Stormwater Report

The Residences at 1500 Main
1500 Main Street
Weymouth, Massachusetts

CHA Project Number: 34672

Submitted To:
Weymouth Board of Zoning Appeals
75 Middle Street
Weymouth, MA 02189

Applicant:
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1500 Main Street, Weymouth
By: USDA and NRCS

LIST OF ACRONYMS & ABBREVIATIONS

BFE	Base Flood Elevation
BMP	Best Management Practice
BVW	Bordering Vegetated Wetland
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
HSG	Hydrologic Soil Group
IWPA	Interim Wellhead Protection Area
MAHW	Mean Annual High-Water
MassDEP	Massachusetts Department of Environmental Protection
NAVD	North American Vertical Datum
NRCS	Natural Resources Conservation Service
SHGW	Seasonal High Groundwater
SWMSH	Stormwater Management Standards Handbook
Tc	Time of Concentration
TSS	Total Suspended Solids
USGS	United States Geological Survey

1.0 NARRATIVE

1.1 EXECUTIVE SUMMARY

On behalf of John M. Corcoran & Co., LLC., (Applicant), CHA has prepared this Stormwater Report for the proposed development of three new buildings (apartments and mixed use) located at 1500 Main Street in Weymouth, Massachusetts. The site is approximately 5.54 acres (See Figure 1 – Locus) in size. The existing site contains two buildings with a floor area of 17,145 square feet. The existing use is listed as Industrial Warehouse according to the Town of Weymouth assessors' database. The property has frontage on Main Street which is 114± feet in length. The property also has 600± feet of frontage on Trotter Road which is a private roadway owned/controlled by Union Point Residential LLC.

The property is bounded to the west by a CVS store and diner and further west by Main Street (Route 18), to the south by residential properties, to the east by the MBTA tracks and US Coast Guard Buoy Depot, and to the north by MBTA South Weymouth Station parking lot and a commercial lot. The underlying zone of the parcel is Limited Business (B-1), according to the Town of Weymouth Zoning Map, but the site is also located within the Commercial Corridor Overlay District. The Commercial Corridor Overlay District was created to permit the incorporation of a residential component as part of mixed-use developments which are not possible within the underlying Business District (B-1). A Special Permit issued by the Board of Zoning Appeals is needed for proposed development submitted under the Commercial Corridor Overlay District requirements.

A portion of the site is located within the Floodplain Overlay District (See Figure 3 – FEMA Firm Floodplain Map). This district includes all special flood hazard areas, established by FEMA, within the Town of Weymouth. The site is not located within a Zone II as designated by MA DEP or within a habitat area designated by the Natural Heritage and Endangered Species Program (NHESP). The site is not located within a Zone I of Zone II of public water supply.

The purpose of this stormwater analysis and report is to assess and compare existing and proposed hydrologic conditions at the property to demonstrate that the stormwater management system design effectively satisfies the requirements of the Massachusetts Stormwater Regulations and the Weymouth Stormwater Protection Ordinance.

There is no existing drainage infrastructure on the site. Currently, stormwater runoff from the impervious surfaces primarily discharge overland toward the undeveloped portion of the site to the low point at the wetland resource area. A portion of the roof nearest to Trotter Road and adjacent impervious areas drain towards Trotter Road.

The proposed project will create a net new impervious area of 1.706 acres. To offset impacts from the increase in impervious area the site design provides stormwater runoff treatment using Best Management Practices (BMPs) including deep sump hooded catch basins, isolator rows, porous pavers, and subsurface infiltration systems. These BMPs are further described in this report and as shown on the attached site development plans. The proposed stormwater management system will

reduce the peak stormwater discharge rates and volume by utilizing outlet control structures to control outflows from the detention/infiltration systems as documented in the included HydroCAD model.

The proposed stormwater management system design complies with all applicable sections of Weymouth Wetlands Protection Ordinance and the 2008 Massachusetts Stormwater Regulations by utilizing multiple BMP's including the subsurface detention/infiltration systems to collect, treat, and control stormwater runoff generated on the site during storm events. The proposed improvements are shown on the attached site development plans prepared by CHA, 141 Longwater Park Drive, Norwell, Massachusetts.

1.2 OBJECTIVE OF CALCULATIONS

The purpose of this stormwater analysis is to assess and quantify the existing and proposed stormwater runoff conditions from the site based upon standard methodologies in accordance with the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards and the applicable provisions of the Town of Weymouth Wetlands Protection Ordinance.

The goals of the stormwater management system design for this project are to provide for stormwater quality treatment, reduction in post-development peak runoff rates as compared to pre-development peak runoff rates, improve water quality, and to protect the surrounding area from any potential flooding impacts in accordance with the Stormwater Management Regulations. The following analysis includes stormwater routing calculations performed using the 2-year, 10-year, 25-year, and 100-year frequency, Type III, 24-hour SCS design storms.

1.3 METHODOLOGY

The HydroCAD Stormwater Modeling computer program, version 10.00, by Applied Microcomputer Systems, Inc. is used to develop peak stormwater runoff rates and volumes for the existing and proposed conditions at the project site. The HydroCAD software is a hydrograph generation and routing program like TR-20. The software uses Soil Conservation Service (SCS) Unit Hydrograph Methodology. Information regarding the equations and calculation procedures utilized in HydroCAD will be made available upon request.

The following basic steps are employed in the routing procedure:

1. A rainfall distribution is selected which indicates how the storm rainfall depth will be distributed over time. This is the standardized Type III SCS distribution based upon the project's location.
2. The design storm rainfall amount is determined from rainfall frequency atlas based upon the return period being modeled. Combined with the distribution of rainfall, a cumulative rainfall depth at each period during the storm is determined.
3. Based upon the Time of Concentration (Tc), the storm is divided into bursts of equal duration. For each burst, the SCS runoff equation and the average Curve Number are used to determine the portion of that burst that will appear as runoff.

4. A unit hydrograph representing the runoff resulting from one inch of precipitation excess generated uniformly over the watershed in conjunction with the Time of Concentration is used to determine how the runoff from a burst is distributed over time. The result is a runoff hydrograph for a single burst.
5. Individual hydrographs are added together for all bursts in the storm yielding the complete runoff hydrograph for each storm.

The SCS rainfall distributions are derived from observations that were used to develop the Intensity-Duration-Frequency relationship or IDF curve. By studying the Weather Bureau's Rainfall Frequency Atlases, the SCS developed four "mass curves" that could be used to represent the characteristics of the rainfall distribution throughout the continental United States. The mass curve is a dimensionless distribution of rainfall over time, which indicates the fraction of the rainfall event that occurs at a given time within a 24-hour precipitation event. This synthetic distribution develops peak rates for storms of varying durations and intensities. The SCS distribution provides a cumulative rainfall at any point in time and allows volume dependent routing runoff calculations to occur.

The HydroCAD software has the additional capability to describe shallow concentrated flow. The "NEH-4 Upland Method" included in the HydroCAD software is applicable for conditions which occur in the headwaters of a watershed up to 2,000 acres. The NEH-4 Upland Method allows the Time of Concentration (Tc) to reflect ground conditions such as overland flow, grassed waterways, paved areas and upland gullies. This results in a model that more accurately reflects the ground surface for shallow concentrated flow conditions, than TR-20, which is limited to distinguishing only paved and unpaved surfaces. Tc is the time required for water to flow from the most distant point on a runoff area to the measurement or collection point. In instances where the watersheds are small and impervious, Tc has been directly entered as a 6-minute minimum, or 0.1 hours. This is consistent with standard engineering practice and Technical Release (TR-55) Urban Hydrology for Small Watersheds graphical method. A lower boundary of 6 minutes will yield a conservative, yet practical measure of stormwater runoff flow for small watersheds contained within the development.

