) (FILL)	
		S-2	2.5-4.5	24	13	15	15	12	14		S-2: Black, fine to coarse sand, some silt, little gravel (pieces of brick and concrete in sample) (construction debris) (FILL)	
5		S-3	5.0-7.0	24	6	12	14	10	10		S-3: Gray, fine to medium sand, some silty clay (FILL)	
		S-4	7.0-9.0	24	0	6	5	4	4		S-4: No recovery	
10		S-5	10.0-12.0	24	0	3	2	7	6		S-5: No recovery	
		S-6	12.0-13.0	12	6	10	8				S-6: Gray, fine to medium sand and silty clay (fuel odor) (FILL)	
		S-6A	13.0-13.5	6	3			5			S-6A: Brown, fine sand, some silt, trace gravel (FILL)	
		S-6B	13.5-14.0	6	4				6		S-6B: Gray, fine to medium sand, some silt, little gravel (FILL)	
15		S-7	15.0-17.0	24	2	3	2	4	2		S-7: Gray, fine to medium sand, some silt, little gravel (FILL)	
		S-8	19.0-21.0	24	10	5	6	9	4		S-8: Gray, fine to medium sand, some silty clay , little gravel (FILL)	
20												
		S-9	24.0-25.0	12	4	7	19				S-9: Gray, fine to medium sand, some silt, little gravel	
25		S-9A	25.0-26.0	12	7			13	7		S-9A: Black, fine sand and silt, little gravel, trace organic matter	
		S-10	26.0-28.0	24	7	6	25	16	16		S-10: Gray, clay, little gravel, trace fine to medium sand	
		S-11	29.0-31.0	24	15	7	6	8	7		S-11: Gray, silty clay, little sand	
30												

Driller: S. Hollabaugh
Helper: B. Carger
Inspector: T. Young

COHESIVE CONSISTENCY (Blows/Foot)	COHESIONLESS (Blows/Foot)	PROPORTIONS USED
0-2 VERY SOFT	0-4 VERY LOOSE	TRACE: 0-10%
2-4 SOFT	4-10 LOOSE	LITTLE: 10-20%
4-8 MEDIUM STIFF	10-30 MEDIUM DENSE	SOME: 20-35%
8-15 STIFF	30-50 DENSE	AND: 35-50%
15-30 HARD	50+ VERY DENSE	

NOTES: (1) Auger grinding at 32'.
(2) Rock in bottom of spoon

REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL. WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

TEST BORING LOG

MILLER ENGINEERING & TESTING, INC.
100 Sheffield Road - Manchester, NH 03103
Ph. (603) 668-6016 - Fax: (603) 668-8641

Project: Hotel Somerbridge, Somerville, MA
Project No.: 15.152.NH
Date Start: 07-07-15
Date End: 07-08-15

Boring No: B-4
Location: See Plan
Approx. Surface Elev:

	CASING	SAMPLER
Type	HSA	SS
Size	2-1/4" ID	1-3/8" ID
Hammer		140 lbs.
Fall		30"

GROUNDWATER OBSERVATIONS

Date	Depth	Casing At	Stabilization Period
07-08-15	10.5'	49'	Upon Completion

Depth/ Elev.	Cas bl/ft	Sample No.	Depth Range	Pen.	Rec.	Blows 0-6"	Blows 6-12"	Blows 12-18"	Blows 18-24"	Strata Change	Sample Description	Notes
35		S-12	34.0-36.1	25	10	18	18	27	27		S-12: Gray, silty clay, little angular gravel, trace fine to medium sand	(1)
40		S-13	39.0-41.0	24	11	10	13	14	17		S-13: Gray, silty clay, some gravel	
45		S-14	44.0-46.0	24	15	8	15	22	30		S-14: Gray, clay, some fine to coarse sand and angular gravel	(2)
50		S-15	49.0-49.8	9	0	37	50/3"				S-15: No recovery	
55		S-16	54.0-54.1	1	1	50/1"					S-16: Black weathered rock	
60											BORING TERMINATED AT 59 ft	

Driller: S. Hollabaugh
Helper: B. Carger
Inspector: T. Young

COHESIVE CONSISTENCY (Blows/Foot)
0-2 VERY SOFT
2-4 SOFT
4-8 MEDIUM STIFF
8-15 STIFF
15-30 HARD

COHESIONLESS (Blows/Foot)
0-4 VERY LOOSE
4-10 LOOSE
10-30 MEDIUM DENSE
30-50 DENSE
50+ VERY DENSE

PROPORTIONS USED
TRACE: 0-10%
LITTLE: 10-20%
SOME: 20-35%
AND: 35-50%

NOTES: (1) Auger grinding at 32'.
(2) Rock in bottom of spoon

REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL.
WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS.
FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

TEST BORING LOG

MILLER ENGINEERING & TESTING, INC.
100 Sheffield Road - Manchester, NH 03103
Ph. (603) 668-6016 - Fax: (603) 668-8641

Project: Hotel Somerbridge, Somerville, MA
Project No: 15.152.NH
Date Start: 07-08-15
Date End: 07-08-15

Sheet 1 **of** 2
Boring No: B-5
Location: See Plan
Approx. Surface Elev:

	CASING	SAMPLER
Type	HSA	SS
Size	2-1/4" ID	1-3/8" ID
Hammer		140 lbs.
Fall		30"

GROUNDWATER OBSERVATIONS

Date	Depth	Casing At	Stabilization Period
07-08-15	11'	44'	Upon Completion

Depth/ Elev.	Cas bl/ft	Sample No.	Depth Range	Pen.	Rec.	Blows 0-6"	Blows 6-12"	Blows 12-18"	Blows 18-24"	Strata Change	Sample Description	Notes
0		-	0.0-0.2	2	5	7	7				-: 2" Asphalt	
		S-1	0.5-1.5	12							S-1: Dark brown, fine to coarse sand, some silt, little gravel (pieces of brick and concrete in sample) (construction debris) (FILL)	
		S-1A	1.5-2.5	12	8			4	5		S-1A: Brown, fine to medium sand, trace silt and gravel (FILL)	
		S-2	2.5-4.5	24	13	4	2	3	4		S-2: Brown, fine to medium sand, trace silt and gravel (FILL)	
5		S-3	4.5-6.5	24	9	5	4	2	6		S-3: Fine to medium sand, some silty clay, little gravel (FILL)	
10		S-4	9.0-11.0	24	11	1	3	3	6		S-4: Wet, clay, trace gravel and fine sand (rock in tip of spoon) (fuel odor) (FILL)	
15		S-5	14.0-16.0	24	9	3	5	23	21		S-5: Wet, silty clay, some gravel and fine sand (pieces of rock in tip of spoon) (fuel odor) (FILL)	
20		S-6	19.0-21.0	24	7	2	2	4	10		S-6: Wet, gray, clayey silt/organic silt (fuel odor)	
25		S-7	24.0-26.0	24	24	4	5	6	8		S-7: Wet, gray, silty clay (blocky, desiccated)	(1)
30		S-8	29.0-31.0	24	16	5	5	13	16		S-8: Wet, gray, silty clay, little fine to coarse sand, trace subangular gravel	

Driller: S. Hollabaugh
Helper: B. Carger
Inspector: T. Young

COHESIVE CONSISTENCY (Blows/Foot)	COHESIONLESS (Blows/Foot)	PROPORTIONS USED
0-2 VERY SOFT	0-4 VERY LOOSE	TRACE: 0-10%
2-4 SOFT	4-10 LOOSE	LITTLE: 10-20%
4-8 MEDIUM STIFF	10-30 MEDIUM DENSE	SOME: 20-35%
8-15 STIFF	30-50 DENSE	AND: 35-50%
15-30 HARD	50+ VERY DENSE	

NOTES: (1) Change in drilling at approximately 26'. The drilling felt gravelly.

REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL. WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

TEST BORING LOG

MILLER ENGINEERING & TESTING, INC.
100 Sheffield Road - Manchester, NH 03103
Ph. (603) 668-6016 - Fax: (603) 668-8641

Project:	Hotel Somerbridge	**Sheet**	2 **of** 2
	Somerville, MA	**Boring No:**	B-5
Project No.:	15.152.NH	**Location:**	See Plan
Date Start:	07-08-15		
Date End:	07-08-15	**Approx. Surface Elev:**	

	CASING	SAMPLER	GROUNDWATER OBSERVATIONS			
			Date	**Depth**	**Casing At**	**Stabilization Period**
Type	HSA	SS	07-08-15	11'	44'	Upon Completion
Size	2-1/4" ID	1-3/8" ID				
Hammer		140 lbs.				
Fall		30"				

Depth/ Elev.	Cas bl/ft	SAMPLE Sample No.	Depth Range	Pen.	Rec.	BLOWS 0-6"	6-12"	12-18"	18-24"	Strata Change	Sample Description	Notes
35		S-9	34.0-36.0	24	9	10	12	16	13		S-9: Gray, silty clay, little angular gravel and fine to coarse sand	
40		S-10	39.0-41.0	24	9	9	10	12	14		S-10: Gray, silty clay, some angular gravel and fine to coarse sand	
45		S-11	44.0-46.0	24	12	14	16	30	34		S-11: Gray, weathered rock	
											BORING TERMINATED AT 46 ft	
50												
55												
60												

Driller: S. Hollabaugh
Helper: B. Carger
Inspector: T. Young

COHESIVE CONSISTENCY (Blows/Foot)
0-2 VERY SOFT
2-4 SOFT
4-8 MEDIUM STIFF
8-15 STIFF
15-30 HARD

COHESIONLESS (Blows/Foot)
0-4 VERY LOOSE
4-10 LOOSE
10-30 MEDIUM DENSE
30-50 DENSE
50+ VERY DENSE

PROPORTIONS USED
TRACE: 0-10%
LITTLE: 10-20%
SOME: 20-35%
AND: 35-50%

NOTES: (1) Change in drilling at approximately 26'. The drilling felt gravelly.

REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL.
WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS.
FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

TEST BORING LOG

MILLER ENGINEERING & TESTING, INC.
100 Sheffield Road - Manchester, NH 03103
Ph. (603) 668-6016 - Fax: (603) 668-8641

Project:	Hotel Somerbridge Somerville, MA	**Sheet**	1 **of** 2
Project No:	15.152.NH	**Boring No:**	B-6
Date Start:	07-08-15	**Location:**	See Plan
Date End:	07-08-15	**Approx. Surface Elev:**	

			GROUNDWATER OBSERVATIONS			
	CASING	**SAMPLER**	**Date**	**Depth**	**Casing At**	**Stabilization Period**
Type	HSA	SS	07-08-15	14'	44'	Upon Completion
Size	2-1/4" ID	1-3/8" ID				
Hammer		140 lbs.				
Fall		30"				

Depth/ Elev.	Cas bl/ft	SAMPLE Sample No.	SAMPLE Depth Range	SAMPLE Pen.	SAMPLE Rec.	BLOWS 0-6"	BLOWS 6-12"	BLOWS 12-18"	BLOWS 18-24"	Strata Change	Sample Description	Notes
0		-	0.0-0.2	2.75							-: 2.75' Asphalt	
		S-1	0.5-1.0	6	4	4					S-1: Dark brown, fine to coarse sand, some silt, little gravel (pieces of brick in sample) (construction debris) (FILL)	
		S-1A	1.0-2.5	18	9		5	2	4		S-1A: Black/gray, fine to medium sand, some silt, little gravel (FILL)	
		S-2	2.5-4.0	18	9	7	3	7			S-2: Black/gray, fine to medium sand, some silt, little gravel (FILL)	
		S-2A	4.0-4.5	6	4	10	8	4	10		S-2A: Silty clay, little fine to medium sand (FILL)	
5		S-3	4.5-6.5	24	6				5		S-3: Silty clay, little fine to medium sand (FILL)	
10		S-4	9.0-11.0	24	20	2	2	1	1		S-4: Orange to dark brown, fine to medium sand, little silt, trace gravel (FILL)	
15		S-5	14.0-16.0	24	7	34	25	24	12		S-5: Black, fine sand and clayey silt, little gravel (organic matter)	(1)
20		S-6	19.0-21.0	24	15	2	5	21	19		S-6: Dark brown, clayey silt (shells, organic matter)	(2)
25		S-7	24.0-24.8	10	10	9	50/4"				S-7: Gray, silty clay, little fine to coarse sand (desiccated)	(3)
30		S-8	29.0-31.0	24	19	7	8	10	11		S-8: Gray, silty clay (desiccated)	

Driller: S. Hollabaugh
Helper: B. Carger
Inspector: T. Young

COHESIVE CONSISTENCY (Blows/Foot)	COHESIONLESS (Blows/Foot)	PROPORTIONS USED
0-2 VERY SOFT	0-4 VERY LOOSE	TRACE: 0-10%
2-4 SOFT	4-10 LOOSE	LITTLE: 10-20%
4-8 MEDIUM STIFF	10-30 MEDIUM DENSE	SOME: 20-35%
8-15 STIFF	30-50 DENSE	AND: 35-50%
15-30 HARD	50+ VERY DENSE	

NOTES:
(1) The spoon was possibly advanced through a large piece of gravel.
(2) There was a large piece of gravel at the bottom of the spoon.
(3) There was a large piece of gravel at the bottom of the spoon.

REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL.
WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS.
FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

TEST BORING LOG

MILLER ENGINEERING & TESTING, INC.
100 Sheffield Road - Manchester, NH 03103
Ph. (603) 668-6016 - Fax: (603) 668-8641

Project:	Hotel Somerbridge Somerville, MA	**Sheet**	2 **of** 2
Project No.:	15.152.NH	**Boring No:**	B-6
Date Start:	07-08-15	**Location:**	See Plan
Date End:	07-08-15	**Approx. Surface Elev:**	

	CASING	SAMPLER	GROUNDWATER OBSERVATIONS Date	Depth	Casing At	Stabilization Period
Type	HSA	SS	07-08-15	14'	44'	Upon Completion
Size	2-1/4" ID	1-3/8" ID				
Hammer		140 lbs.				
Fall		30"				

Depth/ Elev.	Cas bl/ft	SAMPLE Sample No.	Depth Range	Pen.	Rec.	BLOWS 0-6"	6-12"	12-18"	18-24"	Strata Change	Sample Description	Notes
35		S-9	34.0-36.0	24	14	43	39	45	42		S-9: Wet, gray, fine to medium sand and silt, some gravel	
40		S-10	39.0-39.9	11	11	21	50/5"				S-10: Wet, gray, fine to medium sand and silt, some gravel	
45		S-11	44.0-46.0	24	9	10	13	20	25		S-11: Gray, clayey silt, some gravel	
											BORING TERMINATED AT 46 ft	
50												
55												
60												

Driller: S. Hollabaugh
Helper: B. Carger
Inspector: T. Young

COHESIVE CONSISTENCY (Blows/Foot)
0-2 VERY SOFT
2-4 SOFT
4-8 MEDIUM STIFF
8-15 STIFF
15-30 HARD

COHESIONLESS (Blows/Foot)
0-4 VERY LOOSE
4-10 LOOSE
10-30 MEDIUM DENSE
30-50 DENSE
50+ VERY DENSE

PROPORTIONS USED
TRACE: 0-10%
LITTLE: 10-20%
SOME: 20-35%
AND: 35-50%

NOTES:
(1) The spoon was possibly advanced through a large piece of gravel.
(2) There was a large piece of gravel at the bottom of the spoon.
(3) There was a large piece of gravel at the bottom of the spoon.

REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL.
WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS.
FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

TEST BORING LOG

MILLER ENGINEERING & TESTING, INC.
100 Sheffield Road - Manchester, NH 03103
Ph. (603) 668-6016 - Fax: (603) 668-8641

Project:	Hotel Somerbridge	Sheet	1 of 2
	Somerville, MA	Boring No:	B-7
Project No:	15.152.NH	Location:	See Plan
Date Start:	07-08-15		
Date End:	07-09-15	Approx. Surface Elev:	

	CASING	SAMPLER	GROUNDWATER OBSERVATIONS Date	Depth	Casing At	Stabilization Period
Type	HSA	SS	07-09-15	14'	49'	Upon Completion
Size	2-1/4" ID	1-3/8" ID				
Hammer		140 lbs.				
Fall		30"				

Depth/ Elev.	Cas bl/ft	SAMPLE Sample No.	Depth Range	Pen.	Rec.	BLOWS 0-6"	6-12"	12-18"	18-24"	Strata Change	Sample Description	Notes
0		-	0.0-0.2	2.25	4	13					-: 2.25' Asphalt	
		S-1	0.5-1.0	6	13		8	4	4		S-1: Brown, fine to coarse sand, little silt and gravel (FILL)	
		S-1A	1.0-2.5	18							S-1A: Dark brown, fine to coarse sand, some silt, little gravel (FILL)	
		S-2	2.5-3.5	12	8	4	3				S-2: Dark brown, fine to coarse sand, some silt, little gravel (FILL)	
		S-2A	3.5-4.5	12	6			3	3		S-2A: Gray, fine to medium sand and clayey silt, little gravel (FILL)	
5		S-3	4.5-6.5	24	16	2	1	2	3		S-3: Gray, fine to medium sand and clayey silt, little gravel (FILL)	
10		S-4	9.0-11.0	24	13	5	4	6	9		S-4: Gray, fine to medium sand and clayey silt, little gravel (FILL)	
15		S-5	14.0-16.0	24	6	4	3	3	3		S-5: Gray, silty clay, some fine to medium sand, trace gravel (FILL)	
20		S-6	19.0-21.0	24	6	8	11	8	12		S-6: Gray, clay, little fine to medium sand and gravel	
25		S-7	24.0-26.0	24	14	7	11	15	13		S-7: Gray, fine sand and silty clay, little gravel	
30		S-8	29.0-31.0	24	17	14	12	15	16		S-8: Gray, fine to medium sand and clayey silt, little gravel	

Driller: S. Hollabaugh
Helper: B. Carger
Inspector: T. Young

COHESIVE CONSISTENCY (Blows/Foot)	COHESIONLESS (Blows/Foot)	PROPORTIONS USED
0-2 VERY SOFT	0-4 VERY LOOSE	TRACE: 0-10%
2-4 SOFT	4-10 LOOSE	LITTLE: 10-20%
4-8 MEDIUM STIFF	10-30 MEDIUM DENSE	SOME: 20-35%
8-15 STIFF	30-50 DENSE	AND: 35-50%
15-30 HARD	50+ VERY DENSE	

NOTES: (1) Change in drilling at approximately 33'. Drilling felt tighter

REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL. WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

TEST BORING LOG

MILLER ENGINEERING & TESTING, INC.
100 Sheffield Road - Manchester, NH 03103
Ph. (603) 668-6016 - Fax: (603) 668-8641

Project: Hotel Somerbridge, Somerville, MA
Project No.: 15.152.NH
Date Start: 07-08-15
Date End: 07-09-15

Sheet 2 **of** 2
Boring No: B-7
Location: See Plan
Approx. Surface Elev:

	CASING	SAMPLER	GROUNDWATER OBSERVATIONS Date	Depth	Casing At	Stabilization Period
Type	HSA	SS	07-09-15	14'	49'	Upon Completion
Size	2-1/4" ID	1-3/8" ID				
Hammer		140 lbs.				
Fall		30"				

Depth/ Elev.	Cas bl/ft	SAMPLE Sample No.	Depth Range	Pen.	Rec.	BLOWS 0-6"	6-12"	12-18"	18-24"	Strata Change	Sample Description	Notes
35		S-9	34.0-36.0	24	18	8	11	12	13		S-9: Gray, fine sand and clayey silt, little gravel	(1)
40		S-10	39.0-41.0	24	12	7	9	13	14		S-10: Gray, silt, little fine to medium sand, trace angular gravel	
45		S-11	44.0-46.0	24	6	15	13	15	16		S-11: Gray, silt, little fine to medium sand, trace angular gravel	
50		S-12	49.0-49.1	1	1	50/1"					S-12: Gray, silt, little fine to medium sand, trace angular gravel BORING TERMINATED AT 49.1 ft	
55												
60												