The curve number or CN is a land sensitive coefficient that determines the relationship between total rainfall depth and direct stormwater runoff. Based upon the cover in each sub-watershed a weighted average CN value was determined. The area, CN value, and time of concentration are input into the HydroCAD modeling software to develop runoff hydrographs for the pre and post-developed conditions at the site.

As previously mentioned, two design points were chosen at the down gradient point in each of the drainage areas to compare runoff conditions for both the pre development and post development conditions for each of the following SCS Type III 24-hour design storm events. The design storm frequencies and corresponding rainfall depths were compiled from the "Atlas of Precipitation Extremes for the Northeastern United States and Southeastern Canada" and Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and 1 to 100 Years" and have been estimated as follows for Norfolk County:

Storm Frequency (Years)	Rainfall Depth (Inches)
2	3.2
10	4.7
25	5.5
100	6.7

Drainage area maps for both pre- and post-development conditions have been included in this submission in Section 3.3 of this Stormwater Report.

1.4 SITE HYDROLOGY

Hydrologic soil groups (HSG) are used primarily to estimate runoff from precipitation in engineering calculations. HSG designations vary from "A" to "D" with "A" having the highest infiltration rate and "D" the slowest. The delineated soil boundaries from the Natural Resources Conservation Service (NRCS) soil survey show that the middle and north portions of the site consist of 602 Urban Land and the south portion consists of 260B Sudbury fine sandy loam (HSG B). Additional soil information can be found in the attached "Custom Soil Resource Report for Norfolk and Suffolk Counties, Massachusetts, 1500 Main Street, Weymouth" by the NRCS.

An array of soil test pits and borings were also performed across the site to examine soils and groundwater levels. The Foundation Engineering Report, by McPhail Associates, LLC, summarizes the onsite testing information and confirms widespread fill (gravely sand with traces of silt) layer overtop glacial outwash (fine sandy loam). For surface runoff calculations, the entire site has been classified as HSG C to approximate the amount of runoff generated by the fill soils and remaining soils in the location in and around the onsite, slow draining, wetland area. The HSG C assumption will also be used in the post developed runoff conditions.

The onsite testing of the glacial outwash underlying the fill layers is consistent with the soil description of the NRCS report for Sudbury fine sandy loam (HSG B). For the infiltration calculations in the HydroCAD model, the rate has been conservatively assumed as Sandy Loam (HSG B) at 1.02 in/hr.

1.4.1 PRE-DEVELOPED HYDROLOGY

The existing site utilized overland flow to direct stormwater runoff to the onsite wetland depression on the south end of the site (Design Point, DP-1) and to a catch basin in Trotter Road (Design Point DP-2). There is currently no onsite stormwater infrastructure to capture and conveyance runoff.

The site is analyzed and divided into sub-watershed areas that are tributary to those design points. The sub-watershed areas are depicted on the Pre-Developed Drainage Subcatchment Plan (DR-1) that is included in Section 3.3.1. of this report. The ground cover condition of the existing drainage areas consists pavement, roofs, and wooded areas. The hydrologic soil group (HSG) is assumed to be "C" for all sub catchments in this analysis.

The existing condition hydrology consists of two different sub-catchment areas, Area 1S and Area 2S. There are two design points selected as analysis points, DP-1 is the existing wetland and DP-2 is Trotter Road, which captures stormwater runoff from the property through an existing catch basin.

Existing Conditions Sub-catchment Area 1S

This sub-catchment encompasses the majority of the site and is the area tributary to the existing wetland. Stormwater runoff runs from a high point on the property and flows down the slope towards the wetland. The major cover types in Sub-catchment Area 1S are woods and impervious area (roof, pavements).

Existing Conditions Sub-catchment Area 2S

This sub-catchment encompasses the area tributary to DP-2 and consists mainly of pavement/roof areas. Stormwater runoff runs from a high point on the pavement and flows toward Trotter Road.

1.4.2 POST DEVELOPED HYDROLOGY

The proposed project consists of the construction of three multi-story buildings, two of which will contain underneath parking garages. A large parking area is also proposed in the center of the project site. Along Trotter Road, the pedestrian walkway areas have been designed with porous pavers to directly infiltrate stormwater runoff. The runoff from the proposed buildings' roofs will be collected and conveyed directly to the subsurface infiltration chamber systems.

Stormwater runoff generated from the proposed driveways and parking lots will be collected, treated, and infiltrated through deep sump hooded catch basins and multiple subsurface StormTech MC-3500 drainage chambers systems (UG-1, 2, 3, 4, & 5) located beneath the pavement. Stormwater discharges from the subsurface system will be controlled through an outlet control structure (OC) and conveyed via a pipe system to the existing onsite wetland. Stormwater runoff that flows towards the project site from the adjacent property will be diverted around Building C and towards the existing wetland.

The post development hydrologic model consists of seven (7) different sub-catchment areas, Area 1S through Area 7S. Refer to the Post-developed Drainage Subcatchment Plan (DR-2), attached in Section 3.3.2 of this report. The analysis is performed utilizing the same two design points as in the existing conditions case to allow comparison. Design Point 1 (DP-1) is the analysis point for post developed hydrologic conditions at the existing onsite wetland, and Design Point 2 (DP-2) is the analysis point for conditions expected at the catch basin inlet in Trotter Road.

Proposed Conditions Sub-catchment Areas 1S – 5S

The sub-catchment areas 1S through 5S are made up of proposed building areas and pavement areas. Each sub-catchment collects stormwater through catch basins and conveys

runoff to the respective subsurface infiltration chamber systems, labeled 1P through 5P in the hydrology model and on plan DR-2. The Tc path is set to the minimum recommended time of 6 minutes.

Proposed Conditions Sub-catchment Area 6S
This sub-catchment is comprised of the remaining on-site and off-site areas tributary to the onsite wetland. The catchment area consists of impervious area from the adjacent property and the remaining onsite wooded areas outside the project's limit of work. Most runoff flows overland directly to the wetland. The pavement on the adjacent property is proposed to be collected in a gravel trench with perforated pipe underdrain to convey stormwater around the proposed Building C and to the wetland area. The underdrain will discharge to energy dissipator/level spreader to prevent erosion.

Proposed Conditions Sub-catchment Area 7S
This sub-catchment is comprised of the pedestrian walkway area adjacent to Trotter Road. The catchment area consists mainly of porous pavers and landscaped areas. A conservative CN value of 70 was assumed for the porous pavers, which in actuality, will generate little runoff. The proposed grades slope this area towards the gutter line of Trotter Road and to the existing catch basin designated Design Point 2 (DP-2). The Tc path is the minimum of 6 minutes based on the impervious area.

1.5 STORMWATER MANAGEMENT

The following section describes how the proposed project addresses and complies with the 2008 MassDEP Stormwater Management Regulation requirements.

Standard 1: No New Untreated Discharges – No new stormwater system conveyances will discharge untreated runoff or cause erosion in wetlands or waters of the Commonwealth.

The new stormwater system conveyances will not discharge untreated runoff or cause erosion in wetlands or waters of the Commonwealth. Please see rip-rap calculations in Section 4.4 that will show the design of the energy dissipator that will prevent erosion at the pipe outlets.

Standard 2: Peak Rate Attenuation – Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

The peak discharge rates are calculated with the aid of a hydrograph routing program using TR-20 methodology called HydroCAD. The HydroCAD calculations estimating the expected Pre- and Post-Development runoff peak rates have been performed. The proposed HydroCAD analysis examines hydrologic conditions at two design points as shown on the Watershed Plans. The analysis demonstrates that the proposed stormwater management system reduces post-development peak rates of runoff below pre-development peak rates. Refer to Section 1.8 for a summary of pre-development and post-development peak runoff rates for comparison.

<u>Standard 3: Recharge</u> – 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. MassDEP also recognizes that on some sites, there is a risk that infiltrating the required recharge volume may cause or contribute to groundwater contamination. MassDEP requires infiltration only to the maximum extent practicable on project sites where contamination has been capped in place.

The project's stormwater management system utilizes subsurface infiltration/detention chamber systems and porous pavers to provide recharge. Based on the recharge calculations contained in this Stormwater Report, the proposed project provides the Required Recharge Volume to meet the requirements for Standard 3. Please refer to the Required Recharge Volume calculations located in ***Section 4*** *of this Stormwater Report.*

<u>Standard 4: Water Quality</u> – 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.**

The project proposes to use deep sump hooded catch basins to remove 25% TSS followed by Isolator Rows (69%) to remove greater than 44% prior to infiltration (80%) from the MC-3500 StormTech units for a total greater than 80% TSS removal for the project. The Long-Term Pollution Prevention Plan is included in conjunction with the Operation and Maintenance Plan required by Standard 9, which outlines routine inspections, cleaning & street sweeping procedures and frequencies. Refer to Section 4.1 of this report for the TSS removal calculation worksheet.

<u>Standard 5: Land Uses with Higher Potential Pollutant Loads</u> – 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.

The project is considered a LUHPL (Land Use with Higher Potential Pollutant Load) due to the proposed parking lot potentially generating of over 1,000 vehicle trips per day. The stormwater design has used the 1.0-inch Water Quality Volume (WQV) converted to a flow in calculating the proposed BMP sizes. The design also provides 44% or greater pretreatment before stormwater is infiltrated through the use of Deep-sump Catch basins (25%) and Isolator Rows (69%) BMPs. Runoff collected in the parking garage areas are treated with oil/grit separators before discharging to the sanitary sewer system.

Standard 6: Critical Areas – Critical areas are Outstanding Resource Waters as designated in 314 CMR 4.00, Special Resource Waters as designated in 314 CMR 4.00, recharge areas for public water supplies as defined in 310 CMR 22.02 (Zone Is, Zone IIs, and Interim Wellhead Protection Areas for groundwater sources and Zone (A)s for surface water sources.)

There are no critical areas associated with this project.

Standard 7: Redevelopment and Other Projects Subject to the Standards only to the maximum extent practicable – 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.

The project is considered a mix of new development and redevelopment per the Stormwater Handbook. The project has been designed to fully comply with the MA Stormwater regulations as a new development.

Standard 8: Construction Period Pollution Prevention Plan and Erosion and Sedimentation Control – 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.

The project will require an EPA NPDES Construction General Permit and the prerequisite Stormwater Pollution Prevention Plan prior to commencement of construction activities.

Standard 9: Operation and Maintenance Plan – A long-term Operation and Maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

An Operation and Maintenance Plan has been prepared for this project. Refer to Section 2 attached. Provisions to maintain runoff control devices have been assured through non-structural, structural, and construction management approaches.

<u>Standard 10: Prohibition of Illicit Discharges</u> – All illicit discharges to the stormwater management system are prohibited.

The Operation and Maintenance plan required by Standard 9 includes measures to prevent illicit discharges. An Illicit Discharge Compliance Statement is included in Section 4.6.

1.6 BEST MANAGEMENT PRACTICES (BMP'S)

A system of deep sump hooded catch basins and StormTech Isolator Rows are proposed to treat site generated stormwater runoff. See Section 4.3 for the Total Suspended Solids (TSS) calculation spreadsheet. A description of the devices used to provide treatment is provide below.

1.6.1 PROPOSED STRUCTURAL AND TREATMENT BMPs

1. DEEP SUMP HOODED CATCH BASINS

Deep sump catch basins are modified versions of inlet structures installed to collect and convey stormwater on the site. The deep sumps, typically a 4-ft dimension below the outlet pipe invert, are most effective of placed "off-line"; that is they do not have inlet pipes. The catch basins contain traps or hoods on the outlet pipes and serve as pretreatment for other downstream BMPs. Deep sump catch basins will be installed throughout the site to remove trash, debris, sediment and a limited amount of oil and grease from stormwater runoff. Catch basins shall be cleaned, in dry weather, when half of the sump capacity is filled or at a minimum quarterly or as required through periodic inspection. Cleaning will take place at the completion of construction and in early spring after sanding of roadways has ceased or as needed depending on the frequency of major storm events (greater than 1-inch of rainfall).

2. ISOLATOR ROWS

The Isolator Row is a series of StormTech chambers surrounded with filter fabric and connected to one or more manholes for access. The chambers are wrapped in fabric and provide settling and filtration. Stormwater runoff is first directed to the Isolator Row where they capture sediments, thereby protecting the rest of the underground system consisting of standard chambers in a stone bed. This technology will be used as a part of a treatment train consisting of other structural and non-structural approaches such as street sweeping and reduced road salt alternatives. Isolator Rows will be inspected routinely and cleaned in accordance with manufacturer's recommendations.

3. SUBSURFACE INFILTRATION SYSTEMS (UG-1, UG-2, UG-3, UG-4, UG-5)

A subsurface drainage system consisting of high-density polyethylene plastic chambers (StormTech) set in a stone bed are proposed to detain, recharge, and infiltrate storm runoff. The chamber system aims to provide peak flow reduction, stormwater runoff volume reduction, and TSS removal for various storm events. The proposed system drains down completely between storm events due to the orifice being placed at the bottom of the detention chambers. Manhole risers or manufacturer recommended inspection ports are proposed at the ground surface to allow inspection and maintenance access.

4. OUTLET CONTROL STRUCTURES

The outlet control structure (OCS) detains the stormwater utilizing orifices to control the outlet flow and are below grade with access via covers to grade. Although the outlet control structures should not collect much debris, they should be inspected along with the underground system inspection to make sure they are clean of debris and functioning properly. Sand accumulation within the OCS is a sign there is an issue with the upstream stormwater treatment device. The OCS shall be inspected once per year. It may be necessary to clean the structure and the use of a vacuum truck may be necessary.

5. POROUS PAVERS

Porous pavers will be located on the outer edges of the parking lot and identified on the attached site plans. The pavers will store stormwater in a stone reservoir layer beneath the surface. Stormwater will then flow down through the reservoir and infiltrate into the groundwater.

6. LEVEL SPREADER/PLUNGE POOL/ENERGY DISSIPATER AND DOWNSTREAM SLOPES:

The level spreader/plunge pool/energy dissipaters are utilized at the outlet pipes prior to discharge to the wetland to prevent erosion. The level spreader/plunge pool/energy dissipaters should be inspected at least once a year for sand accumulation and debris which may impact its effectiveness to slow water. Cleaning should take place during the early spring, although, additional inspections and cleaning may be needed.