Driller: S. Hollabaugh
Helper: B. Carger
Inspector: T. Young

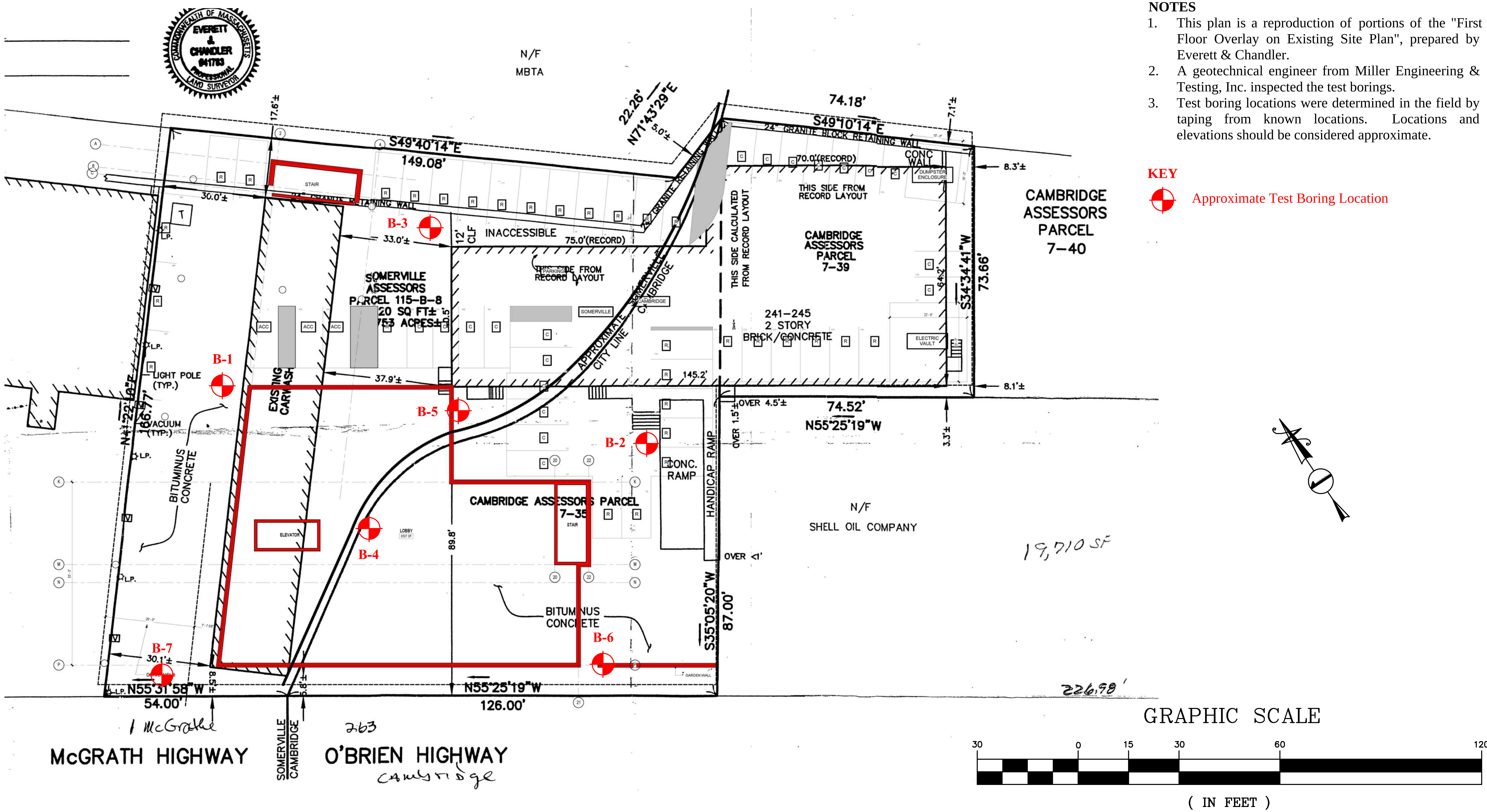
COHESIVE CONSISTENCY (Blows/Foot)
0-2 VERY SOFT
2-4 SOFT
4-8 MEDIUM STIFF
8-15 STIFF
15-30 HARD

COHESIONLESS (Blows/Foot)
0-4 VERY LOOSE
4-10 LOOSE
10-30 MEDIUM DENSE
30-50 DENSE
50+ VERY DENSE

PROPORTIONS USED
TRACE: 0-10%
LITTLE: 10-20%
SOME: 20-35%
AND: 35-50%

NOTES: (1) Change in drilling at approximately 33'. Drilling felt tighter

REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL. WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.



NOTES

1. This plan is a reproduction of portions of the "First Floor Overlay on Existing Site Plan", prepared by Everett & Chandler.
2. A geotechnical engineer from Miller Engineering & Testing, Inc. inspected the test borings.
3. Test boring locations were determined in the field by taping from known locations. Locations and elevations should be considered approximate.

KEY

Approximate Test Boring Location

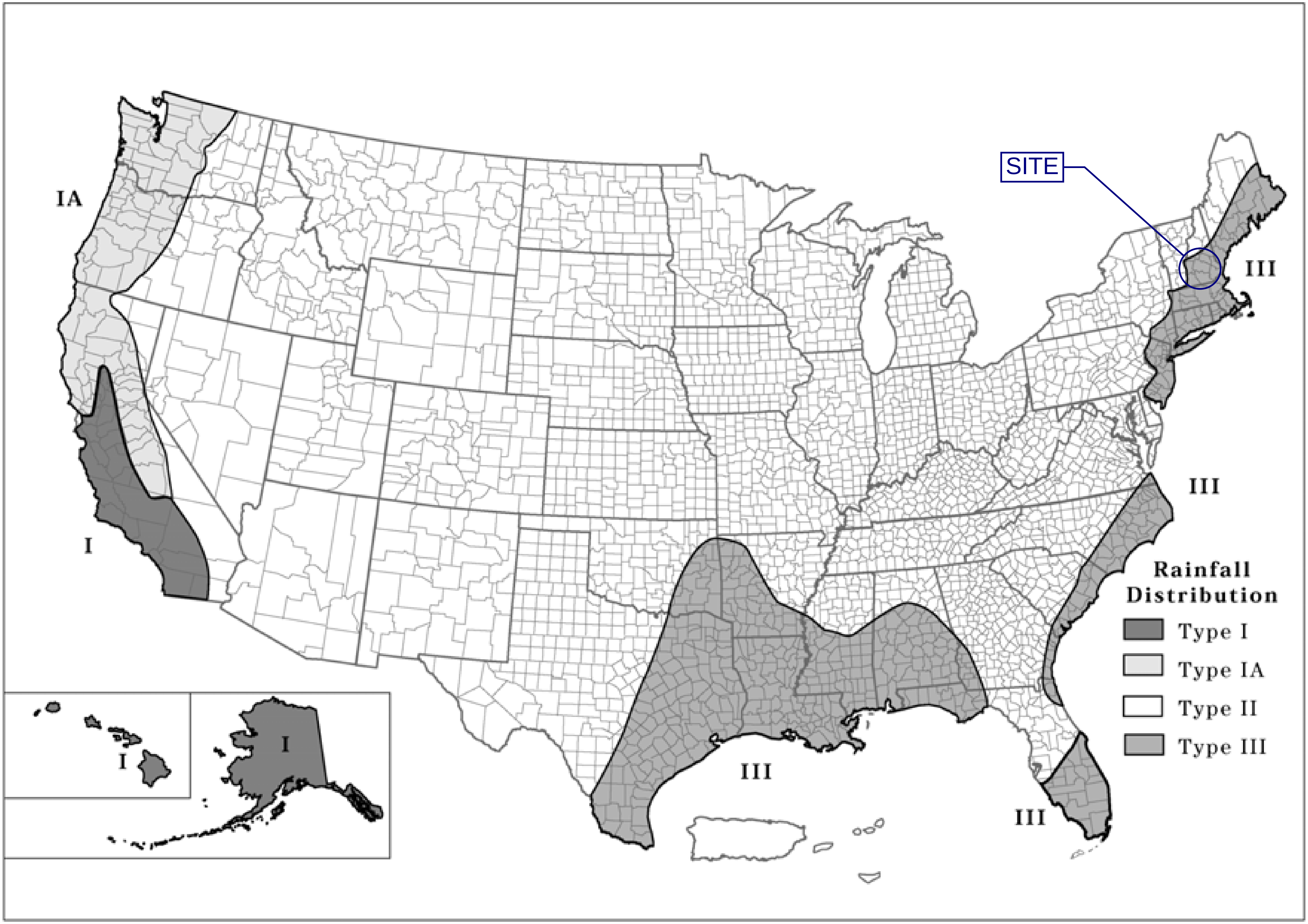
MILLER ENGINEERING & TESTING, INC.

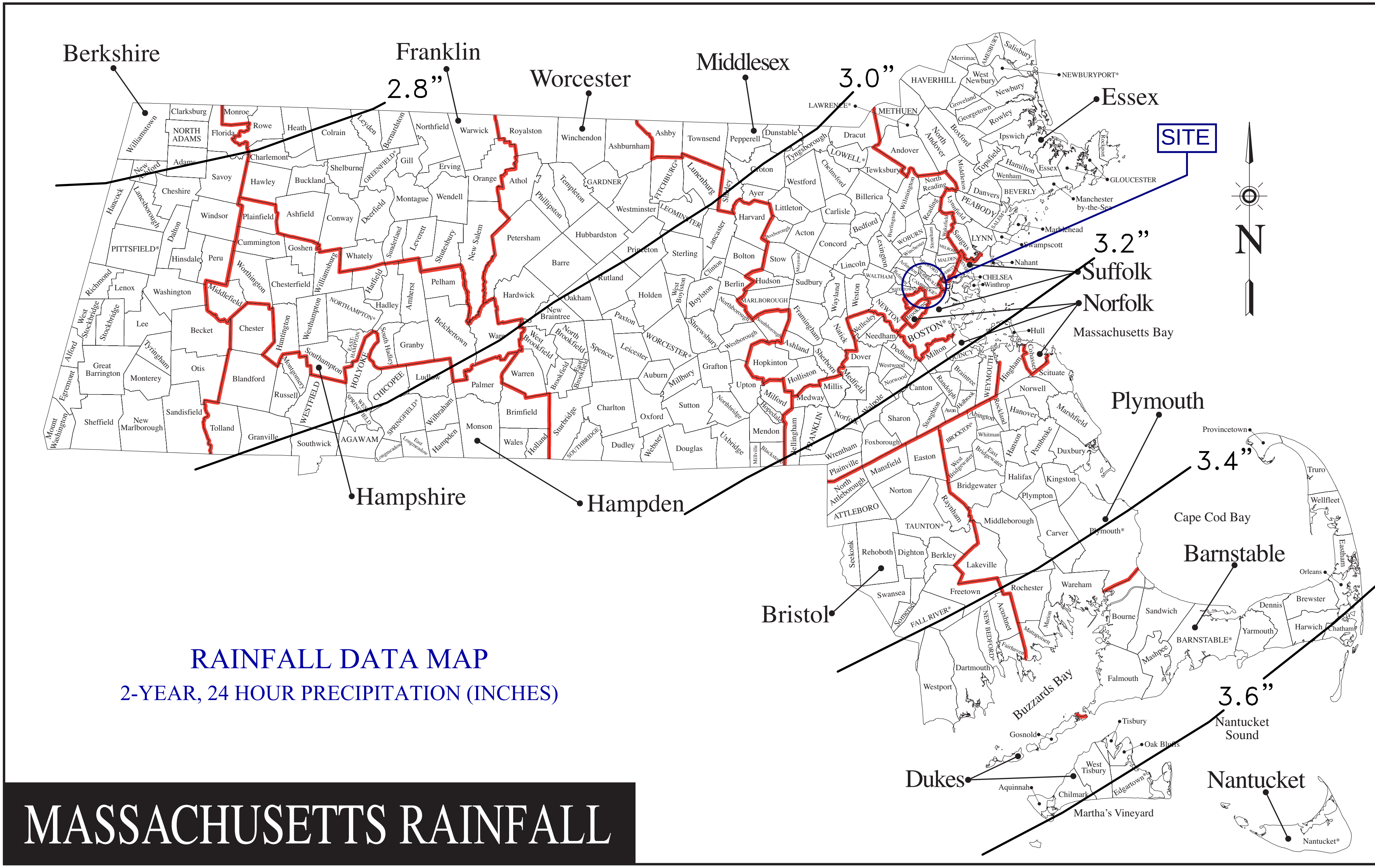
100 SHEFFIELD ROAD - PO BOX 4776
MANCHESTER, NEW HAMPSHIRE 03108
TEL (603) 668-6016 // FAX (603) 668-8641

Hotel Somerbridge
Somerville, MA
July 2015
Project No. 15.152.NH

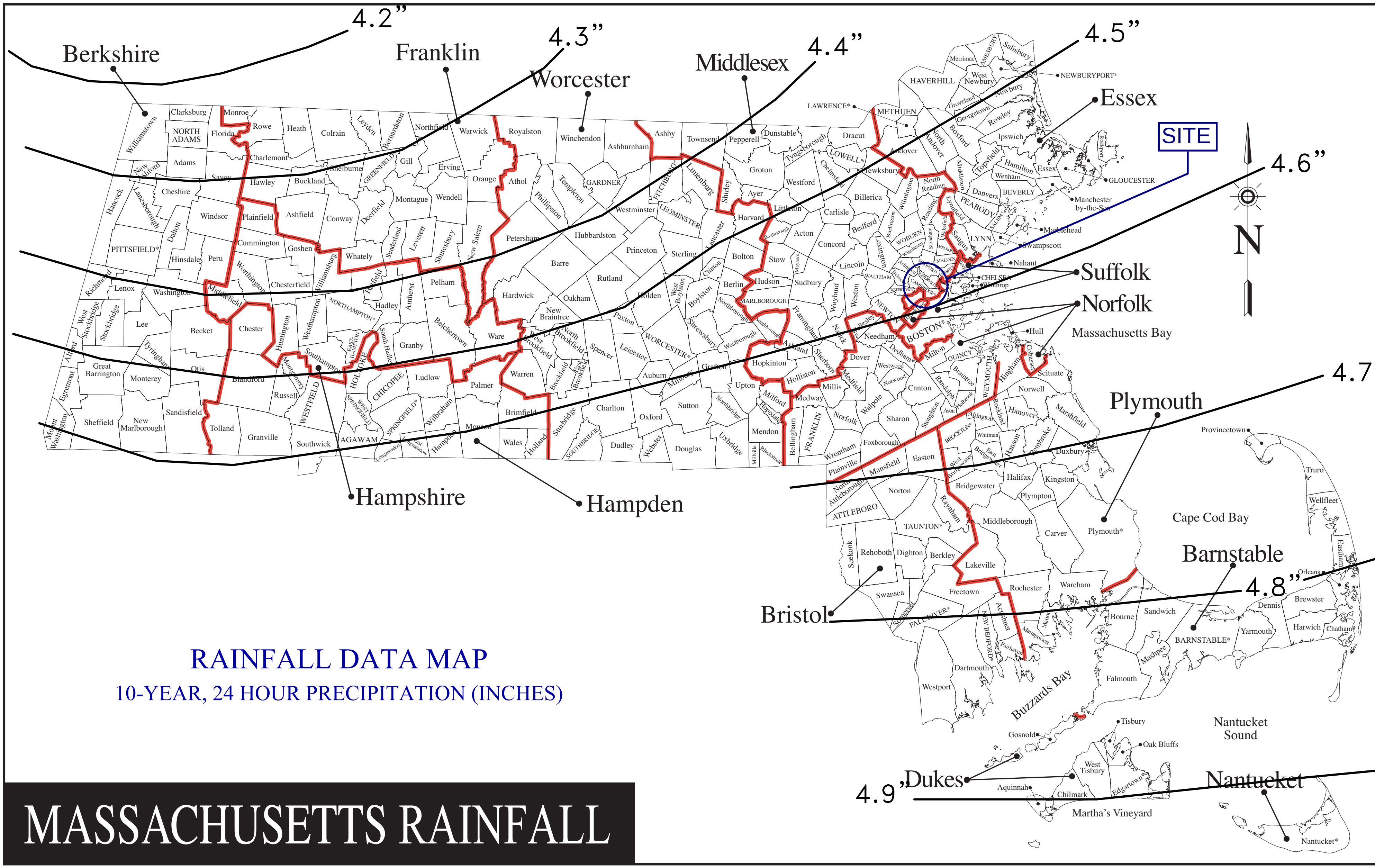
SUBSURFACE EXPLORATION LOCATION PLAN

FIGURE No. 1


SITE
IA
I
III
III
III
III
III
I
I
Rainfall Distribution
Type I
Type IA
Type II
Type III



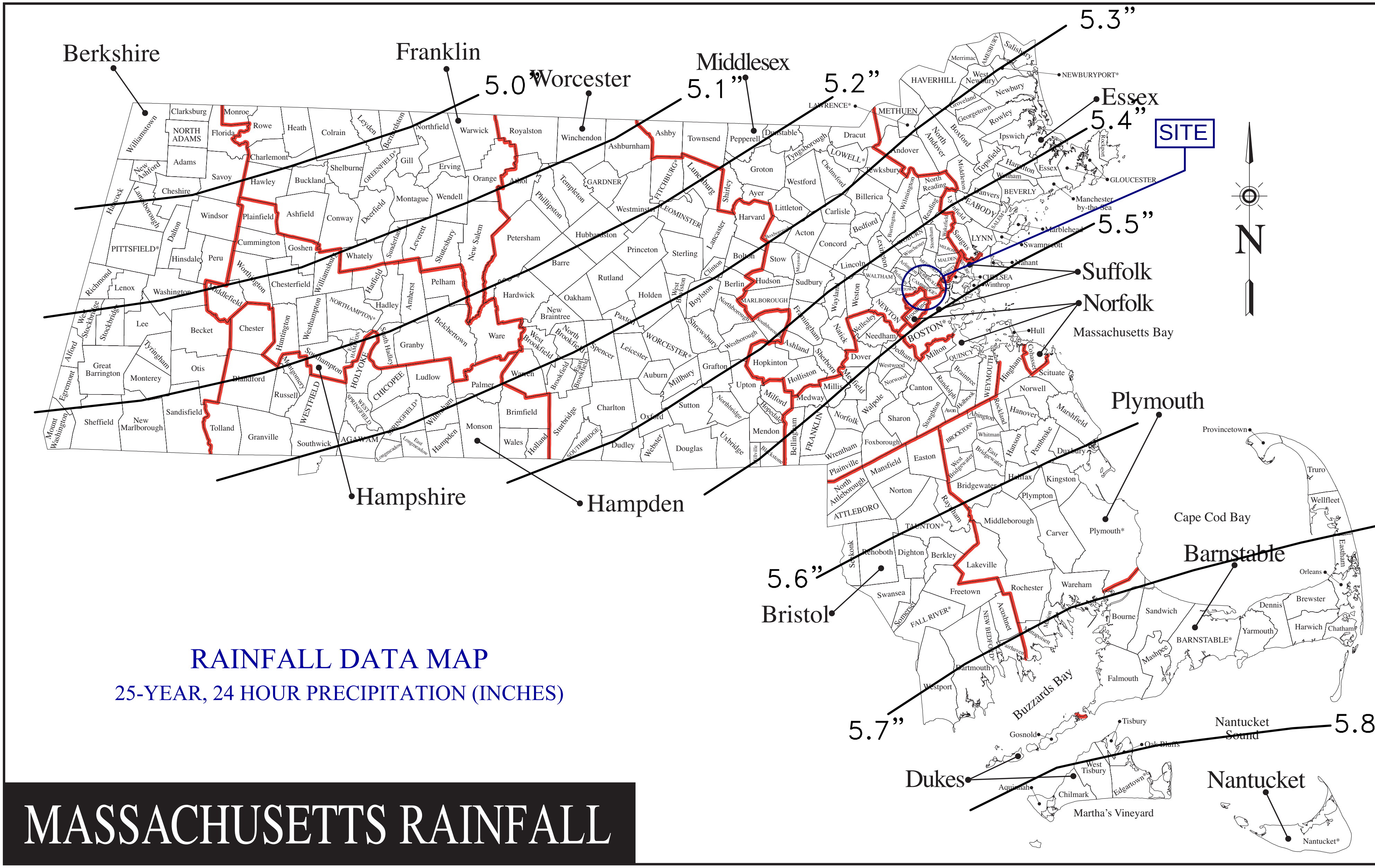
Berkshire
Franklin
Worcester
Middlesex
Essex
Suffolk
Norfolk
Plymouth
Bristol
Barnstable
Dukes
Nantucket
Hampshire
Hampden
2.8"
3.0"
3.2"
3.4"
3.6"
SITE
N
Massachusetts Bay
Cape Cod Bay
Buzzards Bay
Nantucket Sound
Martha's Vineyard
RAINFALL DATA MAP
2-YEAR, 24 HOUR PRECIPITATION (INCHES)
MASSACHUSETTS RAINFALL