In order to ensure that the level spreader systems are working, the outlets as well as slopes downstream for the first three (3) years of operation, should be inspected after every storm of 1" or greater to assure no erosion of the slope. After the first three years, we recommend inspections after any large storm (25+ year event) for erosion. If no erosion is evident, then the stone size and level spreader design is adequate. Should there be erosion of the level spreader, stone size should be increased or additional large stones added to enhance energy dissipation of water. If downstream slopes exhibit signs of erosion, repairs to soils and slope should be made and then a treatment such as an erosion control matting should be instituted to reinforce soils until vegetative cover can be restored. We recommend that the aprons and downstream slopes be inspected and cleaned annually as part of the outlet maintenance to ensure future adequacy.

1.7 HYDRAULICS AND PIPE SIZING

The closed-conveyance storm drain collection system was analyzed using the Rational Method.

Q = CiA, for estimating runoff where C is a coefficient dependent on land cover, is storm intensity in in/hr based upon published I-D-F curves, and A is area in acres. Q or flow is calculated in cubic feet per second.

The project site and access road were subdivided by catch basin or inlets based upon drainage areas tributary to each. A "C" value for each area was assigned based upon overall character of land. "C" values ranged from 0.9 in paved/impervious conditions to 0.3 for grass and landscaped areas. IDF curves from Boston, Massachusetts are used to establish the rainfall rate for the 100-year event.

Pipe hydraulic design was completed using Manning's full flow capacity equation for circular pipe with an n-value of 0.013 for PVC.

Q = 1.49/n AR2/3 S1/2, where, n is coefficient depending on channel roughness, A is area of flow, R is the hydraulic radius, and S is the channel slope.

1.8 SUMMARY OF HYDROLOGY & STORMWATER CALCULATIONS

The results of the pre and post-development hydrology calculations provided in Section 3 are summarized in the following tables. The table corresponds to the design points as indicated on the drainage area maps and hydrograph routing calculations.

TOTAL RUNOFF PEAK FLOW RATE (CFS)
DESIGN POINT 1 (DP-1)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	7.89	7.87	-0.02
10-YEAR	14.27	14.06	-0.21
25-YEAR	17.74	16.93	-0.81
100-YEAR	23.01	22.88	-0.13

TOTAL VOLUME (AF)
DESIGN POINT 1 (DP-1)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	0.754	0.643	-0.111
10-YEAR	1.361	1.263	-0.098
25-YEAR	1.701	1.610	-0.091
100-YEAR	2.224	2.143	-0.081

TOTAL RUNOFF PEAK FLOW RATE (CFS)
DESIGN POINT 2 (DP-2)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	0.67	0.21	-0.46
10-YEAR	0.99	0.44	-0.55
25-YEAR	1.16	0.56	-0.60
100-YEAR	1.41	0.76	-0.65

TOTAL VOLUME (AF)
DESIGN POINT 2 (DP-2)

STORM SCS 24-HR	EXISTING	PROPOSED	DIFFERENCE
2-YEAR	0.053	0.016	-0.037
10-YEAR	0.080	0.031	-0.049
25-YEAR	0.094	0.040	-0.054
100-YEAR	0.116	0.054	-0.062

The proposed project design meets or reduces the flow in the post-developed condition at all Design Points, DP-1 through DP-2 for the listed design storm events. The design also reduces volume at DP-1 and 2 in the 2, 10, 25, and 100-year design storms.

1.9 CONCLUSION

In conclusion, the project provides a reduction in post-developed peak rates and volume of runoff compared to pre-development rates and volume through the detailed design of stormwater Best Management Practices (BMPs). The overall drainage system has been designed to control peak discharge rates and runoff volumes for up to and including the 100-yr design storm event. The design provides total suspended solids (TSS) removal and water quality treatment, as required by the Massachusetts Stormwater Management Regulations.

It is our professional opinion that the proposed development project will not adversely affect the surrounding drainage patterns. The following routing calculations, Best Management Practice design, and associated documentation within this report have been prepared to illustrate that runoff from the project has been mitigated.

1.10 REFERENCES

1. Commonwealth of Massachusetts, Department of Environmental Protection, Stormwater Management Standards Handbook. Volumes 1-3 February 2008 (DEP Stormwater Management Policy 2008).

2. Commonwealth of Massachusetts, Department of Environmental Protection. 310 CMR 10.00: Massachusetts Wetlands Protection Act Regulations. 2008.

3. Commonwealth of Massachusetts, Department of Environmental Protection. 314 CMR 4.00: Massachusetts Surface Water Quality Standards. 2007.

4. Commonwealth of Massachusetts, Department of Environmental Protection. 314 CMR 9.00: Massachusetts Water Quality Regulations. 2008.

5. United States Department of Agriculture, Natural Resources Conservation Services Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55). June 1986.

6. United States Department of Agriculture, Natural Resources Conservation Services Project Formulation Hydrology Program System, Technical Release 20 (TR-20). Oct. 2004.

1.10 GENERAL CONSTRUCTION SEQUENCING

The following section provides construction details and highlights the construction sequence and timing of earthmoving activities. The overall project will be broken down into the following phases:

A. Pre-construction Meeting

An on-site meeting will be conducted by the Owner's Representative prior to the start of construction activity. The appropriate State & Town Departments will be invited to participate. A copy of the Stormwater Pollution Prevention Plan (SWPPP) and NPDES Construction General Permit (CGP) will be provided to applicable parties, Authorities, and Town Departments.

B. Installation of Erosion Controls

Erosion and sedimentation controls (i.e. silt fence, filter socks, and inlet protection) will be installed at the limits of work and within the existing catch basins, as applicable. Tree protection will be installed around trees specified to remain within the limit of work. Structures to remain shall also be visibly flagged/protected.

C. Installation of Construction Entrance

A construction entrance will be installed in the location as shown on the Erosion Control Plan in accordance with the construction detail provided in the plan set. Existing pavement will be removed within the limits of the proposed construction entrance to accommodate the crushed stone entrance.

D. Demolition

Any existing building, utilities services, and pavement within the project area will be demolished in accordance with the Construction Plans. Those utilities effected by construction activates shall be coordinated with the utility purveyors and Dig Safe procedures taken prior to implementation of agreed upon connections/disconnections/abandonment of services. Materials that are to be removed from the site will be transported to an appropriate facility or will be disposed of elsewhere according to Federal, State, and Local guidelines. Inactive stockpiles or areas of granular material or topsoil shall be temporarily secured in accordance with the SWPPP in order to control sediment laden runoff.

E. Site Clearing and Rough Grading

The site will be cleared and rough graded in accordance with the proposed grading as shown on the plans. If suitable topsoil is found, it will be removed and stockpiled within the project limits. Areas which have been cleared (outside of the right-of-way) will be stabilized.

F. Building Construction

This phase of construction will involve the installation of the buildings including the proposed foundations and vertical construction of the buildings. All building waste is to be properly

disposed of in dumpsters. While this phase commences, other site construction activities will be taking place.

G. Installation of Drainage and Utilities

Utility relocations and modifications, including water, gas, and electric, are anticipated to occur in conjunction with the drainage work. Temporary sediment basins will be constructed at this time on an as-needed basis to collect stormwater runoff during construction. Stockpiles will be established in designated areas as shown on project plans. All temporary/inactive stockpile areas will be encompassed by straw bales or other approved erosion control devices to control sediment laden runoff as necessary and will be temporarily seeded, mulched or covered with plastic, as necessary. Material stabilization will be in accordance with the SWPPP.

H. Fine Grading, Paving, Etc.

The fine grading and shaping will commence along with the installation of curbing to prepare for paving operations. Areas outside of the parking lot will be shaped and prepped for loam, seed, or other treatments. Paving operations will begin with the installation of both binder and finish course layers.

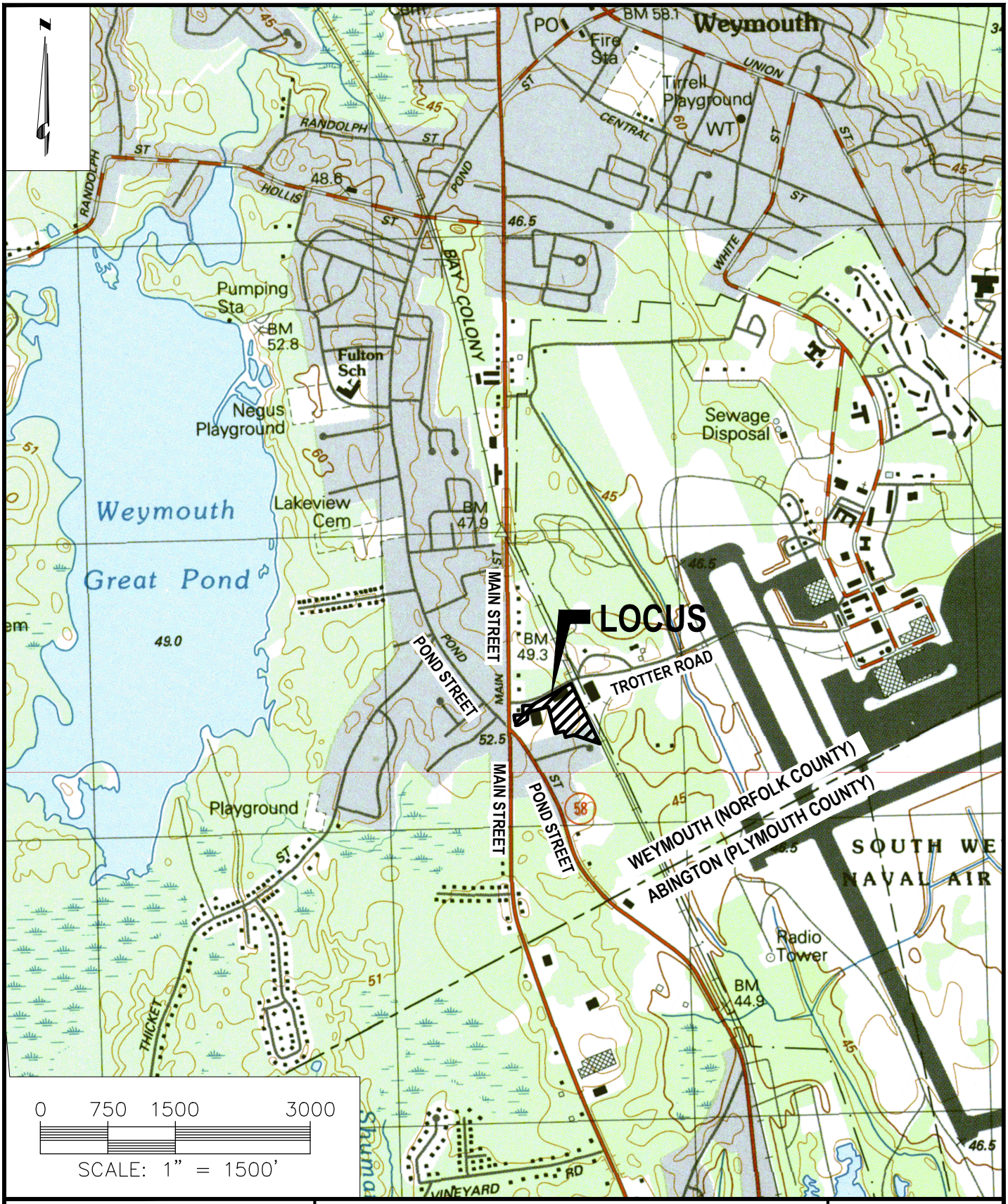
I. Permanent / Final Site Stabilization

The final phase of the project final parking lot paving, landscaping, and restoration and stabilization of all exposed surfaces. Curb installation, final parking lot paving, and final landscaping will be performed upon completion construction.

Disturbed areas will be landscaped, mulched or seeded in accordance with the landscape requirements. Permanent restoration and revegetation measures serve to control erosion and sedimentation by establishing a vegetative cover. In the event that weather conditions prevent final restoration, temporary erosion and sedimentation measures will be employed until the weather is suitable for final cleanup. A final inspection will ensure that the project site is cleared of all project debris and that erosion and sedimentation controls are functioning properly. Once the site has been stabilized, newly installed catch basins and the subsurface recharge/detention system will be inspected for sediment deposits and cleaned if necessary.

Section 1.12

Figures



CHA
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Norwell, MA 02061
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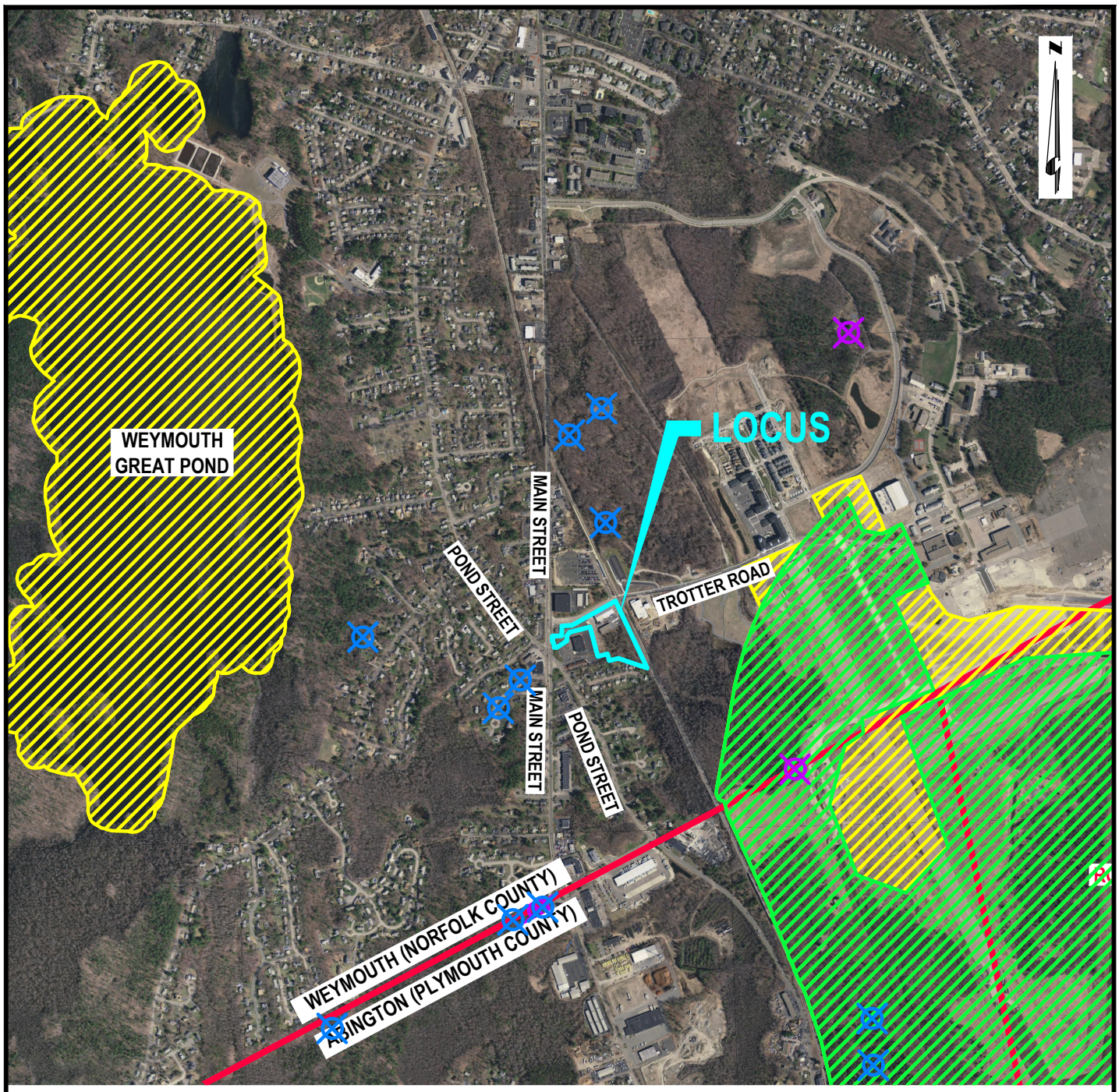
USGS PLAN
THE RESIDENCES AT 1500 MAIN
WEYMOUTH, MASSACHUSETTS