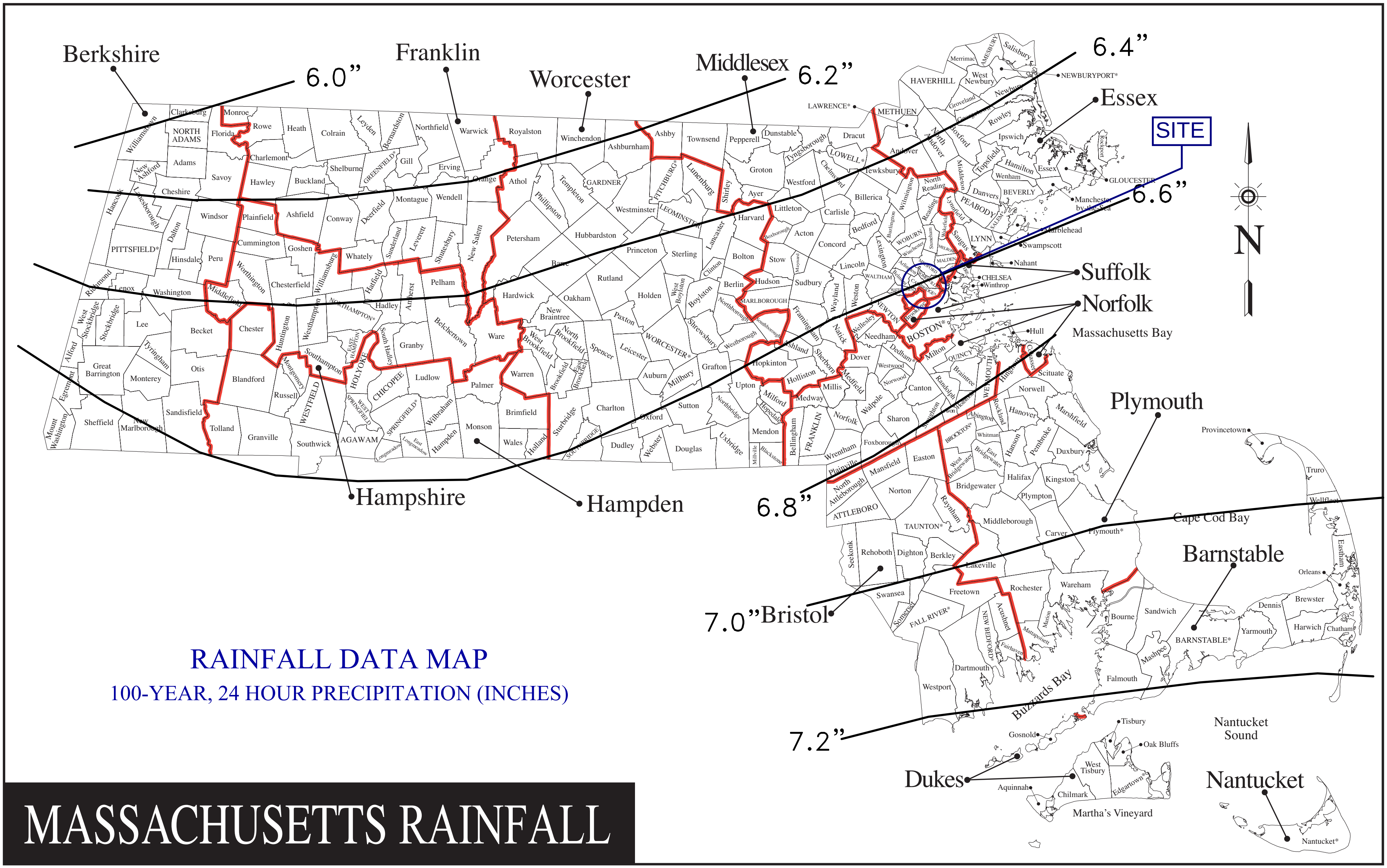

MASSACHUSETTS RAINFALL
RAINFALL DATA MAP
10-YEAR, 24 HOUR PRECIPITATION (INCHES)
SITE
N
4.2”
4.3”
4.4”
4.5”
4.6”
4.7”
4.8”
4.9”
Berkshire
Franklin
Worcester
Middlesex
Essex
Suffolk
Norfolk
Plymouth
Barnstable
Bristol
Dukes
Nantucket
Hampshire
Hampden
Massachusetts Bay
Cape Cod Bay
Buzzards Bay
Nantucket Sound
Martha’s Vineyard

MASSACHUSETTS RAINFALL

RAINFALL DATA MAP

25-YEAR, 24 HOUR PRECIPITATION (INCHES)





Berkshire
Franklin
Worcester
Middlesex
Essex
Suffolk
Norfolk
Plymouth
Barnstable
Bristol
Dukes
Nantucket
Hampshire
Hampden
6.0"
6.2"
6.4"
6.6"
6.8"
7.0"
7.2"
SITE
N
Massachusetts Bay
Cape Cod Bay
Buzzards Bay
Nantucket Sound
Martha's Vineyard
RAINFALL DATA MAP
100-YEAR, 24 HOUR PRECIPITATION (INCHES)
MASSACHUSETTS RAINFALL

Illicit Discharge Compliance Statement

Responsibility:

The Owner is responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy, the USEPA NPDES Construction General Permit and responsible for identifying and eliminating illicit discharges (as defined by the USEPA).

OWNER NAME: Somerbridge Hotel LLC c/o Jal Hospitality Design, LLC

ADDRESS: 227 Marginal Street
Chelsea, MA 02150

TEL. NUMBER: (603) 518-7250

Engineer's Compliance Statement:

To the best of my knowledge, the attached plans, computations and specifications meet the requirements of Standard 10 of the Massachusetts Stormwater Handbook regarding illicit discharges to the stormwater management system and that no detectable illicit discharges exist on the site. All documents and attachments were prepared under my direction and qualified personnel properly gathered and evaluated the information submitted, to the best of my knowledge.

Included with this statement are site plans, drawn to scale, that identify the location of systems for conveying stormwater on the site and show that these systems do not allow the entry of any illicit discharges into the stormwater management system. The plans also show any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater systems.

For a redevelopment project (if applicable), all actions taken to identify and remove illicit discharges, including without limitation, visual screening, dye or smoke testing, and the removal of any sources of illicit discharges to the stormwater management system are documented and included with this statement.

ALLEN & MAJOR ASSOCIATES, INC.

Project No.	1362-16	**Sheet**	1 of 2
Project Description	Staybridge Hotel		
	Somerville & Cambridge, MA		
Calculated By	SM	**Date**	3/12/2019
Checked By	MM	**Date**	3/12/2019

ESTIMATION FOR PHOSPHORUS REMOVAL

1. Calculate Site Impervious Cover

Total Watershed: 32,806 sf

Pre-Development:

Percent Impervious: 93.57%

Total Impervious = 30,697 sf

Post-Development:

Percent Impervious: 91.48%

Total Impervious = 30,011 sf

2. Pre-Development Phosphorus Loading

Pre-Development Phosphorus Loading, L_{pre} = (P) (R_v) (C) (A) (0.20)

Where:

L_{pre} = Average annual load of total phosphorus exported from the site prior to development (lbs/year)

P = Rainfall depth over the desired time interval (inches) = 39

R_v = Runoff coefficient, which expresses the fraction of rainfall which is converted into runoff = 0.05 + 0.009(I_{pre}) = 0.8921

I_{pre} = Pre-development (existing) site imperviousness (i.e., I = 75 if site is 75% impervious) = 93.57

C = Flow-weighted mean concentration of the pollutant (total phosphorus) in urban runoff (mg/l) = 0.3 mg/l

A = Area of the development site (acres) = 0.75312 acr

*0.20 is a regional constant and unit conversion factor

L_{pre} = 39 * 0.892 * 0.3 * 0.753 * 0.2 = 1.58 lbs/year

3. Post-Development Phosphorus Loading

Post-Development Phosphorus Loading, L_{post} = (P) (R_v) (C) (A) (0.20)

Where:

L_{post} = Average annual load of total phosphorus exported from the site after development (lbs/year)

P = Rainfall depth over the desired time interval (inches) = 39

R_v = Runoff coefficient, which expresses the fraction of rainfall which is converted into runoff = 0.05 + 0.009(I_{pre}) = 0.8733

I_{post} = Post-development (existing) site imperviousness (i.e., I = 75 if site is 75% impervious) = 91.48

C = Flow-weighted mean concentration of the pollutant (total phosphorus) in urban runoff (mg/l) = 0.3 mg/l

A = Area of the development site (acres) = 0.75312 acr

*0.20 is a regional constant and unit conversion factor

L_{post} = 39 * 0.873 * 0.3 * 0.753 * 0.2 = 1.55 lbs/year

4. Calculate the Pollutant Removal Requirement

RR = L_{post} - 0.65(L_{pre})

Where:

RR*= Pollutant removal requirement (lbs/year)

L_{post} = Average annual load of total phosphorus exported from the post-development site (lbs/year)

L_{pre} = Average annual load of total phosphorus exported from the site prior to development (lbs/year)

*0.65 is suggested post-development phosphorus load reduction

RR= 1.55 - (0.65 * 1.58) = 0.52 lbs/year

5. Identify Feasible BMPs

$LR = (L_{post}) (BMP_{RE})$ (% DA Served)   To Infiltration System = 29,364 sf

Total = 29,364 sf

Where:

LR = Annual total phosphorus load removed by the proposed BMP (lbs/year)

L_{post} = Average annual load of total phosphorus exported from the post-development site prior to development (lbs/year)

BMP_{RE} = BMP removal efficiency for total phosphorus, Table 8 (%) = 40% *(per MADEP Structural BMPs - Volume 2 - Chapter 2)*

% DA Served = Fraction of the drainage area served by the BMP (% = 98%

LR = 1.55 * 40% * 98% = 0.61 lbs/year

6. Determine if Annual total phosphorus load removed is greater that Pollutant removal requirement

LR > RR

0.61 lbs/yr > 0.52 lbs/yr ≈ 116.5%   Therefore phosphorus removal criteria is met

Project: Somerbridge Hotel
Location: Somerville, MA
Prepared For: Allen & Major

CONTECH ENGINEERED SOLUTIONS

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1" of runoff from the contributing impervious surface.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Procedure: Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

Compute Q Rate using the following equation:

Q = (qu) (A) (WQV)

where:

Q = flow rate associated with first 1" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1" in this case)

Structure Name	Impv. (acres)	A (miles^2)	t_c (min)	t_c (hr)	WQV (in)	qu (csm/in.)	Q (cfs)
CB1	0.15	0.0002415	5.0	0.083	1.00	795.00	0.19
CB2	0.15	0.0002397	5.0	0.083	1.00	795.00	0.19
CB3	0.02	0.0000246	5.0	0.083	1.00	795.00	0.02

CONTECH ENGINEERED SOLUTIONS

VORTSENTRY® HS ESTIMATED NET ANNUAL TSS REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

SOMERBRIDGE HOTEL
SOMERVILLE, MA

Area	0.15 ac	Unit Site Deignation	CB1
Weighted C	0.9	Rainfall Station #	69
t_c	5 min	Design Ratio[1]	**0.0050**
VSHS Model	HS36	VSHS Treatment Capacity	**0.55 cfs**

Rainfall Intensity[1] (in/hr)	Flow Rate (cfs)	Operating Rate[2] cfs/ft[3]	% Total Rainfall	Rel. Effcy (%)
0.02	0.00	0.00010	10.2%	10.0%
0.04	0.01	0.00021	9.6%	9.5%
0.06	0.01	0.00031	9.4%	9.3%
0.08	0.01	0.00042	7.7%	7.6%
0.10	0.01	0.00052	8.6%	8.4%
0.12	0.02	0.00063	6.3%	6.2%
0.14	0.02	0.00073	4.7%	4.6%
0.16	0.02	0.00084	4.6%	4.5%
0.18	0.03	0.00094	3.5%	3.5%
0.20	0.03	0.00105	4.3%	4.3%
0.25	0.03	0.00131	8.0%	7.8%
0.30	0.04	0.00157	5.6%	5.5%
0.35	0.05	0.00184	4.4%	4.3%
0.40	0.06	0.00210	2.5%	2.5%
0.45	0.06	0.00236	2.5%	2.5%
0.50	0.07	0.00262	1.4%	1.4%
0.75	0.10	0.00394	5.0%	4.9%
1.00	0.14	0.00525	1.0%	1.0%
1.50	0.21	0.00787	0.0%	0.0%
2.00	0.28	0.01049	0.0%	0.0%
3.00	0.42	0.01574	0.5%	0.4%
				98.0%
			% rain falling at >3"/hr =	0.0%
			Removal Efficiency Adjustment[4] =	6.5%
			Predicted Net Annual Load Removal Efficiency =	**91.5%**

1 - Design Ratio = (Total Drainage Area x Runoff Coefficient) / VortSentry HS Treatment Volume
= The Total Drainage Area and Runoff Coefficient are specified by the site engineer.
2 - Operating Rate (cfs/ft^3) = Rainfall Intensity ("/hr) x Design Ratio
3 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
4 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

VORTSENTRY® HS ESTIMATED NET ANNUAL TSS REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

SOMERBRIDGE HOTEL
SOMERVILLE, MA

Area	0.15 ac	Unit Site Deignation	CB2
Weighted C	0.9	Rainfall Station #	69
t_c	5 min	Design Ratio[1]	0.0050
VSHS Model	HS36	VSHS Treatment Capacity	0.55 cfs

Rainfall Intensity[1] (in/hr)	Flow Rate (cfs)	Operating Rate[2] cfs/ft^3	% Total Rainfall	Rel. Effcy (%)
0.02	0.00	0.00010	10.2%	10.0%
0.04	0.01	0.00021	9.6%	9.5%
0.06	0.01	0.00031	9.4%	9.3%
0.08	0.01	0.00042	7.7%	7.6%
0.10	0.01	0.00052	8.6%	8.4%
0.12	0.02	0.00063	6.3%	6.2%
0.14	0.02	0.00073	4.7%	4.6%
0.16	0.02	0.00083	4.6%	4.5%
0.18	0.02	0.00094	3.5%	3.5%
0.20	0.03	0.00104	4.3%	4.3%
0.25	0.03	0.00130	8.0%	7.8%
0.30	0.04	0.00156	5.6%	5.5%
0.35	0.05	0.00182	4.4%	4.3%
0.40	0.06	0.00208	2.5%	2.5%
0.45	0.06	0.00234	2.5%	2.5%
0.50	0.07	0.00260	1.4%	1.4%
0.75	0.10	0.00391	5.0%	4.9%
1.00	0.14	0.00521	1.0%	1.0%
1.50	0.21	0.00781	0.0%	0.0%
2.00	0.28	0.01042	0.0%	0.0%
3.00	0.41	0.01563	0.5%	0.4%
				98.0%
			% rain falling at >3"/hr =	0.0%
			Removal Efficiency Adjustment[4] =	6.5%
			Predicted Net Annual Load Removal Efficiency =	**91.5%**

1 - Design Ratio = (Total Drainage Area x Runoff Coefficient) / VortSentry HS Treatment Volume
= The Total Drainage Area and Runoff Coefficient are specified by the site engineer.

2 - Operating Rate (cfs/ft^3) = Rainfall Intensity ("/hr) x Design Ratio

3 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA

4 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

VORTSENTRY® HS ESTIMATED NET ANNUAL TSS REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

SOMERBRIDGE HOTEL
SOMERVILLE, MA

Area	0.02 ac	Unit Site Deignation	CB3
Weighted C	0.9	Rainfall Station #	69
t_c	5 min	Design Ratio[1]	0.0010
VSHS Model	HS36	VSHS Treatment Capacity	0.55 cfs

Rainfall Intensity[1] (in/hr)	Flow Rate (cfs)	Operating Rate[2] cfs/ft[3]	% Total Rainfall	Rel. Effcy (%)
0.02	0.00	0.00001	10.2%	10.0%
0.04	0.00	0.00002	9.6%	9.5%
0.06	0.00	0.00003	9.4%	9.3%
0.08	0.00	0.00004	7.7%	7.6%
0.10	0.00	0.00005	8.6%	8.4%
0.12	0.00	0.00006	6.3%	6.2%
0.14	0.00	0.00007	4.7%	4.6%
0.16	0.00	0.00009	4.6%	4.5%
0.18	0.00	0.00010	3.5%	3.5%
0.20	0.00	0.00011	4.3%	4.3%
0.25	0.00	0.00013	8.0%	7.8%
0.30	0.00	0.00016	5.6%	5.5%
0.35	0.00	0.00019	4.4%	4.3%
0.40	0.01	0.00021	2.5%	2.5%
0.45	0.01	0.00024	2.5%	2.5%
0.50	0.01	0.00027	1.4%	1.4%
0.75	0.01	0.00040	5.0%	4.9%
1.00	0.01	0.00053	1.0%	1.0%
1.50	0.02	0.00080	0.0%	0.0%
2.00	0.03	0.00107	0.0%	0.0%
3.00	0.04	0.00160	0.5%	0.5%
				98.0%
			% rain falling at >3"/hr =	0.0%
			Removal Efficiency Adjustment[4] =	6.5%
			Predicted Net Annual Load Removal Efficiency =	**91.5%**

1 - Design Ratio = (Total Drainage Area x Runoff Coefficient) / VortSentry HS Treatment Volume
= The Total Drainage Area and Runoff Coefficient are specified by the site engineer.

2 - Operating Rate (cfs/ft^3) = Rainfall Intensity ("/hr) x Design Ratio

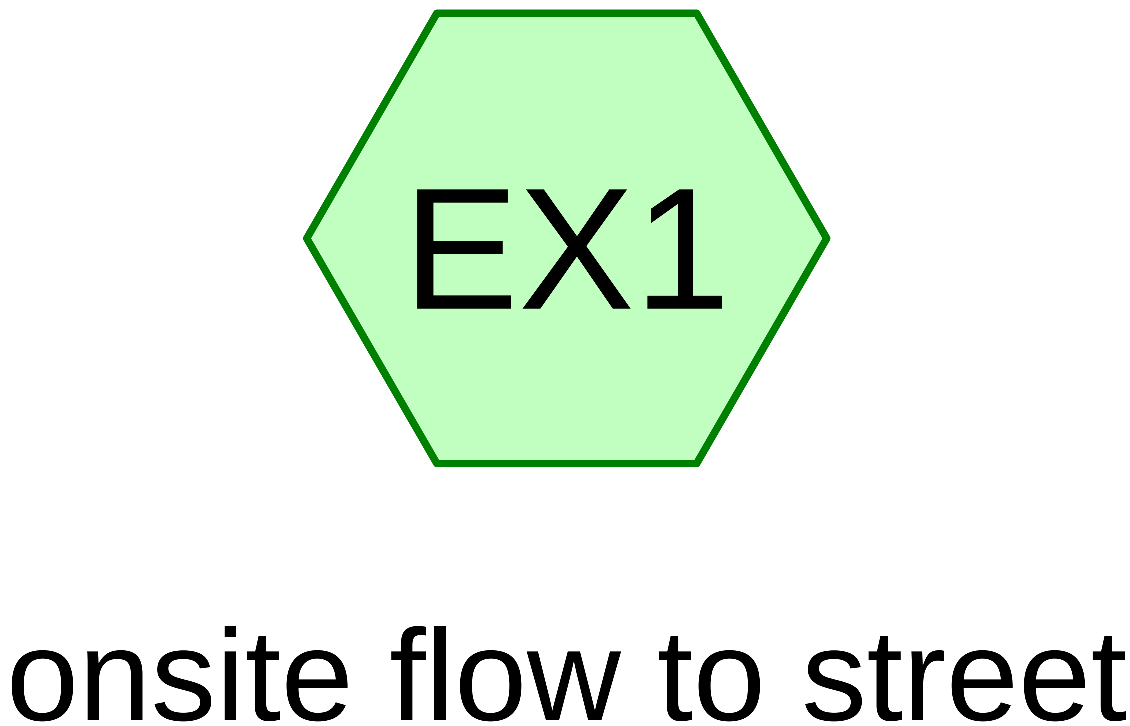
3 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA

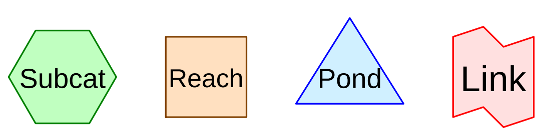
4 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

APPENDIX B

PRE-DEVELOPMENT DRAINAGE CALCULATIONS

TYPE III, 2, 10, 25 & 100YR STORM EVENT





Routing Diagram for Pre-Development
Prepared by Allen & Major, Printed 2/25/2016
HydroCAD® 10.00 s/n 02881 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
2,109	87	Dirt roads, HSG C (EX1)
30,697	98	Unconnected pavement, HSG C (EX1)
32,806	**97**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX1: onsite flow to street Runoff Area=32,806 sf 93.57% Impervious Runoff Depth=2.76"
Flow Length=215' Slope=0.0330 '/' Tc=5.0 min CN=97 Runoff=2.3 cfs 7,538 cf

Total Runoff Area = 32,806 sf Runoff Volume = 7,538 cf Average Runoff Depth = 2.76"
6.43% Pervious = 2,109 sf 93.57% Impervious = 30,697 sf

Summary for Subcatchment EX1: onsite flow to street

Runoff = 2.3 cfs @ 12.07 hrs, Volume= 7,538 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
2,109	87	Dirt roads, HSG C
30,697	98	Unconnected pavement, HSG C
32,806	97	Weighted Average
2,109		6.43% Pervious Area
30,697		93.57% Impervious Area
30,697		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	215	0.0330	1.92		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.08"
1.9	215	Total, Increased to minimum Tc = 5.0 min			

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentEX1: onsite flow to street Runoff Area=32,806 sf 93.57% Impervious Runoff Depth=4.15"
Flow Length=215' Slope=0.0330 '/' Tc=5.0 min CN=97 Runoff=3.4 cfs 11,343 cf