PROJECT NO. 34672

DATE: 11/2/2018

FIGURE 1



0 750 1500 3000

SCALE: 1" = 1500'

ESTIMATED HABITAT OF RARE WILDLIFE

PRIORITY HABITAT OF RARE SPECIES

CERTIFIED VERNAL POOL

POTENTIAL VERNAL POOL

NHESP HABITAT DATA FROM MASSGIS - EFFECTIVE DATE: AUGUST 1, 2017

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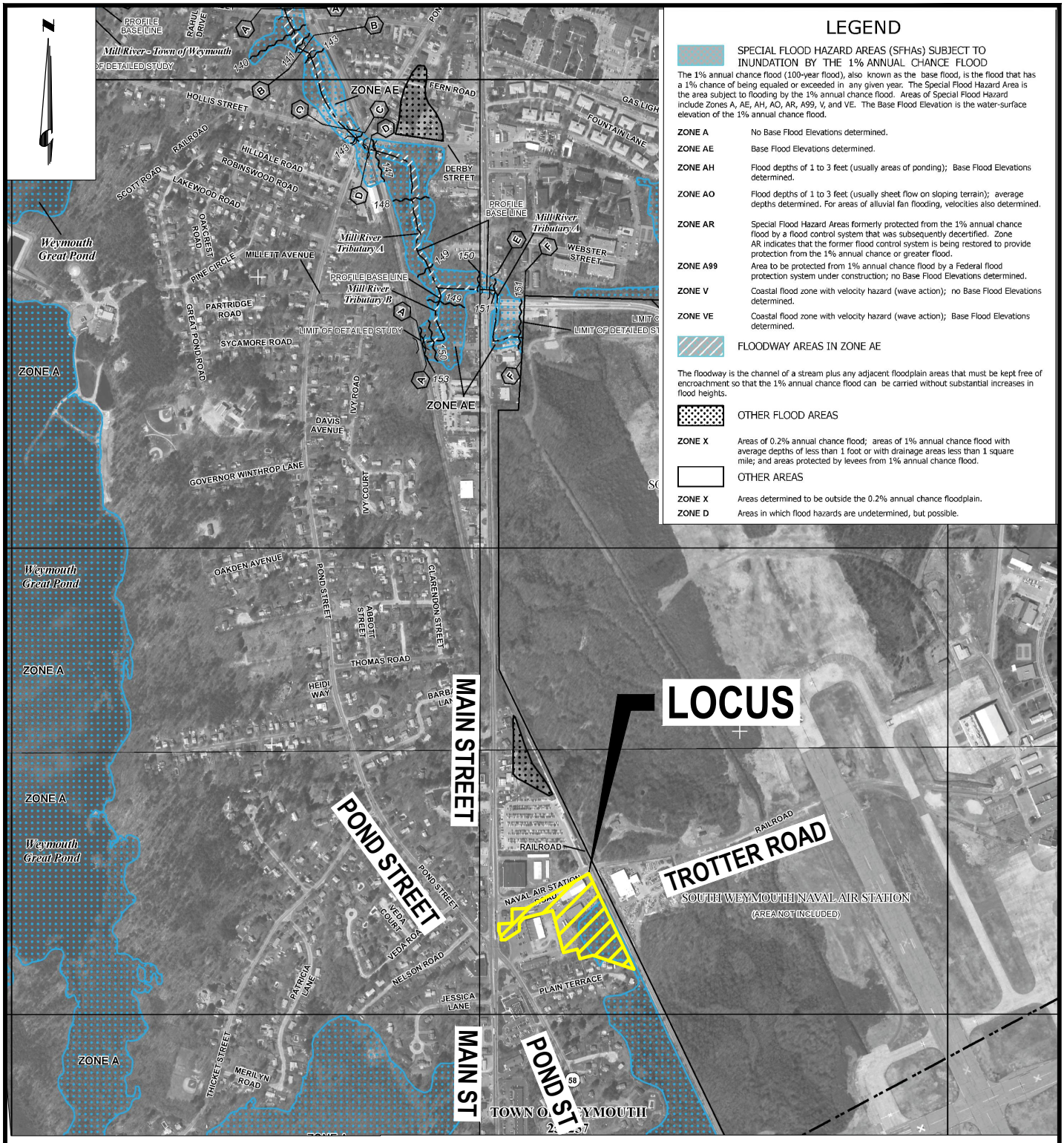
NHESP HABITAT MAP
THE RESIDENCES AT 1500 MAIN
WEYMOUTH, MASSACHUSETTS

PROJECT NO. 34672

DATE: 11/02/18

FIGURE 2



0 500 1000 2000

SCALE: 1" = 1000'

FEMA FLOOD MAP NORFOLK COUNTY, MASSACHUSETTS - MAP NUMBER 25021C0237E, EFFECTIVE DATE: JULY 17, 2012 & MAP NUMBER 25021C0239E, EFFECTIVE DATE: JULY 17, 2012

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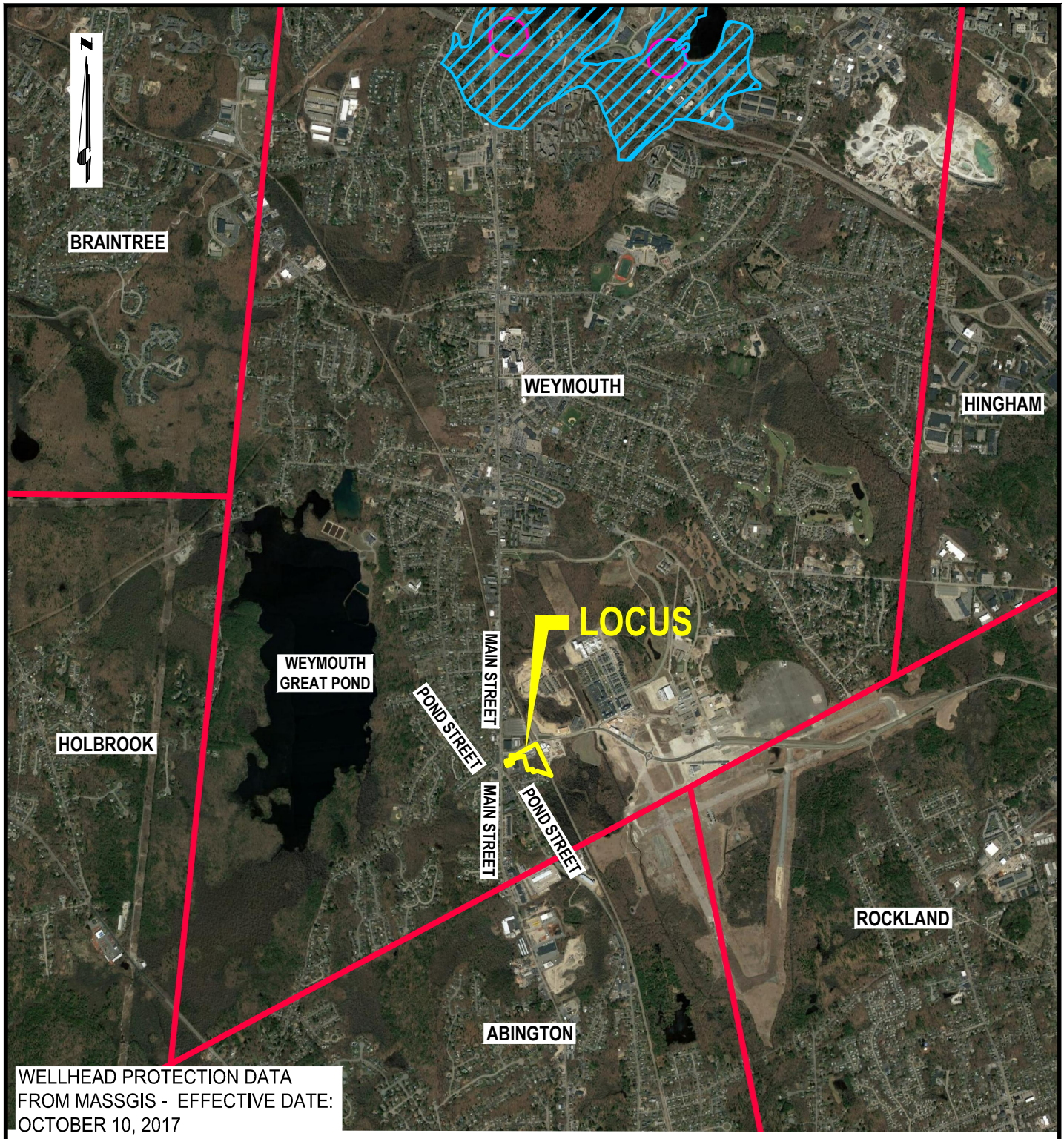
FEMA FLOOD MAP
THE RESIDENCES AT 1500 MAIN
WEYMOUTH, MASSACHUSETTS

PROJECT NO. 34672

DATE: 11/02/18

FIGURE 3



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WELLHEAD PROTECTION AREA MAP
THE RESIDENCES AT 1500 MAIN
WEYMOUTH, MASSACHUSETTS

PROJECT NO.
34672

DATE: 11/02/18

FIGURE 4

Section 2.0

Long-Term Pollution Prevention and Operation and Maintenance Plan

Section 2.1

Operation and Maintenance Narrative

LONG-TERM STORMWATER POLLUTION PREVENTION AND OPERATION & MAINTENANCE PLAN TO COMPLY WITH STORMWATER STANDARDS 4, 6, & 9

APPLICABILITY

This document identifies constituents of concern that have the potential to contaminate stormwater runoff from the proposed project site located at 1500 Main Street and provides a framework of Best Management Practices (BMPs) for handling stormwater runoff. It also outlines an inspection and maintenance program to ensure continued effectiveness of the proposed stormwater management system. The proposed BMPs are shown on the plans prepared by CHA, 141 Longwater Drive, Norwell, Massachusetts.

PROJECT OVERVIEW:

The proposed project includes the development of 3 multi-story buildings. One (1) access driveway is proposed from Trotter Road, and one (1) exising driveway will be reconstructed in conjunction with the adjacent improvements. Parking will be situated within a centralized lot between the three (3) buildings and a few street spaces will be constructed along Trotter Road. Basement level and ground level parking is also proposed beneath the buildings, and shared parking to the west adjacent to the existing CVS is also available. Runoff from the parking lot and building will be collected through the use of deep sump catch basins and conveyed to underground drainage chamber systems. The underground chamber systems will treat stormwater (TSS removal) through the use of isolator rows. The project proposes to treat stormwater runoff from impervious areas in accordance with the 2008 Massachusetts Stormwater Handbook. The project has been designed to improve management of stormwater by reducing proposed peak runoff rates below existing peak rates and removal of Total Suspended Solids (TSS) by use of non-structural and structural BMPs.

OWNER AND RESPONSIBLE PARTY:

Owner:

John M. Corcoran & Co., LLC
100 Grandview Road, Suite 203
Braintree, MA 02184

Day-to-day Operation and Maintenance:

John M. Corcoran & Co., LLC
100 Grandview Road, Suite 203
Braintree, MA 02184

CONSTRUCTION MANAGEMENT:

A construction manager with adequate knowledge and experience on projects of similar size and scope shall be employed to oversee all site work related construction. The contractor shall incorporate the appropriate techniques to control sediment and erosion pollution during construction in accordance with the Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas and any conditions of approval from the local conservation commission.

The design incorporates measures to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities. The information contained herein and within the engineering drawings identifies construction period pollution prevention measures, responsible parties, erosion control measures (straw bales and silt fence, etc.), BMPs for collecting and treating runoff and groundwater during construction[1], site stabilization measures (i.e. gravel, seed, pavement, etc.), an operations and maintenance plan & long-term pollution prevention plan contained herein.

Care should be taken when constructing stormwater control structures. Light earth-moving equipment shall be used when operating over top of buried utilities or drain or chambers.

ON-GOING MAINTENANCE CONTRACT

The non-structural and structural approaches recommended below, as well as the required BMP maintenance, will be completed by an appropriate contractor. Adequate personnel with appropriate training and access to proper equipment will be available to complete the tasks. Future responsible parties must be notified of their responsibility to operate and maintain the system in perpetuity.

LIVING DOCUMENT PROVISIONS

This document shall be updated as necessary to reflect new procedures, technologies or requirements.

MAINTENANCE LOG

The Responsible Party shall develop and maintain a log of inspections, maintenance, repairs, and disposal (including location of disposal) during the life of the project. Records will be maintained for at least 3 years be made available for viewing to the Massachusetts Department of Environmental Protection in accordance with the provisions of the Massachusetts Stormwater Handbook. Copies of the maintenance log shall be submitted to the Weymouth Conservation Commission annually for their reference. A sample of such a maintenance log is provided.