Total Runoff Area = 32,806 sf Runoff Volume = 11,343 cf Average Runoff Depth = 4.15"
6.43% Pervious = 2,109 sf 93.57% Impervious = 30,697 sf

Summary for Subcatchment EX1: onsite flow to street

Runoff = 3.4 cfs @ 12.07 hrs, Volume= 11,343 cf, Depth= 4.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,109	87	Dirt roads, HSG C
30,697	98	Unconnected pavement, HSG C
32,806	97	Weighted Average
2,109		6.43% Pervious Area
30,697		93.57% Impervious Area
30,697		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	215	0.0330	1.92		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.08"
1.9	215	Total, Increased to minimum Tc = 5.0 min			

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX1: onsite flow to street Runoff Area=32,806 sf 93.57% Impervious Runoff Depth=4.95"
Flow Length=215' Slope=0.0330 '/' Tc=5.0 min CN=97 Runoff=4.0 cfs 13,522 cf

Total Runoff Area = 32,806 sf Runoff Volume = 13,522 cf Average Runoff Depth = 4.95"
6.43% Pervious = 2,109 sf 93.57% Impervious = 30,697 sf

Summary for Subcatchment EX1: onsite flow to street

Runoff = 4.0 cfs @ 12.07 hrs, Volume= 13,522 cf, Depth= 4.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
2,109	87	Dirt roads, HSG C
30,697	98	Unconnected pavement, HSG C
32,806	97	Weighted Average
2,109		6.43% Pervious Area
30,697		93.57% Impervious Area
30,697		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	215	0.0330	1.92		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.08"
1.9	215	Total, Increased to minimum Tc = 5.0 min			

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX1: onsite flow to street Runoff Area=32,806 sf 93.57% Impervious Runoff Depth=6.14"
Flow Length=215' Slope=0.0330 '/' Tc=5.0 min CN=97 Runoff=5.0 cfs 16,794 cf

Total Runoff Area = 32,806 sf Runoff Volume = 16,794 cf Average Runoff Depth = 6.14"
6.43% Pervious = 2,109 sf 93.57% Impervious = 30,697 sf

Summary for Subcatchment EX1: onsite flow to street

Runoff = 5.0 cfs @ 12.07 hrs, Volume= 16,794 cf, Depth= 6.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

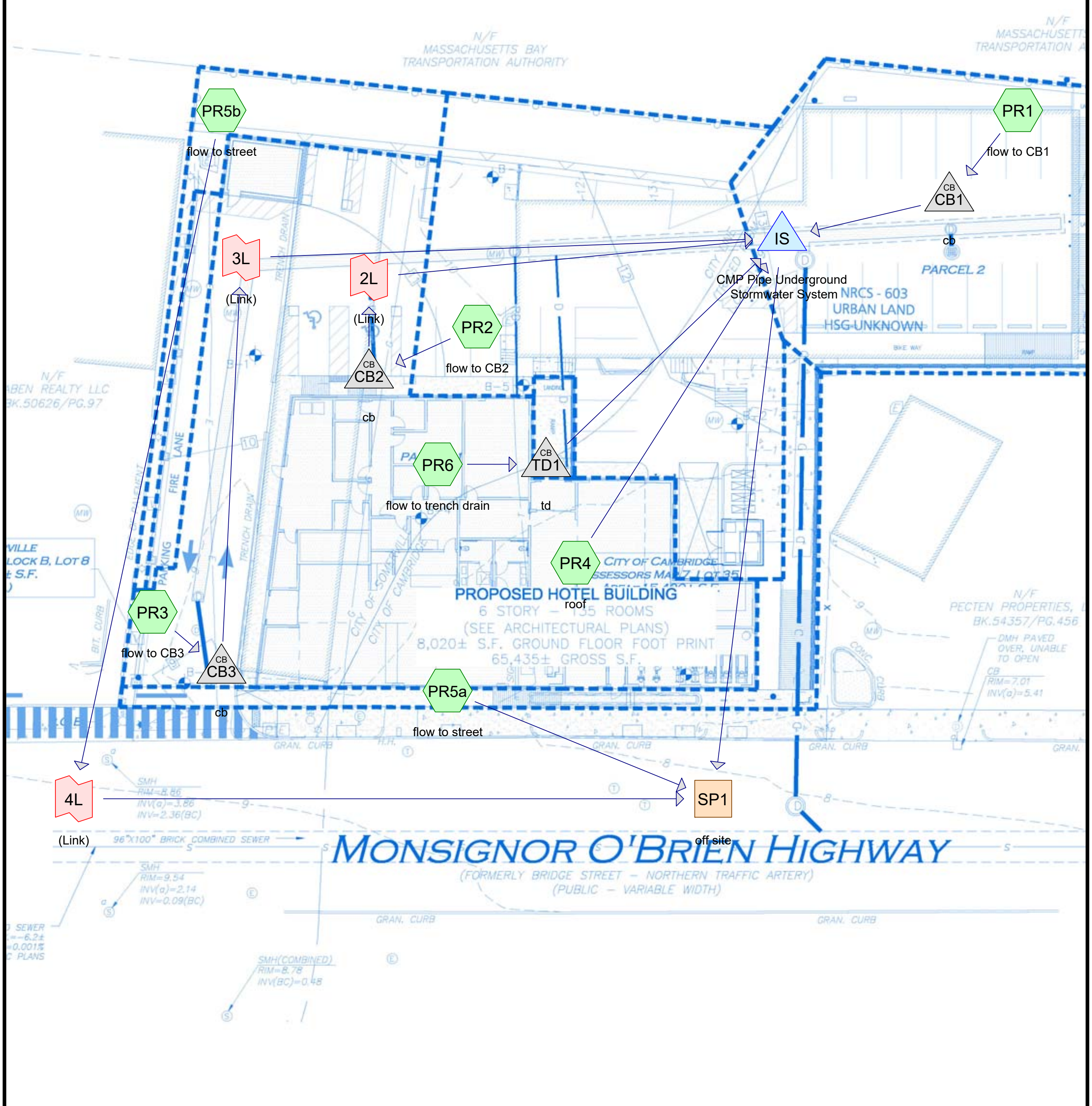
Area (sf)	CN	Description
2,109	87	Dirt roads, HSG C
30,697	98	Unconnected pavement, HSG C
32,806	97	Weighted Average
2,109		6.43% Pervious Area
30,697		93.57% Impervious Area
30,697		100.00% Unconnected

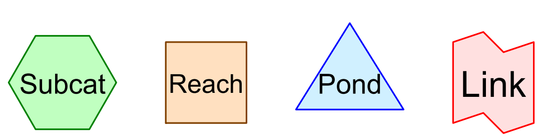
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	215	0.0330	1.92		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.08"
1.9	215	Total, Increased to minimum Tc = 5.0 min			

APPENDIX C

POST-DEVELOPMENT DRAINAGE CALCULATIONS

TYPE III, 2, 10, 25 & 100YR STORM EVENT





Routing Diagram for Post Development
Prepared by Allen & Major Associates, Inc., Printed 8/6/2019
HydroCAD® 10.00-24 s/n 02881 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
2,795	74	>75% Grass cover, Good, HSG C (PR1, PR2, PR5a, PR5b)
16,674	98	Paved parking, HSG C (PR1, PR2, PR3, PR5a, PR5b, PR6)
13,337	98	Roofs, HSG C (PR4)
32,806	**96**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
32,806	HSG C	PR1, PR2, PR3, PR4, PR5a, PR5b, PR6
0	HSG D	
0	Other	
32,806		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	0	2,795	0	0	2,795	>75% Grass cover, Good	PR1, PR2, PR5a, PR5b
0	0	16,674	0	0	16,674	Paved parking	PR1, PR2, PR3, PR5a, PR5b, PR6
0	0	13,337	0	0	13,337	Roofs	PR4
0	**0**	**32,806**	**0**	**0**	**32,806**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	CB1	6.62	6.50	6.0	0.0200	0.013	12.0	0.0	0.0
2	CB2	7.00	5.50	26.0	0.0577	0.013	12.0	0.0	0.0
3	CB3	5.75	5.56	19.0	0.0100	0.013	12.0	0.0	0.0
4	IS	1.97	0.60	137.0	0.0100	0.013	12.0	0.0	0.0
5	TD1	7.45	4.75	55.0	0.0491	0.010	6.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR1: flow to CB1	Runoff Area=6,852 sf 98.25% Impervious Runoff Depth=2.87" Tc=5.0 min CN=98 Runoff=0.5 cfs 1,638 cf
Subcatchment PR2: flow to CB2	Runoff Area=8,211 sf 81.38% Impervious Runoff Depth=2.45" Tc=5.0 min CN=94 Runoff=0.5 cfs 1,674 cf
Subcatchment PR3: flow to CB3	Runoff Area=686 sf 100.00% Impervious Runoff Depth=2.87" Tc=5.0 min CN=98 Runoff=0.0 cfs 164 cf
Subcatchment PR4: roof	Runoff Area=13,337 sf 100.00% Impervious Runoff Depth=2.87" Tc=5.0 min CN=98 Runoff=1.0 cfs 3,187 cf
Subcatchment PR5a: flow to street	Runoff Area=1,891 sf 88.95% Impervious Runoff Depth=2.55" Tc=5.0 min CN=95 Runoff=0.1 cfs 401 cf
Subcatchment PR5b: flow to street	Runoff Area=1,551 sf 39.59% Impervious Runoff Depth=1.60" Tc=5.0 min CN=84 Runoff=0.1 cfs 207 cf
Subcatchment PR6: flow to trench drain	Runoff Area=278 sf 100.00% Impervious Runoff Depth=2.87" Tc=5.0 min CN=98 Runoff=0.0 cfs 66 cf
Reach SP1: off site	Inflow=1.5 cfs 4,672 cf Outflow=1.5 cfs 4,672 cf
Pond CB1: cb	Peak Elev=6.99' Inflow=0.5 cfs 1,638 cf 12.0" Round Culvert n=0.013 L=6.0' S=0.0200 '/' Outflow=0.5 cfs 1,638 cf
Pond CB2: cb	Peak Elev=7.37' Inflow=0.5 cfs 1,674 cf 12.0" Round Culvert n=0.013 L=26.0' S=0.0577 '/' Outflow=0.5 cfs 1,674 cf
Pond CB3: cb	Peak Elev=5.86' Inflow=0.0 cfs 164 cf 12.0" Round Culvert n=0.013 L=19.0' S=0.0100 '/' Outflow=0.0 cfs 164 cf
Pond IS: CMP Pipe Underground Stormwater System	Peak Elev=5.69' Storage=1,636 cf Inflow=2.1 cfs 6,730 cf Discarded=0.0 cfs 2,666 cf Primary=1.3 cfs 4,064 cf Outflow=1.4 cfs 6,730 cf
Pond TD1: td	Peak Elev=7.53' Inflow=0.0 cfs 66 cf 6.0" Round Culvert n=0.010 L=55.0' S=0.0491 '/' Outflow=0.0 cfs 66 cf
Link 2L: (Link)	Inflow=0.5 cfs 1,674 cf Primary=0.5 cfs 1,674 cf
Link 3L: (Link)	Inflow=0.0 cfs 164 cf Primary=0.0 cfs 164 cf
Link 4L: (Link)	Inflow=0.1 cfs 207 cf Primary=0.1 cfs 207 cf

Total Runoff Area = 32,806 sf Runoff Volume = 7,338 cf Average Runoff Depth = 2.68"
8.52% Pervious = 2,795 sf 91.48% Impervious = 30,011 sf

Summary for Subcatchment PR1: flow to CB1

Runoff = 0.5 cfs @ 12.07 hrs, Volume= 1,638 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
6,732	98	Paved parking, HSG C
120	74	>75% Grass cover, Good, HSG C
6,852	98	Weighted Average
120		1.75% Pervious Area
6,732		98.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR2: flow to CB2

Runoff = 0.5 cfs @ 12.07 hrs, Volume= 1,674 cf, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,529	74	>75% Grass cover, Good, HSG C
6,682	98	Paved parking, HSG C
8,211	94	Weighted Average
1,529		18.62% Pervious Area
6,682		81.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR3: flow to CB3

Runoff = 0.0 cfs @ 12.07 hrs, Volume= 164 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
686	98	Paved parking, HSG C
686		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR4: roof

Runoff = 1.0 cfs @ 12.07 hrs, Volume= 3,187 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
13,337	98	Roofs, HSG C
13,337		100.00% Impervious Area

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

Summary for Subcatchment PR5a: flow to street

Runoff = 0.1 cfs @ 12.07 hrs, Volume= 401 cf, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
209	74	>75% Grass cover, Good, HSG C
1,682	98	Paved parking, HSG C
1,891	95	Weighted Average
209		11.05% Pervious Area
1,682		88.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR5b: flow to street

Runoff = 0.1 cfs @ 12.08 hrs, Volume= 207 cf, Depth= 1.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
937	74	>75% Grass cover, Good, HSG C
614	98	Paved parking, HSG C
1,551	84	Weighted Average
937		60.41% Pervious Area
614		39.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR6: flow to trench drain

Runoff = 0.0 cfs @ 12.07 hrs, Volume= 66 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
278	98	Paved parking, HSG C
278		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Reach SP1: off site

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

Inflow Area = 32,806 sf, 91.48% Impervious, Inflow Depth = 1.71" for 2-Year event
Inflow = 1.5 cfs @ 12.13 hrs, Volume= 4,672 cf
Outflow = 1.5 cfs @ 12.13 hrs, Volume= 4,672 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3

Summary for Pond CB1: cb

Inflow Area = 6,852 sf, 98.25% Impervious, Inflow Depth = 2.87" for 2-Year event
Inflow = 0.5 cfs @ 12.07 hrs, Volume= 1,638 cf
Outflow = 0.5 cfs @ 12.07 hrs, Volume= 1,638 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.5 cfs @ 12.07 hrs, Volume= 1,638 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 6.99' @ 12.07 hrs
Flood Elev= 12.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	6.62'	**12.0" Round Culvert** L= 6.0' Ke= 0.500 Inlet / Outlet Invert= 6.62' / 6.50' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.5 cfs @ 12.07 hrs HW=6.99' TW=5.55' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.5 cfs @ 2.73 fps)

Summary for Pond CB2: cb

Inflow Area = 8,211 sf, 81.38% Impervious, Inflow Depth = 2.45" for 2-Year event
Inflow = 0.5 cfs @ 12.07 hrs, Volume= 1,674 cf
Outflow = 0.5 cfs @ 12.07 hrs, Volume= 1,674 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.5 cfs @ 12.07 hrs, Volume= 1,674 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 7.37' @ 12.07 hrs
Flood Elev= 10.76'

Device	Routing	Invert	Outlet Devices
#1	Primary	7.00'	**12.0" Round Culvert** L= 26.0' Ke= 0.500 Inlet / Outlet Invert= 7.00' / 5.50' S= 0.0577 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.5 cfs @ 12.07 hrs HW=7.37' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.5 cfs @ 2.06 fps)

Summary for Pond CB3: cb

Inflow Area = 686 sf,100.00% Impervious, Inflow Depth = 2.87" for 2-Year event
Inflow = 0.0 cfs @ 12.07 hrs, Volume= 164 cf
Outflow = 0.0 cfs @ 12.07 hrs, Volume= 164 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.0 cfs @ 12.07 hrs, Volume= 164 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 5.86' @ 12.07 hrs
Flood Elev= 8.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	5.75'	**12.0" Round Culvert** L= 19.0' Ke= 0.500 Inlet / Outlet Invert= 5.75' / 5.56' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.0 cfs @ 12.07 hrs HW=5.86' TW=0.00' (Dynamic Tailwater)
└—**1=Culvert** (Barrel Controls 0.0 cfs @ 1.52 fps)

Summary for Pond IS: CMP Pipe Underground Stormwater System

Primary pond storage is provided by a stone-filled excavation which contains perforated CMP pipe set 0.5 feet above the bottom.

If the underground storage fills during larger storm events, water will back-up into the solid CMP pipe which is set 1.0 feet above the perforated CMP pipe.

Exfiltration is only applied to the stone-filled excavation area of the system.

Inflow Area =	29,364 sf, 94.38% Impervious,	Inflow Depth = 2.75"	for 2-Year event
Inflow =	2.1 cfs @ 12.07 hrs, Volume=	6,730 cf	
Outflow =	1.4 cfs @ 12.15 hrs, Volume=	6,730 cf, Atten= 34%, Lag= 4.8 min	
Discarded =	0.0 cfs @ 12.15 hrs, Volume=	2,666 cf	
Primary =	1.3 cfs @ 12.15 hrs, Volume=	4,064 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 5.69' @ 12.15 hrs Surf.Area= 700 sf Storage= 1,636 cf
Flood Elev= 7.00' Surf.Area= 700 sf Storage= 2,721 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 107.2 min (871.1 - 763.9)

Volume	Invert	Avail.Storage	Storage Description
#1	3.00'	724 cf	**5.00'W x 140.00'L x 4.00'H Stone around perf pipe** 2,800 cf Overall - 990 cf Embedded = 1,810 cf x 40.0% Voids
#2	3.50'	990 cf	**36.0" Round Horizontal Cylinder (perf pipe)** Inside #1 L= 140.0'
#3	4.50'	1,131 cf	**36.0" Round Horizontal Cylinder (solid pipe)** Impervious L= 160.0'
		2,845 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	1.97'	**12.0" Round Culvert** L= 137.0' Ke= 0.500 Inlet / Outlet Invert= 1.97' / 0.60' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	4.60'	**4.5" Vert. Orifice in standpipe** C= 0.600
#3	Device 1	5.00'	**7.0" Vert. Orifice in standpipe** C= 0.600
#4	Device 1	6.50'	**12.0" Horiz. Top of standpipe** C= 0.600 Limited to weir flow at low heads
#5	Discarded	3.00'	**1.200 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.0 cfs @ 12.15 hrs HW=5.69' (Free Discharge)
└—**5=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=1.3 cfs @ 12.15 hrs HW=5.69' TW=0.00' (Dynamic Tailwater)
└—**1=Culvert** (Passes 1.3 cfs of 5.3 cfs potential flow)
  ├—**2=Orifice in standpipe** (Orifice Controls 0.5 cfs @ 4.58 fps)
  ├—**3=Orifice in standpipe** (Orifice Controls 0.8 cfs @ 3.04 fps)
  └—**4=Top of standpipe** (Controls 0.0 cfs)

Summary for Pond TD1: td

Inflow Area =	278 sf,100.00% Impervious,	Inflow Depth = 2.87"	for 2-Year event
Inflow =	0.0 cfs @ 12.07 hrs, Volume=	66 cf	
Outflow =	0.0 cfs @ 12.07 hrs, Volume=	66 cf, Atten= 0%, Lag= 0.0 min	
Primary =	0.0 cfs @ 12.07 hrs, Volume=	66 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 7.53' @ 12.07 hrs
Flood Elev= 9.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	7.45'	**6.0" Round Culvert** L= 55.0' Ke= 0.500

Inlet / Outlet Invert= 7.45' / 4.75' S= 0.0491 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.0 cfs @ 12.07 hrs HW=7.53' TW=5.55' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.0 cfs @ 0.97 fps)

Summary for Link 2L: (Link)

Inflow Area = 8,211 sf, 81.38% Impervious, Inflow Depth = 2.45" for 2-Year event
Inflow = 0.5 cfs @ 12.07 hrs, Volume= 1,674 cf
Primary = 0.5 cfs @ 12.07 hrs, Volume= 1,674 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 3L: (Link)

Inflow Area = 686 sf,100.00% Impervious, Inflow Depth = 2.87" for 2-Year event
Inflow = 0.0 cfs @ 12.07 hrs, Volume= 164 cf
Primary = 0.0 cfs @ 12.07 hrs, Volume= 164 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 4L: (Link)

Inflow Area = 1,551 sf, 39.59% Impervious, Inflow Depth = 1.60" for 2-Year event
Inflow = 0.1 cfs @ 12.08 hrs, Volume= 207 cf
Primary = 0.1 cfs @ 12.08 hrs, Volume= 207 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR1: flow to CB1	Runoff Area=6,852 sf 98.25% Impervious Runoff Depth=4.26" Tc=5.0 min CN=98 Runoff=0.7 cfs 2,435 cf
Subcatchment PR2: flow to CB2	Runoff Area=8,211 sf 81.38% Impervious Runoff Depth=3.82" Tc=5.0 min CN=94 Runoff=0.8 cfs 2,611 cf
Subcatchment PR3: flow to CB3	Runoff Area=686 sf 100.00% Impervious Runoff Depth=4.26" Tc=5.0 min CN=98 Runoff=0.1 cfs 244 cf
Subcatchment PR4: roof	Runoff Area=13,337 sf 100.00% Impervious Runoff Depth=4.26" Tc=5.0 min CN=98 Runoff=1.4 cfs 4,739 cf
Subcatchment PR5a: flow to street	Runoff Area=1,891 sf 88.95% Impervious Runoff Depth=3.92" Tc=5.0 min CN=95 Runoff=0.2 cfs 618 cf
Subcatchment PR5b: flow to street	Runoff Area=1,551 sf 39.59% Impervious Runoff Depth=2.82" Tc=5.0 min CN=84 Runoff=0.1 cfs 364 cf
Subcatchment PR6: flow to trench drain	Runoff Area=278 sf 100.00% Impervious Runoff Depth=4.26" Tc=5.0 min CN=98 Runoff=0.0 cfs 99 cf
Reach SP1: off site	Inflow=2.0 cfs 8,104 cf Outflow=2.0 cfs 8,104 cf
Pond CB1: cb	Peak Elev=7.09' Inflow=0.7 cfs 2,435 cf 12.0" Round Culvert n=0.013 L=6.0' S=0.0200 '/' Outflow=0.7 cfs 2,435 cf
Pond CB2: cb	Peak Elev=7.46' Inflow=0.8 cfs 2,611 cf 12.0" Round Culvert n=0.013 L=26.0' S=0.0577 '/' Outflow=0.8 cfs 2,611 cf
Pond CB3: cb	Peak Elev=5.89' Inflow=0.1 cfs 244 cf 12.0" Round Culvert n=0.013 L=19.0' S=0.0100 '/' Outflow=0.1 cfs 244 cf
Pond IS: CMP Pipe Underground Stormwater System	Peak Elev=6.15' Storage=2,076 cf Inflow=3.0 cfs 10,127 cf Discarded=0.0 cfs 3,006 cf Primary=1.8 cfs 7,122 cf Outflow=1.9 cfs 10,127 cf
Pond TD1: td	Peak Elev=7.55' Inflow=0.0 cfs 99 cf 6.0" Round Culvert n=0.010 L=55.0' S=0.0491 '/' Outflow=0.0 cfs 99 cf
Link 2L: (Link)	Inflow=0.8 cfs 2,611 cf Primary=0.8 cfs 2,611 cf
Link 3L: (Link)	Inflow=0.1 cfs 244 cf Primary=0.1 cfs 244 cf
Link 4L: (Link)	Inflow=0.1 cfs 364 cf Primary=0.1 cfs 364 cf

Total Runoff Area = 32,806 sf Runoff Volume = 11,110 cf Average Runoff Depth = 4.06"
8.52% Pervious = 2,795 sf 91.48% Impervious = 30,011 sf

Summary for Subcatchment PR1: flow to CB1

Runoff = 0.7 cfs @ 12.07 hrs, Volume= 2,435 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
6,732	98	Paved parking, HSG C
120	74	>75% Grass cover, Good, HSG C
6,852	98	Weighted Average
120		1.75% Pervious Area
6,732		98.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR2: flow to CB2

Runoff = 0.8 cfs @ 12.07 hrs, Volume= 2,611 cf, Depth= 3.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,529	74	>75% Grass cover, Good, HSG C
6,682	98	Paved parking, HSG C
8,211	94	Weighted Average
1,529		18.62% Pervious Area
6,682		81.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR3: flow to CB3

Runoff = 0.1 cfs @ 12.07 hrs, Volume= 244 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
686	98	Paved parking, HSG C
686		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR4: roof

Runoff = 1.4 cfs @ 12.07 hrs, Volume= 4,739 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
13,337	98	Roofs, HSG C
13,337		100.00% Impervious Area

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

Summary for Subcatchment PR5a: flow to street

Runoff = 0.2 cfs @ 12.07 hrs, Volume= 618 cf, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
209	74	>75% Grass cover, Good, HSG C
1,682	98	Paved parking, HSG C
1,891	95	Weighted Average
209		11.05% Pervious Area
1,682		88.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR5b: flow to street

Runoff = 0.1 cfs @ 12.07 hrs, Volume= 364 cf, Depth= 2.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
937	74	>75% Grass cover, Good, HSG C
614	98	Paved parking, HSG C
1,551	84	Weighted Average
937		60.41% Pervious Area
614		39.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR6: flow to trench drain

Runoff = 0.0 cfs @ 12.07 hrs, Volume= 99 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
278	98	Paved parking, HSG C
278		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Reach SP1: off site

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

Inflow Area = 32,806 sf, 91.48% Impervious, Inflow Depth = 2.96" for 10-Year event
Inflow = 2.0 cfs @ 12.13 hrs, Volume= 8,104 cf
Outflow = 2.0 cfs @ 12.13 hrs, Volume= 8,104 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3

Summary for Pond CB1: cb

Inflow Area = 6,852 sf, 98.25% Impervious, Inflow Depth = 4.26" for 10-Year event
Inflow = 0.7 cfs @ 12.07 hrs, Volume= 2,435 cf
Outflow = 0.7 cfs @ 12.07 hrs, Volume= 2,435 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.7 cfs @ 12.07 hrs, Volume= 2,435 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 7.09' @ 12.07 hrs
Flood Elev= 12.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	6.62'	**12.0" Round Culvert** L= 6.0' Ke= 0.500 Inlet / Outlet Invert= 6.62' / 6.50' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.7 cfs @ 12.07 hrs HW=7.09' TW=5.89' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.7 cfs @ 2.94 fps)

Summary for Pond CB2: cb

Inflow Area = 8,211 sf, 81.38% Impervious, Inflow Depth = 3.82" for 10-Year event
Inflow = 0.8 cfs @ 12.07 hrs, Volume= 2,611 cf
Outflow = 0.8 cfs @ 12.07 hrs, Volume= 2,611 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.8 cfs @ 12.07 hrs, Volume= 2,611 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 7.46' @ 12.07 hrs
Flood Elev= 10.76'

Device	Routing	Invert	Outlet Devices
#1	Primary	7.00'	**12.0" Round Culvert** L= 26.0' Ke= 0.500 Inlet / Outlet Invert= 7.00' / 5.50' S= 0.0577 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.8 cfs @ 12.07 hrs HW=7.46' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.8 cfs @ 2.31 fps)

Summary for Pond CB3: cb

Inflow Area = 686 sf,100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
Inflow = 0.1 cfs @ 12.07 hrs, Volume= 244 cf
Outflow = 0.1 cfs @ 12.07 hrs, Volume= 244 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.1 cfs @ 12.07 hrs, Volume= 244 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 5.89' @ 12.07 hrs
Flood Elev= 8.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	5.75'	**12.0" Round Culvert** L= 19.0' Ke= 0.500 Inlet / Outlet Invert= 5.75' / 5.56' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.1 cfs @ 12.07 hrs HW=5.89' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 0.1 cfs @ 1.69 fps)

Summary for Pond IS: CMP Pipe Underground Stormwater System

Primary pond storage is provided by a stone-filled excavation which contains perforated CMP pipe set 0.5 feet above the bottom.

If the underground storage fills during larger storm events, water will back-up into the solid CMP pipe which is set 1.0 feet above the perforated CMP pipe.

Exfiltration is only applied to the stone-filled excavation area of the system.

Inflow Area =	29,364 sf, 94.38% Impervious,	Inflow Depth = 4.14"	for 10-Year event
Inflow =	3.0 cfs @ 12.07 hrs,	Volume=	10,127 cf
Outflow =	1.9 cfs @ 12.16 hrs,	Volume=	10,127 cf, Atten= 39%, Lag= 5.5 min
Discarded =	0.0 cfs @ 12.16 hrs,	Volume=	3,006 cf
Primary =	1.8 cfs @ 12.16 hrs,	Volume=	7,122 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 6.15' @ 12.16 hrs Surf.Area= 700 sf Storage= 2,076 cf
Flood Elev= 7.00' Surf.Area= 700 sf Storage= 2,721 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 87.9 min (843.7 - 755.8)

Volume	Invert	Avail.Storage	Storage Description
#1	3.00'	724 cf	**5.00'W x 140.00'L x 4.00'H Stone around perf pipe**
			2,800 cf Overall - 990 cf Embedded = 1,810 cf x 40.0% Voids
#2	3.50'	990 cf	**36.0" Round Horizontal Cylinder (perf pipe)** Inside #1
			L= 140.0'
#3	4.50'	1,131 cf	**36.0" Round Horizontal Cylinder (solid pipe)** Impervious
			L= 160.0'
		2,845 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	1.97'	**12.0" Round Culvert** L= 137.0' Ke= 0.500
			Inlet / Outlet Invert= 1.97' / 0.60' S= 0.0100 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	4.60'	**4.5" Vert. Orifice in standpipe** C= 0.600
#3	Device 1	5.00'	**7.0" Vert. Orifice in standpipe** C= 0.600
#4	Device 1	6.50'	**12.0" Horiz. Top of standpipe** C= 0.600 Limited to weir flow at low heads
#5	Discarded	3.00'	**1.200 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.0 cfs @ 12.16 hrs HW=6.15' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=1.8 cfs @ 12.16 hrs HW=6.15' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.8 cfs of 5.6 cfs potential flow)
  ├─**2=Orifice in standpipe** (Orifice Controls 0.6 cfs @ 5.62 fps)
  ├─**3=Orifice in standpipe** (Orifice Controls 1.2 cfs @ 4.46 fps)
  └─**4=Top of standpipe** (Controls 0.0 cfs)

Summary for Pond TD1: td

Inflow Area =	278 sf,100.00% Impervious,	Inflow Depth = 4.26"	for 10-Year event
Inflow =	0.0 cfs @ 12.07 hrs,	Volume=	99 cf
Outflow =	0.0 cfs @ 12.07 hrs,	Volume=	99 cf, Atten= 0%, Lag= 0.0 min
Primary =	0.0 cfs @ 12.07 hrs,	Volume=	99 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 7.55' @ 12.07 hrs
Flood Elev= 9.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	7.45'	**6.0" Round Culvert** L= 55.0' Ke= 0.500

Inlet / Outlet Invert= 7.45' / 4.75' S= 0.0491 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.0 cfs @ 12.07 hrs HW=7.55' TW=5.89' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.0 cfs @ 1.07 fps)

Summary for Link 2L: (Link)

Inflow Area = 8,211 sf, 81.38% Impervious, Inflow Depth = 3.82" for 10-Year event
Inflow = 0.8 cfs @ 12.07 hrs, Volume= 2,611 cf
Primary = 0.8 cfs @ 12.07 hrs, Volume= 2,611 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 3L: (Link)

Inflow Area = 686 sf,100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
Inflow = 0.1 cfs @ 12.07 hrs, Volume= 244 cf
Primary = 0.1 cfs @ 12.07 hrs, Volume= 244 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 4L: (Link)

Inflow Area = 1,551 sf, 39.59% Impervious, Inflow Depth = 2.82" for 10-Year event
Inflow = 0.1 cfs @ 12.07 hrs, Volume= 364 cf
Primary = 0.1 cfs @ 12.07 hrs, Volume= 364 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR1: flow to CB1	Runoff Area=6,852 sf 98.25% Impervious Runoff Depth=5.06" Tc=5.0 min CN=98 Runoff=0.8 cfs 2,891 cf
Subcatchment PR2: flow to CB2	Runoff Area=8,211 sf 81.38% Impervious Runoff Depth=4.60" Tc=5.0 min CN=94 Runoff=1.0 cfs 3,150 cf
Subcatchment PR3: flow to CB3	Runoff Area=686 sf 100.00% Impervious Runoff Depth=5.06" Tc=5.0 min CN=98 Runoff=0.1 cfs 289 cf
Subcatchment PR4: roof	Runoff Area=13,337 sf 100.00% Impervious Runoff Depth=5.06" Tc=5.0 min CN=98 Runoff=1.6 cfs 5,627 cf
Subcatchment PR5a: flow to street	Runoff Area=1,891 sf 88.95% Impervious Runoff Depth=4.72" Tc=5.0 min CN=95 Runoff=0.2 cfs 743 cf
Subcatchment PR5b: flow to street	Runoff Area=1,551 sf 39.59% Impervious Runoff Depth=3.55" Tc=5.0 min CN=84 Runoff=0.2 cfs 458 cf
Subcatchment PR6: flow to trench drain	Runoff Area=278 sf 100.00% Impervious Runoff Depth=5.06" Tc=5.0 min CN=98 Runoff=0.0 cfs 117 cf
Reach SP1: off site	Inflow=2.3 cfs 10,157 cf Outflow=2.3 cfs 10,157 cf
Pond CB1: cb	Peak Elev=7.13' Inflow=0.8 cfs 2,891 cf 12.0" Round Culvert n=0.013 L=6.0' S=0.0200 '/' Outflow=0.8 cfs 2,891 cf
Pond CB2: cb	Peak Elev=7.51' Inflow=1.0 cfs 3,150 cf 12.0" Round Culvert n=0.013 L=26.0' S=0.0577 '/' Outflow=1.0 cfs 3,150 cf
Pond CB3: cb	Peak Elev=5.90' Inflow=0.1 cfs 289 cf 12.0" Round Culvert n=0.013 L=19.0' S=0.0100 '/' Outflow=0.1 cfs 289 cf
Pond IS: CMP Pipe Underground Stormwater System	Peak Elev=6.46' Storage=2,345 cf Inflow=3.6 cfs 12,075 cf Discarded=0.0 cfs 3,119 cf Primary=2.1 cfs 8,955 cf Outflow=2.1 cfs 12,075 cf
Pond TD1: td	Peak Elev=7.56' Inflow=0.0 cfs 117 cf 6.0" Round Culvert n=0.010 L=55.0' S=0.0491 '/' Outflow=0.0 cfs 117 cf
Link 2L: (Link)	Inflow=1.0 cfs 3,150 cf Primary=1.0 cfs 3,150 cf
Link 3L: (Link)	Inflow=0.1 cfs 289 cf Primary=0.1 cfs 289 cf
Link 4L: (Link)	Inflow=0.2 cfs 458 cf Primary=0.2 cfs 458 cf

Total Runoff Area = 32,806 sf Runoff Volume = 13,276 cf Average Runoff Depth = 4.86"
8.52% Pervious = 2,795 sf 91.48% Impervious = 30,011 sf

Summary for Subcatchment PR1: flow to CB1

Runoff = 0.8 cfs @ 12.07 hrs, Volume= 2,891 cf, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
6,732	98	Paved parking, HSG C
120	74	>75% Grass cover, Good, HSG C
6,852	98	Weighted Average
120		1.75% Pervious Area
6,732		98.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR2: flow to CB2

Runoff = 1.0 cfs @ 12.07 hrs, Volume= 3,150 cf, Depth= 4.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
1,529	74	>75% Grass cover, Good, HSG C
6,682	98	Paved parking, HSG C
8,211	94	Weighted Average
1,529		18.62% Pervious Area
6,682		81.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR3: flow to CB3

Runoff = 0.1 cfs @ 12.07 hrs, Volume= 289 cf, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
686	98	Paved parking, HSG C
686		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR4: roof

Runoff = 1.6 cfs @ 12.07 hrs, Volume= 5,627 cf, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
13,337	98	Roofs, HSG C
13,337		100.00% Impervious Area

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

Summary for Subcatchment PR5a: flow to street

Runoff = 0.2 cfs @ 12.07 hrs, Volume= 743 cf, Depth= 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
209	74	>75% Grass cover, Good, HSG C
1,682	98	Paved parking, HSG C
1,891	95	Weighted Average
209		11.05% Pervious Area
1,682		88.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR5b: flow to street

Runoff = 0.2 cfs @ 12.07 hrs, Volume= 458 cf, Depth= 3.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
937	74	>75% Grass cover, Good, HSG C
614	98	Paved parking, HSG C
1,551	84	Weighted Average
937		60.41% Pervious Area
614		39.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR6: flow to trench drain

Runoff = 0.0 cfs @ 12.07 hrs, Volume= 117 cf, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
278	98	Paved parking, HSG C
278		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Reach SP1: off site

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

Inflow Area = 32,806 sf, 91.48% Impervious, Inflow Depth = 3.72" for 25-Year event
Inflow = 2.3 cfs @ 12.13 hrs, Volume= 10,157 cf
Outflow = 2.3 cfs @ 12.13 hrs, Volume= 10,157 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3

Summary for Pond CB1: cb

Inflow Area = 6,852 sf, 98.25% Impervious, Inflow Depth = 5.06" for 25-Year event
Inflow = 0.8 cfs @ 12.07 hrs, Volume= 2,891 cf
Outflow = 0.8 cfs @ 12.07 hrs, Volume= 2,891 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.8 cfs @ 12.07 hrs, Volume= 2,891 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 7.13' @ 12.07 hrs
Flood Elev= 12.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	6.62'	**12.0" Round Culvert** L= 6.0' Ke= 0.500 Inlet / Outlet Invert= 6.62' / 6.50' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.8 cfs @ 12.07 hrs HW=7.13' TW=6.09' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.8 cfs @ 3.03 fps)

Summary for Pond CB2: cb

Inflow Area = 8,211 sf, 81.38% Impervious, Inflow Depth = 4.60" for 25-Year event
Inflow = 1.0 cfs @ 12.07 hrs, Volume= 3,150 cf
Outflow = 1.0 cfs @ 12.07 hrs, Volume= 3,150 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.0 cfs @ 12.07 hrs, Volume= 3,150 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 7.51' @ 12.07 hrs
Flood Elev= 10.76'

Device	Routing	Invert	Outlet Devices
#1	Primary	7.00'	**12.0" Round Culvert** L= 26.0' Ke= 0.500 Inlet / Outlet Invert= 7.00' / 5.50' S= 0.0577 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.0 cfs @ 12.07 hrs HW=7.51' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.0 cfs @ 2.43 fps)

Summary for Pond CB3: cb

Inflow Area = 686 sf,100.00% Impervious, Inflow Depth = 5.06" for 25-Year event
Inflow = 0.1 cfs @ 12.07 hrs, Volume= 289 cf
Outflow = 0.1 cfs @ 12.07 hrs, Volume= 289 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.1 cfs @ 12.07 hrs, Volume= 289 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 5.90' @ 12.07 hrs
Flood Elev= 8.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	5.75'	**12.0" Round Culvert** L= 19.0' Ke= 0.500 Inlet / Outlet Invert= 5.75' / 5.56' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.1 cfs @ 12.07 hrs HW=5.90' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 0.1 cfs @ 1.76 fps)

Summary for Pond IS: CMP Pipe Underground Stormwater System

Primary pond storage is provided by a stone-filled excavation which contains perforated CMP pipe set 0.5 feet above the bottom.

If the underground storage fills during larger storm events, water will back-up into the solid CMP pipe which is set 1.0 feet above the perforated CMP pipe.

Exfiltration is only applied to the stone-filled excavation area of the system.

Inflow Area =	29,364 sf,	94.38% Impervious,	Inflow Depth = 4.93"	for 25-Year event
Inflow =	3.6 cfs @	12.07 hrs, Volume=	12,075 cf	
Outflow =	2.1 cfs @	12.17 hrs, Volume=	12,075 cf,	Atten= 41%, Lag= 5.7 min
Discarded =	0.0 cfs @	12.17 hrs, Volume=	3,119 cf	
Primary =	2.1 cfs @	12.17 hrs, Volume=	8,955 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 6.46' @ 12.17 hrs Surf.Area= 700 sf Storage= 2,345 cf
Flood Elev= 7.00' Surf.Area= 700 sf Storage= 2,721 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 79.7 min (832.3 - 752.6)

Volume	Invert	Avail.Storage	Storage Description
#1	3.00'	724 cf	**5.00'W x 140.00'L x 4.00'H Stone around perf pipe** 2,800 cf Overall - 990 cf Embedded = 1,810 cf x 40.0% Voids
#2	3.50'	990 cf	**36.0" Round Horizontal Cylinder (perf pipe)** Inside #1 L= 140.0'
#3	4.50'	1,131 cf	**36.0" Round Horizontal Cylinder (solid pipe)** Impervious L= 160.0'
		2,845 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	1.97'	**12.0" Round Culvert** L= 137.0' Ke= 0.500 Inlet / Outlet Invert= 1.97' / 0.60' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	4.60'	**4.5" Vert. Orifice in standpipe** C= 0.600
#3	Device 1	5.00'	**7.0" Vert. Orifice in standpipe** C= 0.600
#4	Device 1	6.50'	**12.0" Horiz. Top of standpipe** C= 0.600 Limited to weir flow at low heads
#5	Discarded	3.00'	**1.200 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.0 cfs @ 12.17 hrs HW=6.46' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=2.1 cfs @ 12.17 hrs HW=6.46' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 2.1 cfs of 5.8 cfs potential flow)
  ├─**2=Orifice in standpipe** (Orifice Controls 0.7 cfs @ 6.23 fps)
  ├─**3=Orifice in standpipe** (Orifice Controls 1.4 cfs @ 5.21 fps)
  └─**4=Top of standpipe** (Controls 0.0 cfs)

Summary for Pond TD1: td

Inflow Area =	278 sf,	100.00% Impervious,	Inflow Depth = 5.06"	for 25-Year event
Inflow =	0.0 cfs @	12.07 hrs, Volume=	117 cf	
Outflow =	0.0 cfs @	12.07 hrs, Volume=	117 cf,	Atten= 0%, Lag= 0.0 min
Primary =	0.0 cfs @	12.07 hrs, Volume=	117 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 7.56' @ 12.07 hrs
Flood Elev= 9.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	7.45'	**6.0" Round Culvert** L= 55.0' Ke= 0.500

Inlet / Outlet Invert= 7.45' / 4.75' S= 0.0491 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.0 cfs @ 12.07 hrs HW=7.56' TW=6.09' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.0 cfs @ 1.11 fps)

Summary for Link 2L: (Link)

Inflow Area = 8,211 sf, 81.38% Impervious, Inflow Depth = 4.60" for 25-Year event
Inflow = 1.0 cfs @ 12.07 hrs, Volume= 3,150 cf
Primary = 1.0 cfs @ 12.07 hrs, Volume= 3,150 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 3L: (Link)

Inflow Area = 686 sf,100.00% Impervious, Inflow Depth = 5.06" for 25-Year event
Inflow = 0.1 cfs @ 12.07 hrs, Volume= 289 cf
Primary = 0.1 cfs @ 12.07 hrs, Volume= 289 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 4L: (Link)

Inflow Area = 1,551 sf, 39.59% Impervious, Inflow Depth = 3.55" for 25-Year event
Inflow = 0.2 cfs @ 12.07 hrs, Volume= 458 cf
Primary = 0.2 cfs @ 12.07 hrs, Volume= 458 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR1: flow to CB1	Runoff Area=6,852 sf 98.25% Impervious Runoff Depth=6.26" Tc=5.0 min CN=98 Runoff=1.0 cfs 3,575 cf
Subcatchment PR2: flow to CB2	Runoff Area=8,211 sf 81.38% Impervious Runoff Depth=5.79" Tc=5.0 min CN=94 Runoff=1.2 cfs 3,963 cf
Subcatchment PR3: flow to CB3	Runoff Area=686 sf 100.00% Impervious Runoff Depth=6.26" Tc=5.0 min CN=98 Runoff=0.1 cfs 358 cf
Subcatchment PR4: roof	Runoff Area=13,337 sf 100.00% Impervious Runoff Depth=6.26" Tc=5.0 min CN=98 Runoff=2.0 cfs 6,959 cf
Subcatchment PR5a: flow to street	Runoff Area=1,891 sf 88.95% Impervious Runoff Depth=5.91" Tc=5.0 min CN=95 Runoff=0.3 cfs 931 cf
Subcatchment PR5b: flow to street	Runoff Area=1,551 sf 39.59% Impervious Runoff Depth=4.67" Tc=5.0 min CN=84 Runoff=0.2 cfs 603 cf
Subcatchment PR6: flow to trench drain	Runoff Area=278 sf 100.00% Impervious Runoff Depth=6.26" Tc=5.0 min CN=98 Runoff=0.0 cfs 145 cf
Reach SP1: off site	Inflow=3.9 cfs 13,290 cf Outflow=3.9 cfs 13,290 cf
Pond CB1: cb	Peak Elev=7.20' Inflow=1.0 cfs 3,575 cf 12.0" Round Culvert n=0.013 L=6.0' S=0.0200 '/' Outflow=1.0 cfs 3,575 cf
Pond CB2: cb	Peak Elev=7.58' Inflow=1.2 cfs 3,963 cf 12.0" Round Culvert n=0.013 L=26.0' S=0.0577 '/' Outflow=1.2 cfs 3,963 cf
Pond CB3: cb	Peak Elev=5.92' Inflow=0.1 cfs 358 cf 12.0" Round Culvert n=0.013 L=19.0' S=0.0100 '/' Outflow=0.1 cfs 358 cf
Pond IS: CMP Pipe Underground Stormwater System	Peak Elev=6.75' Storage=2,550 cf Inflow=4.4 cfs 15,000 cf Discarded=0.0 cfs 3,245 cf Primary=3.5 cfs 11,756 cf Outflow=3.6 cfs 15,001 cf
Pond TD1: td	Peak Elev=7.57' Inflow=0.0 cfs 145 cf 6.0" Round Culvert n=0.010 L=55.0' S=0.0491 '/' Outflow=0.0 cfs 145 cf
Link 2L: (Link)	Inflow=1.2 cfs 3,963 cf Primary=1.2 cfs 3,963 cf
Link 3L: (Link)	Inflow=0.1 cfs 358 cf Primary=0.1 cfs 358 cf
Link 4L: (Link)	Inflow=0.2 cfs 603 cf Primary=0.2 cfs 603 cf

Total Runoff Area = 32,806 sf Runoff Volume = 16,535 cf Average Runoff Depth = 6.05"
8.52% Pervious = 2,795 sf 91.48% Impervious = 30,011 sf

Summary for Subcatchment PR1: flow to CB1

Runoff = 1.0 cfs @ 12.07 hrs, Volume= 3,575 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
6,732	98	Paved parking, HSG C
120	74	>75% Grass cover, Good, HSG C
6,852	98	Weighted Average
120		1.75% Pervious Area
6,732		98.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR2: flow to CB2

Runoff = 1.2 cfs @ 12.07 hrs, Volume= 3,963 cf, Depth= 5.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,529	74	>75% Grass cover, Good, HSG C
6,682	98	Paved parking, HSG C
8,211	94	Weighted Average
1,529		18.62% Pervious Area
6,682		81.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR3: flow to CB3

Runoff = 0.1 cfs @ 12.07 hrs, Volume= 358 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
686	98	Paved parking, HSG C
686		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR4: roof

Runoff = 2.0 cfs @ 12.07 hrs, Volume= 6,959 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
13,337	98	Roofs, HSG C
13,337		100.00% Impervious Area

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

Summary for Subcatchment PR5a: flow to street

Runoff = 0.3 cfs @ 12.07 hrs, Volume= 931 cf, Depth= 5.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
209	74	>75% Grass cover, Good, HSG C
1,682	98	Paved parking, HSG C
1,891	95	Weighted Average
209		11.05% Pervious Area
1,682		88.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR5b: flow to street

Runoff = 0.2 cfs @ 12.07 hrs, Volume= 603 cf, Depth= 4.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
937	74	>75% Grass cover, Good, HSG C
614	98	Paved parking, HSG C
1,551	84	Weighted Average
937		60.41% Pervious Area
614		39.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment PR6: flow to trench drain

Runoff = 0.0 cfs @ 12.07 hrs, Volume= 145 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
278	98	Paved parking, HSG C
278		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5					**Direct Entry,**
1.5	0	Total, Increased to minimum Tc = 5.0 min			

Summary for Reach SP1: off site

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

Inflow Area = 32,806 sf, 91.48% Impervious, Inflow Depth = 4.86" for 100-Year event
Inflow = 3.9 cfs @ 12.12 hrs, Volume= 13,290 cf
Outflow = 3.9 cfs @ 12.12 hrs, Volume= 13,290 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3

Summary for Pond CB1: cb

Inflow Area = 6,852 sf, 98.25% Impervious, Inflow Depth = 6.26" for 100-Year event
Inflow = 1.0 cfs @ 12.07 hrs, Volume= 3,575 cf
Outflow = 1.0 cfs @ 12.07 hrs, Volume= 3,575 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.0 cfs @ 12.07 hrs, Volume= 3,575 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 7.20' @ 12.07 hrs
Flood Elev= 12.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	6.62'	**12.0" Round Culvert** L= 6.0' Ke= 0.500 Inlet / Outlet Invert= 6.62' / 6.50' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.0 cfs @ 12.07 hrs HW=7.20' TW=6.44' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 1.0 cfs @ 3.16 fps)

Summary for Pond CB2: cb

Inflow Area = 8,211 sf, 81.38% Impervious, Inflow Depth = 5.79" for 100-Year event
Inflow = 1.2 cfs @ 12.07 hrs, Volume= 3,963 cf
Outflow = 1.2 cfs @ 12.07 hrs, Volume= 3,963 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.2 cfs @ 12.07 hrs, Volume= 3,963 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 7.58' @ 12.07 hrs
Flood Elev= 10.76'

Device	Routing	Invert	Outlet Devices
#1	Primary	7.00'	**12.0" Round Culvert** L= 26.0' Ke= 0.500 Inlet / Outlet Invert= 7.00' / 5.50' S= 0.0577 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.2 cfs @ 12.07 hrs HW=7.58' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.2 cfs @ 2.59 fps)

Summary for Pond CB3: cb

Inflow Area = 686 sf,100.00% Impervious, Inflow Depth = 6.26" for 100-Year event
Inflow = 0.1 cfs @ 12.07 hrs, Volume= 358 cf
Outflow = 0.1 cfs @ 12.07 hrs, Volume= 358 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.1 cfs @ 12.07 hrs, Volume= 358 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 5.92' @ 12.07 hrs
Flood Elev= 8.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	5.75'	**12.0" Round Culvert** L= 19.0' Ke= 0.500 Inlet / Outlet Invert= 5.75' / 5.56' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.1 cfs @ 12.07 hrs HW=5.92' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 0.1 cfs @ 1.86 fps)

Summary for Pond IS: CMP Pipe Underground Stormwater System

Primary pond storage is provided by a stone-filled excavation which contains perforated CMP pipe set 0.5 feet above the bottom.

If the underground storage fills during larger storm events, water will back-up into the solid CMP pipe which is set 1.0 feet above the perforated CMP pipe.

Exfiltration is only applied to the stone-filled excavation area of the system.

Inflow Area = 29,364 sf, 94.38% Impervious, Inflow Depth = 6.13" for 100-Year event
Inflow = 4.4 cfs @ 12.07 hrs, Volume= 15,000 cf
Outflow = 3.6 cfs @ 12.12 hrs, Volume= 15,001 cf, Atten= 19%, Lag= 3.2 min
Discarded = 0.0 cfs @ 12.12 hrs, Volume= 3,245 cf
Primary = 3.5 cfs @ 12.12 hrs, Volume= 11,756 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 6.75' @ 12.12 hrs Surf.Area= 700 sf Storage= 2,550 cf
Flood Elev= 7.00' Surf.Area= 700 sf Storage= 2,721 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 70.1 min (819.1 - 749.0)

Volume	Invert	Avail.Storage	Storage Description
#1	3.00'	724 cf	**5.00'W x 140.00'L x 4.00'H Stone around perf pipe** 2,800 cf Overall - 990 cf Embedded = 1,810 cf x 40.0% Voids
#2	3.50'	990 cf	**36.0" Round Horizontal Cylinder (perf pipe)** Inside #1 L= 140.0'
#3	4.50'	1,131 cf	**36.0" Round Horizontal Cylinder (solid pipe)** Impervious L= 160.0'
		2,845 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	1.97'	**12.0" Round Culvert** L= 137.0' Ke= 0.500 Inlet / Outlet Invert= 1.97' / 0.60' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	4.60'	**4.5" Vert. Orifice in standpipe** C= 0.600
#3	Device 1	5.00'	**7.0" Vert. Orifice in standpipe** C= 0.600
#4	Device 1	6.50'	**12.0" Horiz. Top of standpipe** C= 0.600 Limited to weir flow at low heads
#5	Discarded	3.00'	**1.200 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.0 cfs @ 12.12 hrs HW=6.74' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=3.5 cfs @ 12.12 hrs HW=6.74' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 3.5 cfs of 5.9 cfs potential flow)
  ├─**2=Orifice in standpipe** (Orifice Controls 0.7 cfs @ 6.73 fps)
  ├─**3=Orifice in standpipe** (Orifice Controls 1.6 cfs @ 5.80 fps)
  └─**4=Top of standpipe** (Weir Controls 1.2 cfs @ 1.61 fps)

Summary for Pond TD1: td

Inflow Area = 278 sf,100.00% Impervious, Inflow Depth = 6.26" for 100-Year event
Inflow = 0.0 cfs @ 12.07 hrs, Volume= 145 cf
Outflow = 0.0 cfs @ 12.07 hrs, Volume= 145 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.0 cfs @ 12.07 hrs, Volume= 145 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 7.57' @ 12.07 hrs
Flood Elev= 9.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	7.45'	**6.0" Round Culvert** L= 55.0' Ke= 0.500

Inlet / Outlet Invert= 7.45' / 4.75' S= 0.0491 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

Primary OutFlow Max=0.0 cfs @ 12.07 hrs HW=7.57' TW=6.44' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 0.0 cfs @ 1.18 fps)

Summary for Link 2L: (Link)

Inflow Area = 8,211 sf, 81.38% Impervious, Inflow Depth = 5.79" for 100-Year event
Inflow = 1.2 cfs @ 12.07 hrs, Volume= 3,963 cf
Primary = 1.2 cfs @ 12.07 hrs, Volume= 3,963 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 3L: (Link)

Inflow Area = 686 sf,100.00% Impervious, Inflow Depth = 6.26" for 100-Year event
Inflow = 0.1 cfs @ 12.07 hrs, Volume= 358 cf
Primary = 0.1 cfs @ 12.07 hrs, Volume= 358 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 4L: (Link)

Inflow Area = 1,551 sf, 39.59% Impervious, Inflow Depth = 4.67" for 100-Year event
Inflow = 0.2 cfs @ 12.07 hrs, Volume= 603 cf
Primary = 0.2 cfs @ 12.07 hrs, Volume= 603 cf, Atten= 0%, Lag= 0.0 min

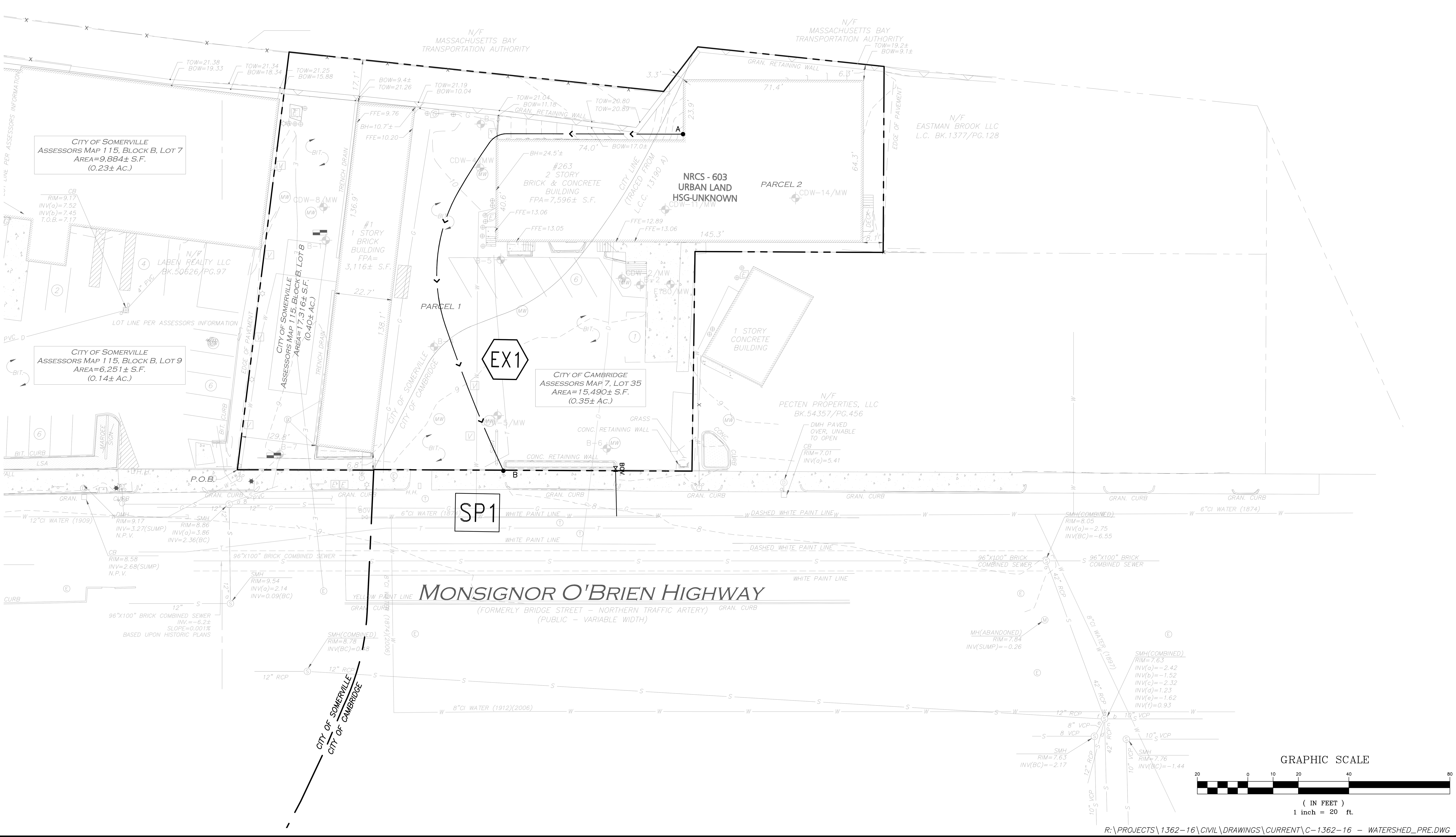
Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

LEGEND:

EX. PROPERTY LINE	
PRE-DEV. WATERSHED AREA	
Tc FLOW PATH	A → B

WATERSHED LEGEND:

E	SUBCATCHMENT: A relatively homogeneous area of land that drains into a single reach or pond. Each subcatchment generates a runoff hydrograph. (A subcatchment may also be used to account for the rain falling directly on the surface of a pond.)
SP1	REACH: A uniform stream, channel, or pipe that conveys water from one point to another reach or pond. The outflow of each reach is determined by a hydrograph routing calculation.
1	POND: 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, or other device(s) at its outlet. The outflow(s) of each pond is determined by a hydrograph routing calculation. The primary and/or secondary outflow may drain into a reach or into another pond.
1L	LINK: Used to enter a hydrograph generated outside HydroCAD, or to interconnect several routing diagrams. A link can also be used to scale a hydrograph, to split it into two components for independent routing, or to define a fixed or tidal tailwater elevation for certain routing methods.



R:\PROJECTS\1362-16\CIVIL\DRAWINGS\CURRENT\C-1362-16 - WATERSHED_PRE.DWG

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION

OWNER:
SOMERBRIDGE HOTEL LLC
c/o JAL HOSPITALITY DESIGN, LLC
10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

PROJECT:
191 ROOM DUAL BRAND HOTEL
263 MONSIGNOR O'BRIEN HIGHWAY
CAMBRIDGE, MA

1 McGRATH HIGHWAY
SOMERVILLE, MA

PROJECT NO.	1362-16	DATE:	NOVEMBER 5, 2021
SCALE:		DWG.:	C-1362-16 - Watershed_Pre
DESIGNED BY:	SM	CHECKED BY:	MM

PREPARED BY:

ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ♦ land surveying
environmental consulting ♦ landscape architecture
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MANCHESTER, NH 03103
TEL: (603) 627-5500 FAX: (603) 627-5501

WOBURN, MA ♦ LAKEVILLE, MA ♦ MANCHESTER, NH

DRAWING TITLE:
PRE-DEVELOPMENT WATERSHED PLAN

SHEET No.
WS-1

LEGEND

EX. PROPERTY LINE	— — —
POST DEV. WATERSHED AREA	▬▬▬

WATERSHED LEGEND

(P) SUBCATCHMENT: A relatively homogeneous area of land that drains into a single reach or pond. Each subcatchment generates a runoff hydrograph. (A subcatchment may also be used to account for the rain falling directly on the surface of a pond.)

SP1 REACH: A uniform stream, channel, or pipe that conveys water from one point to another reach or pond. The outflow of each reach is determined by a hydrograph routing calculation.

(1) POND: 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, or other device(s) at its outlet. The outflow(s) of each pond is determined by a hydrograph routing calculation. The primary and/or secondary outflow may drain into a reach or into another pond.

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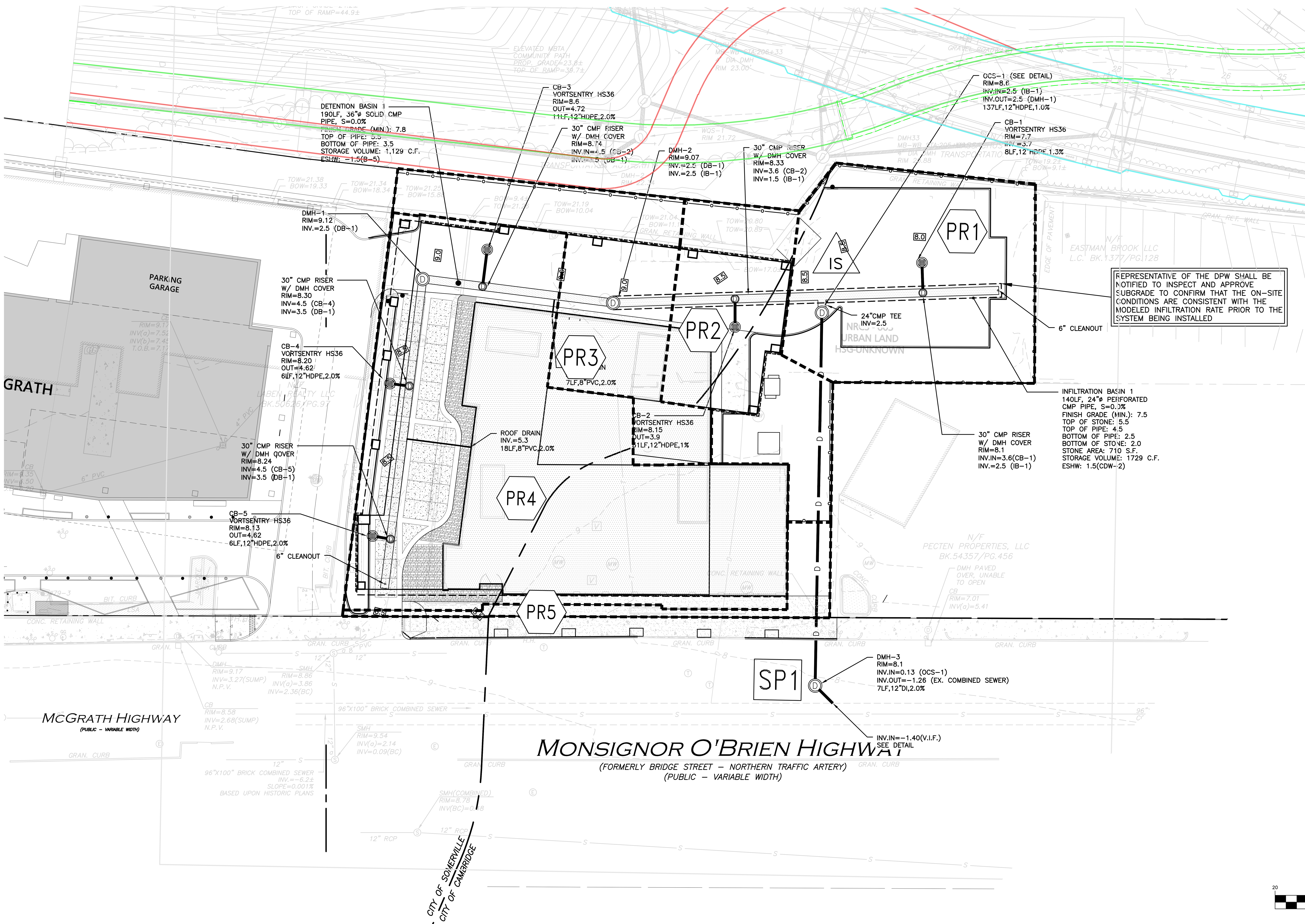

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

R:\PROJECTS\1362-16\CIVIL\DRAWINGS\CURRENT\C-1362-16 – WATERSHED_POST.DWG

REV	DATE	DESCRIPTION
1	09-01-22	MISC. PER CITY COMMENTS

OWNER:
SOMERBRIDGE HOTEL LLC
c/o JAL HOSPITALITY DESIGN, LLC
10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

PROJECT:
199 ROOM DUAL BRAND HOTEL
263 MONSIGNOR O'BRIEN HIGHWAY
CAMBRIDGE, MA

1 McGRATH HIGHWAY
SOMERVILLE, MA

PROJECT NO.	1362-16	DATE:	NOVEMBER 5, 2021
SCALE:		DWG.:	C-1362-16 - Watershed_Post
DESIGNED BY:	SM	CHECKED BY:	MM

PREPARED BY:

ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ♦ land surveying
environmental consulting ♦ landscape architecture
www.allenmajor.com

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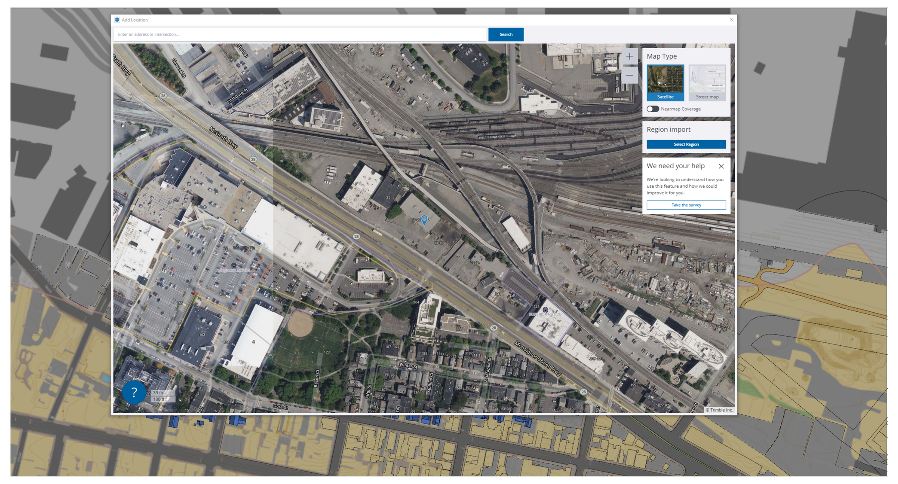
MANCHESTER, NH 03103
TEL: (603) 627-5500 FAX: (603) 627-5501

WOBURN, MA ♦ LAKEVILLE, MA ♦ MANCHESTER, NH

DRAWING TITLE:
POST DEVELOPMENT WATERSHED PLAN

SHEET No.
WS-2


GOOGLE LOCATION OVERLAY ON SKETCH UP PRO FOR GEO LOCATION

KEY:

EXISTING

HOTEL

MBTA BUS T

9 AM MARCH 21

12 PM MARCH 21

3 PM MARCH 21

1 VERNAL EQUINOX - SHADOW STUDIES

N PROJECT NORTH

N TRUE NORTH

jal Hospitality Design, LLC

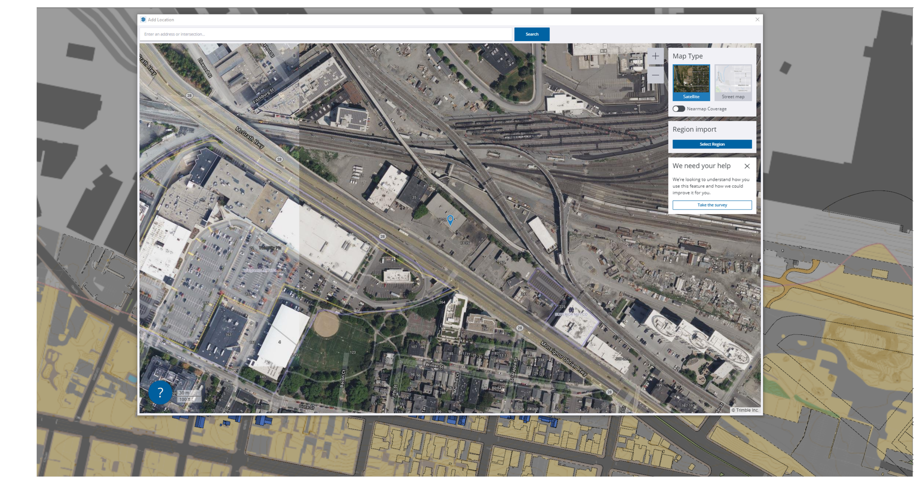
10 CABOT ROAD, SUITE 209
MEDFORD, MA 02155

AC HOTEL & ELEMENT

263 MONSIGNOR OBRIEN HWY CAMBRIDGE, MA 02141
1 MCGRATH HWY, SOMERVILLE, MA 02143

VERNAL EQUINOX - SHADOW STUDIES

2021_1105
REVISED: 2022_0901



9 AM JUNE 21

12 PM JUNE 21

KEY:

- **EXISTING**
- **HOTEL**
- **MBTA BUS** (T)

3 PM JUNE 21

6 PM JUNE 21

(1) SUMMER SOLSTICE - SHADOW STUDIES

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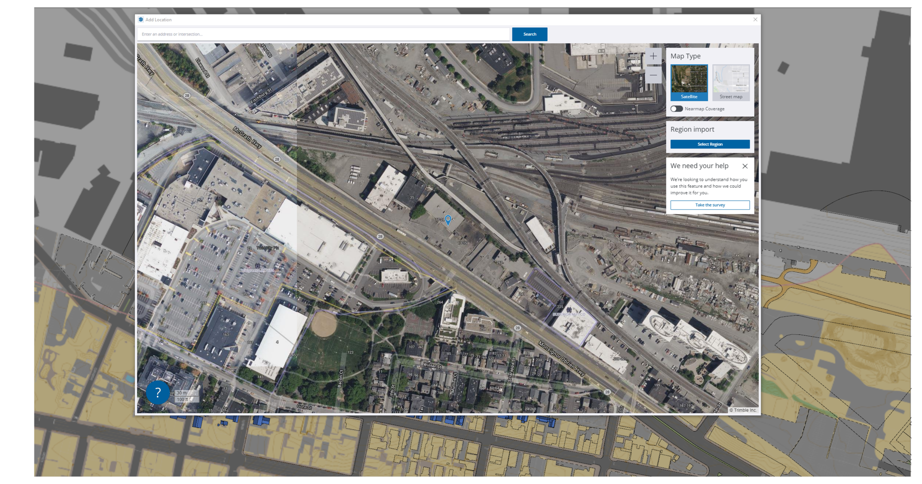
1 MCGRATH HWY, SOMERVILLE, MA 02143

SUMMER SOLSTICE - SHADOW STUDIES

2021_1105
REVISED: 2022_0901



GOOGLE LOCATION OVERLAY ON SKETCH UP PRO FOR GEO LOCATION

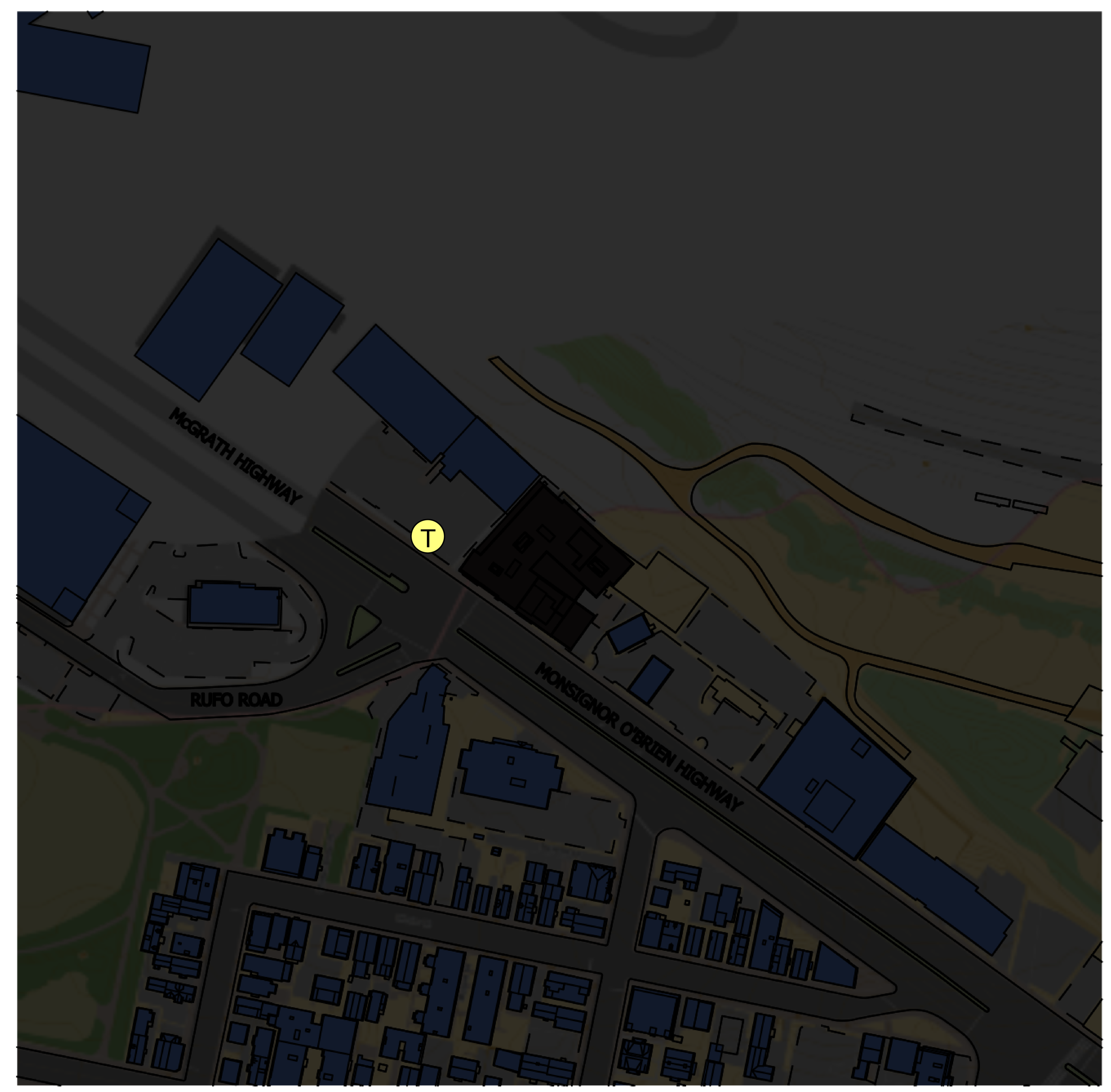
9 AM SEPTEMBER 21

12 PM SEPTEMBER 21

KEY:

- **EXISTING**
- **HOTEL**
- **MBTA BUS** (T)

3 PM SEPTEMBER 21



6 PM SEPTEMBER 21

(1) AUTUMNAL EQUINOX - SHADOW STUDIES

PROJECT NORTH — TRUE NORTH

jal Hospitality Design, LLC

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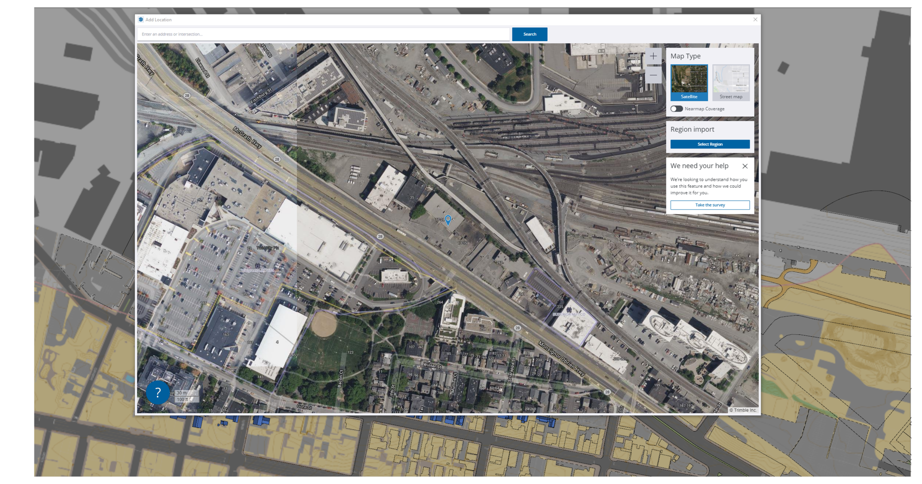
MEDFORD, MA 02155



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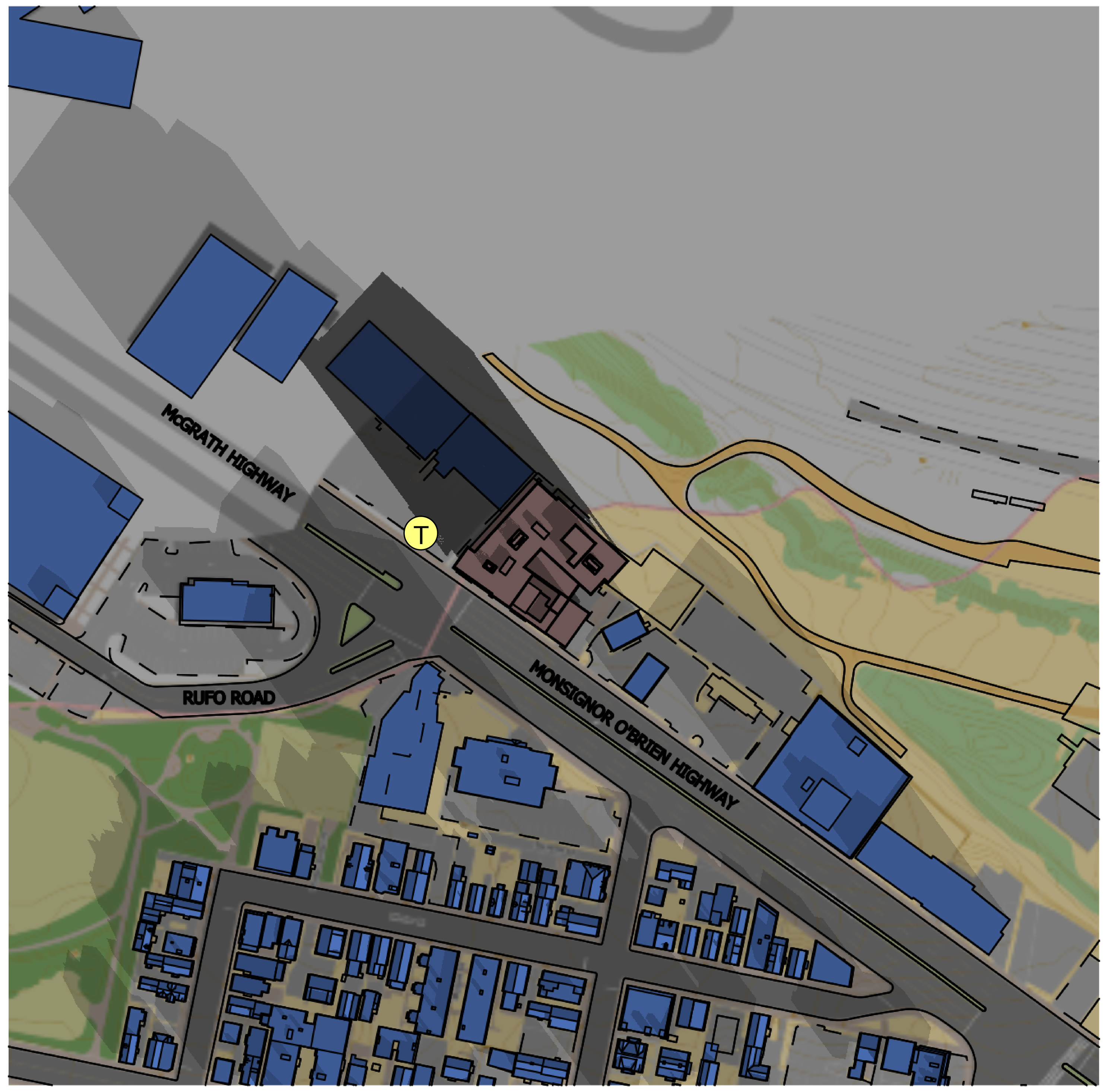
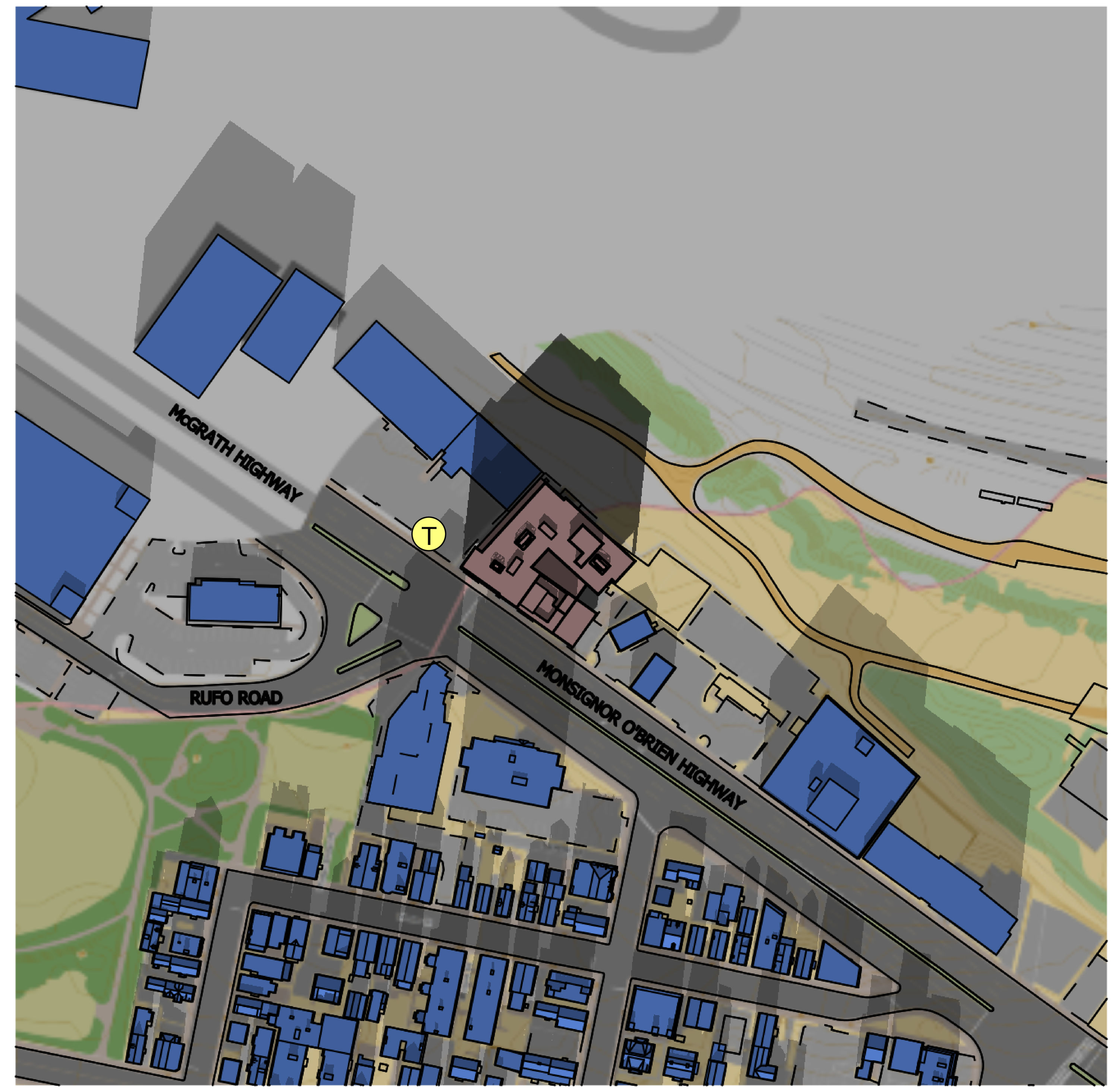


9 AM DECEMBER 21



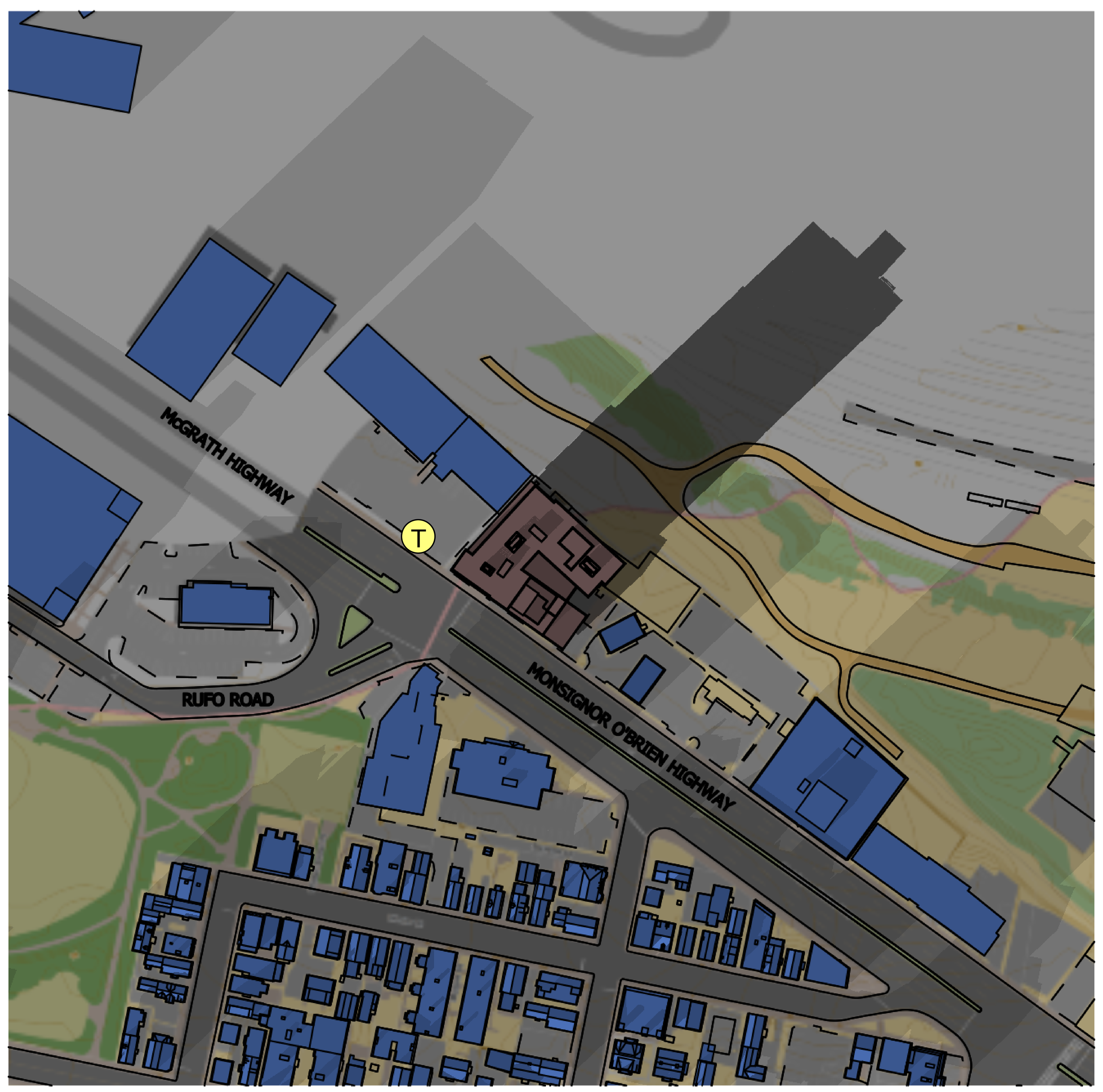
12 PM DECEMBER 21

KEY:

EXISTING

HOTEL

MBTA BUS (T)



3 PM DECEMBER 21

(1) WINTER SOLSTICE - SHADOW STUDIES

N — PROJECT NORTH

N — TRUE NORTH

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MEDFORD, MA 02155

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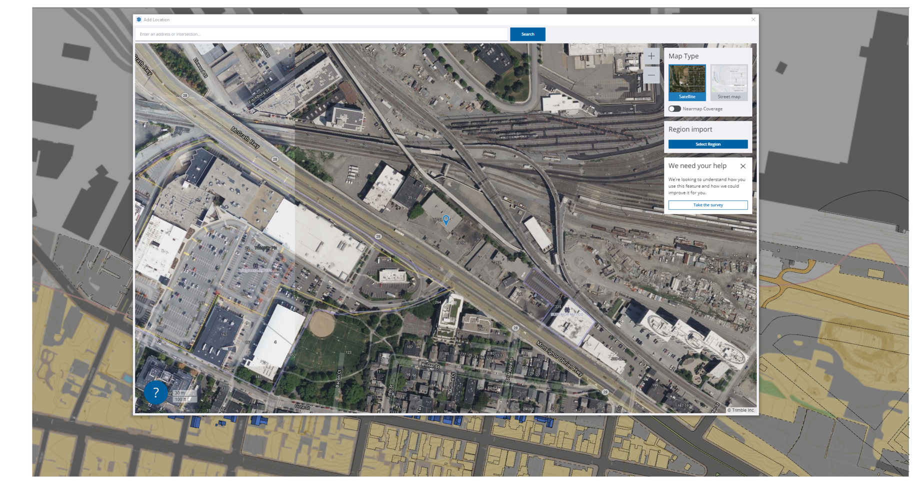
WINTER SOLSTICE - SHADOW STUDIES

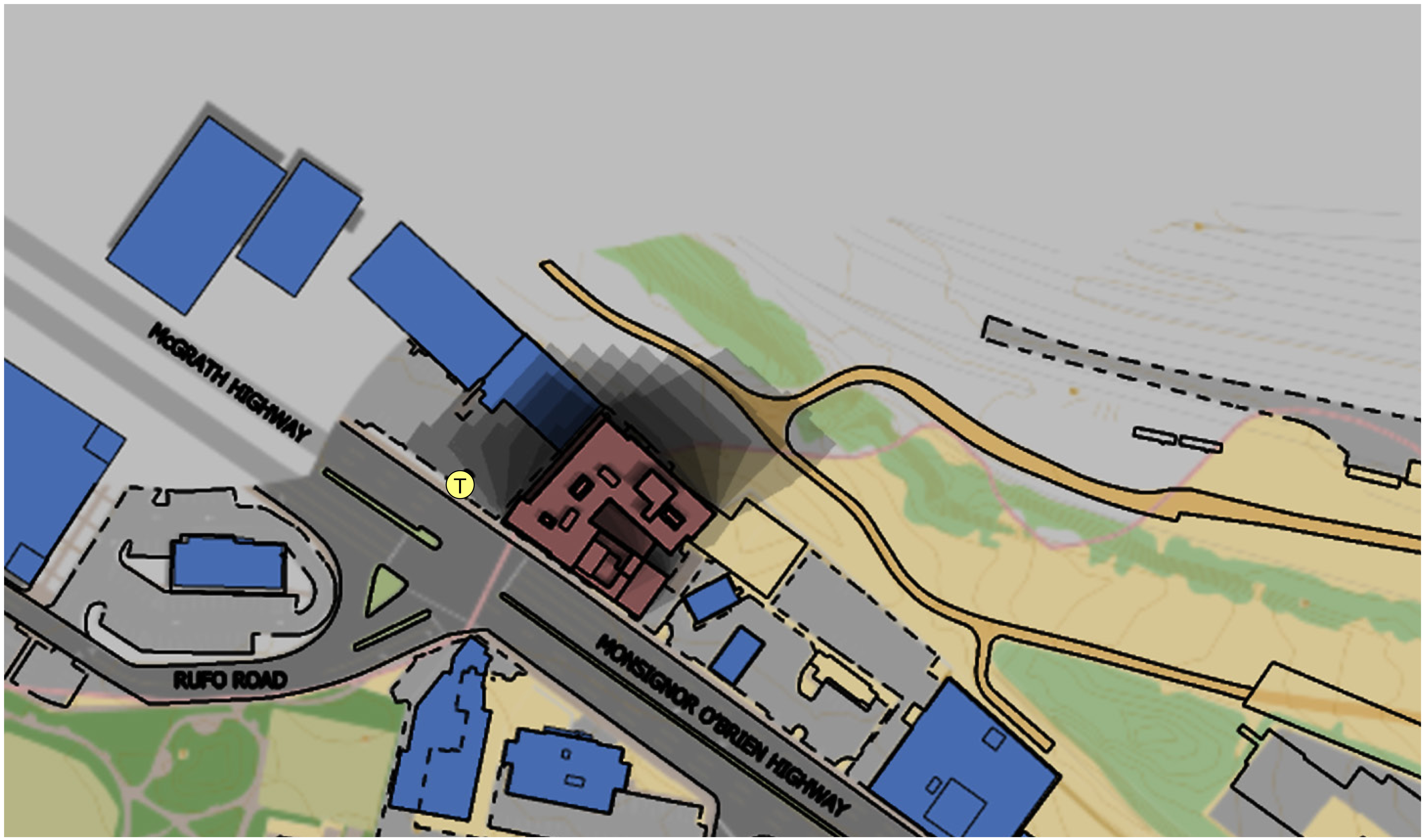
2021_1105
REVISED: 2022_0901



GOOGLE LOCATION OVERLAY ON SKETCH UP PRO FOR GEO LOCATION

KEY:

- **EXISTING**
- **HOTEL**
- **MBTA BUS** (T)



(1) MARCH CUMULATIVE SHADOW OVERLAY

N — PROJECT NORTH

N — TRUE NORTH

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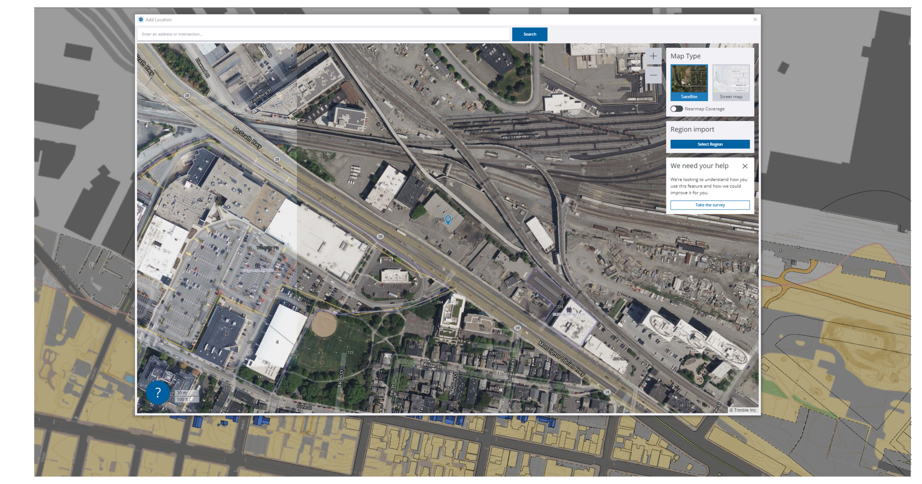
MEDFORD, MA 02155



GOOGLE LOCATION OVERLAY ON SKETCH UP PRO FOR GEO LOCATION

KEY:

EXISTING	
HOTEL	
MBTA BUS	T

1 JUNE CUMULATIVE SHADOW OVERLAY

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N TRUE NORTH

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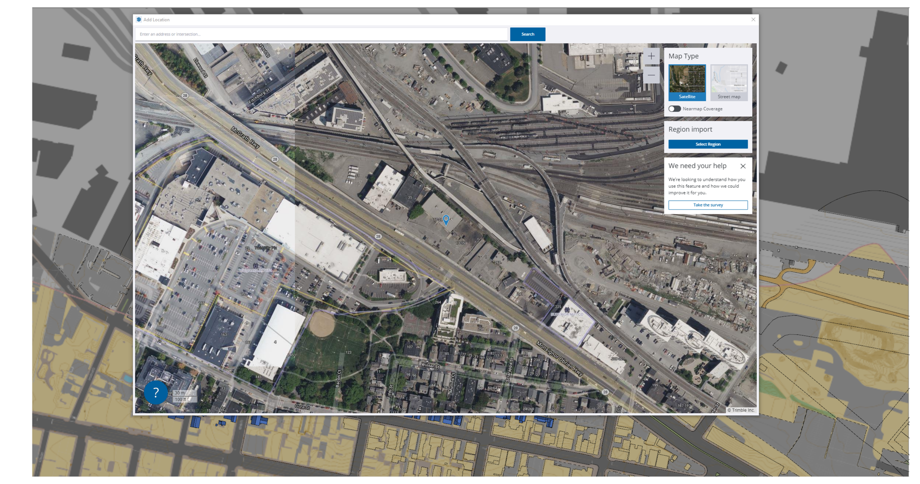
MEDFORD, MA 02155



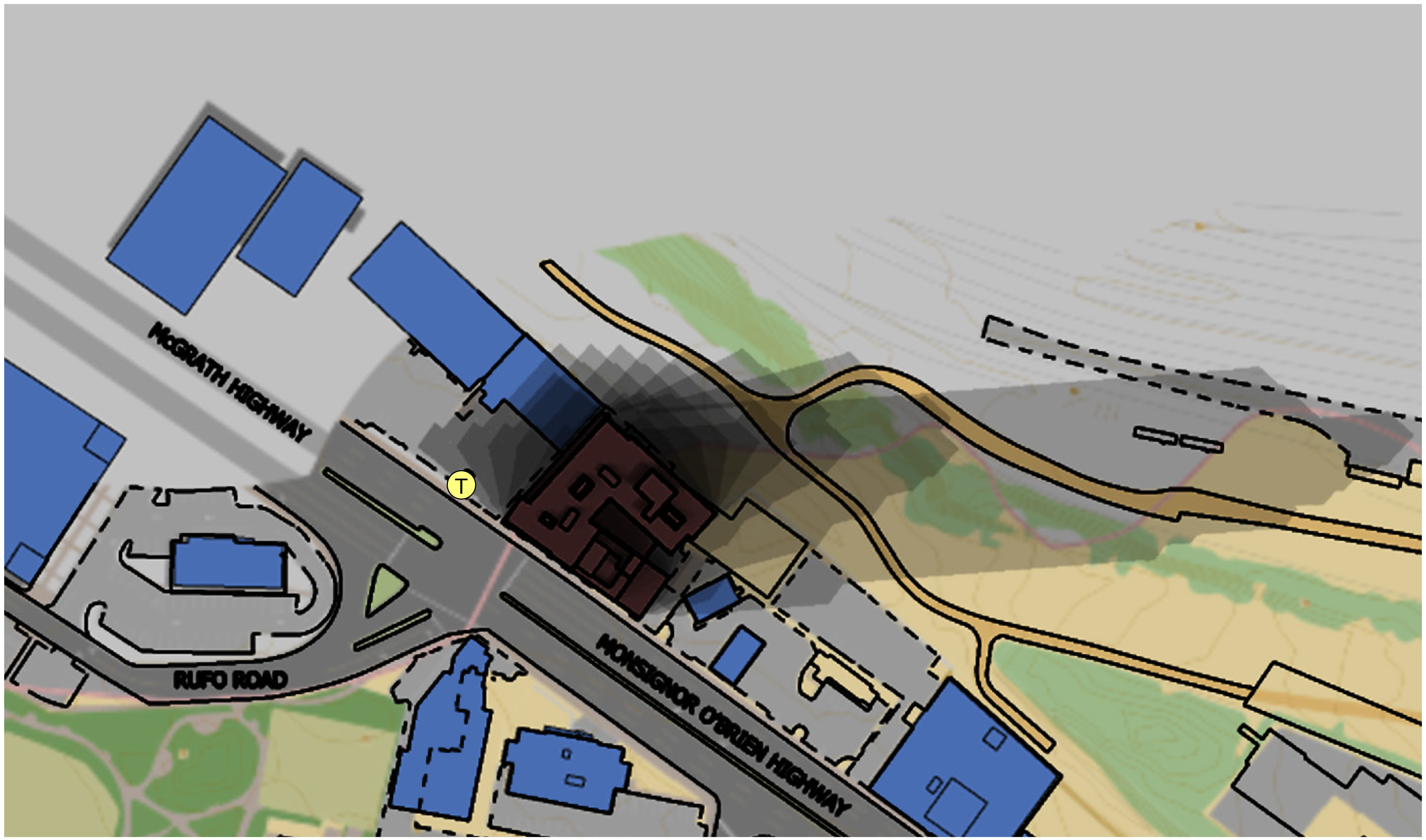
GOOGLE LOCATION OVERLAY ON SKETCH UP PRO FOR GEO LOCATION

KEY:

EXISTING

HOTEL

MBTA BUS (T)



(1) SEPTEMBER CUMULATIVE SHADOW OVERLAY

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jal Hospitality Design, LLC

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MEDFORD, MA 02155

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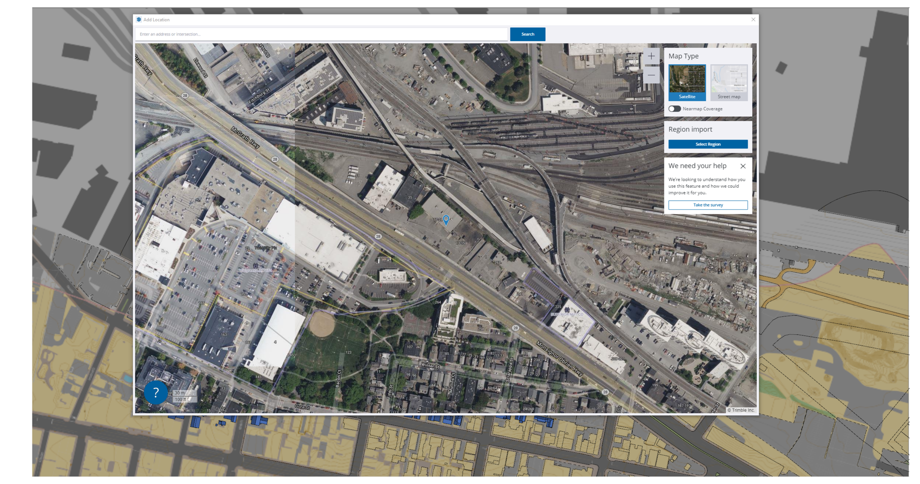
SEPTEMBER CUMULATIVE SHADOW OVERLAY

2022_0901



GOOGLE LOCATION OVERLAY ON SKETCH UP PRO FOR GEO LOCATION

KEY:

EXISTING

HOTEL

MBTA BUS (T)

1 DECEMBER CUMULATIVE SHADOW OVERLAY

N PROJECT NORTH

N TRUE NORTH

jal Hospitality Design, LLC

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MEDFORD, MA 02155

AC HOTEL & ELEMENT

263 MONSIGNOR OBRIEN HWY CAMBRIDGE, MA 02141
1 MCGRATH HWY, SOMERVILLE, MA 02143

DECEMBER CUMULATIVE SHADOW OVERLAY

2022_0901