---

[1] Should the need for de-watering arise during construction at the site, groundwater will be pumped directly from the work area into geotextile filter bags, temporary settling basins, or portable fractionation tanks (depending on the nature and volume of water encountered) which will act as sediment traps during construction. Discharge points will be setback outside of all resource areas and buffers monitored by qualified personnel (wetland scientist, licensed site professional, civil engineer, etc.) to ensure no impacts to resource areas and compliance with applicable Federal and state regulations. All discharges will be free from visible floating, suspended, and settleable solids that would impair the functions of the nearby drainage systems, wetlands, or downstream rivers. Refer to the details provided on the drawing set for additional information.

GOOD HOUSEKEEPING PRACTICES DURING CONSTRUCTION

The Responsible Party shall maintain good housekeeping practices by maintaining a clean and orderly facility to prevent potential pollution sources, including debris, from coming into contact with stormwater and degrading water quality. It includes establishing protocols to reduce the possibility of mishandling materials or equipment and training employees in good housekeeping techniques. Common areas where good housekeeping practices should be followed shall include: material storage areas, vehicle and equipment maintenance areas, and loading areas. Good housekeeping practices must include a designated and secure location for garbage. A schedule for regular pickup and disposal of garbage and waste materials and routine inspections of containers for leaks and structural integrity shall be developed.

Specific good housekeeping practices that will be implemented include routine removal of trash. items including scrap, metal, wood, plastic, miscellaneous trash, paper, glass, insulation, misc. building materials, and packaging. Additional practices include securing and covering any containers, supplies, or equipment that could become sources of stormwater pollution.

MINIMIZING EXPOSURE DURING CONSTRUCTION

The Responsible Party will minimize exposure of potential pollutant sources, including debris, from coming into contact with precipitation and being picked up by stormwater and carried into drains and surface waters using the following steps:

- Storing all containerized materials in a protected, secure location away from drains and plainly labeled.
- Containing all activities that can generate sources of contaminants from reaching the receiving water or the stormwater management system.
- Securing any equipment or supplies so that they are not transported during storm events into receiving waters or stormwater management system.

BEST MANAGEMENT PRACTICES (BMP) MAINTENANCE POST CONSTRUCTION

The proposed stormwater management system has been designed with appropriate BMPs aimed at reducing the pollutants typically found in stormwater discharge based upon the intended subdivision development land use. All BMPs require regular maintenance to function as intended. Some management measures have simple maintenance requirements; others are more involved. The Responsible Party must have all BMPs regularly inspected to ensure they are operating properly on an as needed basis, including during storm events exceeding 0.5 inches of rainfall.

A description of the non-structural and structural approaches to be incorporated are indicated below. The following Best Management Practices are proposed to be incorporated into the stormwater management system treatment train design to reduce source runoff and improve stormwater runoff discharge quality. The Responsible Party will regularly inspect all BMPs to ensure they are operating properly. If any deficiencies are identified during these inspections, action to resolve it will be initiated and documented on the maintenance log.

NON-STRUCTURAL BEST MANAGEMENT PRACTICES (BMPs)

STREET SWEEPING

As street sweeping is a BMP under MassDEP guidelines, this non-structural BMP is an effective removal of Total Suspended Solids (TSS) in a comprehensive stormwater management program. A maintenance program of street sweeping with a High Efficiency Vacuum Sweeper or a Regenerative Air Sweeper can reduce sediment accumulation in the deep sump catch basins and subsurface systems. Sweeping will be conducted on a monthly basis in the side/rear parking lot which contains porous pavers. Sweeping will be conducted on a semi-annual basis (primarily in the spring and fall) in the front parking lot. Street sweeping is performed to keep downstream treatment train BMPs operating effectively.

GRADING

The impervious areas of the site shall be graded as gently as possible to reduce runoff velocities. Steep slopes will be permanently vegetated to dissipate energy and reduce potential erosion. No constructed vegetated slopes should exceed 2H: 1V without providing additional reinforcement. Steep slopes may require soil reinforcement and additional vegetation.

SNOW STORAGE AND DEICING

Snow storage is anticipated to occur around the perimeter of the parking areas. The landscaping has been designed accordingly.

In the interest of reducing the volume of dissolved salt that enters the watershed, the operator of the development will rely on sand alone where traction on snowy surfaces is the primary objective. However, when deicing is necessary due to safety reasons during winter months, paved surfaces will typically be treated with a mixture of 90% sand and 10% road salt (NaCl).

FERTILIZER:

Slow release organic fertilizers are recommended to be used in landscape areas to limit nutrient transport to groundwater and the wetland area. It is recommended that application be limited to 5 lbs. per 1000 square feet of lawn area.

WASTE MANAGEMENT:

Solid waste will be contained within standard residential trash and recycling containers.

STRUCTURAL BEST MANAGEMENT PRACTICES:

Prior to final completion and full occupancy of the development, it is recommended that a representative of the Contractor, Manufacturer, and/or Engineer either designing or building the facility for the Owner properly instruct the Responsible Party as to the maintenance practices required to responsibly maintain the effectiveness of the drainage system. These frequencies and requirements are recommendations to maintain minimum effectiveness in most typical environments. Ultimately, the Responsible Party will implement the procedures and frequencies as

they see fit under their current plan and inspect the systems as needed to maintain minimum effectiveness as recommended by the manufacturer. The following maintenance of structural BMPs will be implemented:

DEEP SUMP HOODED CATCH BASINS AND MANHOLE STRUCTURES

Catch basins shall be cleaned, in dry weather, when half of the sump capacity is filled or at a minimum quarterly or as required through periodic inspection. Cleaning will take place at the completion of construction and in early spring after sanding of roadways has ceased or as needed depending on the frequency of major storm events (greater than 1-inch of rainfall). All manholes shall be inspected bi-annually. Any obstructions, sediment, and debris that could potentially cause clogs shall be removed within the conveyance system as necessary. Inverts, grates, and hoods shall be checked and replaced as necessary to maintain hydraulic effectiveness.

ISOLATOR ROW

The Isolator Rows in the subsurface systems shall be inspected once per year and cleaned as dictated by the results of each inspection and in accordance with the manufacturer's recommendations. Periodic inspections performed by the Responsible Party may dictate cleaning on a more frequent basis depending on the suspended solids loading. During construction accumulated sediment may need to be removed more frequently. Conduct JetVac process annually or when inspection shows that maintenance is necessary. See attached maintenance documentation from the manufacturer.

SUBSURFACE INFILTRATION SYSTEMS

The subsurface system has been designed with StormTech® chamber system from ADS and utilize Isolator Rows to remove sediment and debris within the stormwater. The subsurface system has riser structures/inspection ports at grade to inspect sediment accumulation and allow for removal of sediment and debris from the detention system. The subsurface drainage system connects to a multi-stage outlet structure to regulate discharge from storm events. Once the system goes online, inspections should occur after each major storm event for the first few months to ensure proper stabilization, function, and to ensure that the outlets remain free of obstructions. After that, the system should be inspected annually. Water levels should be checked and recorded against rainfall amounts to verify that the drainage system is working properly.

OUTLET CONTROL STRUCTURES

The outlet control structure (OCS) detains the stormwater utilizing orifices to control the outlet flow and are below grade with access via covers to grade. Although the outlet control structures should not collect much debris, they should be inspected along with the underground system inspection to make sure they are clean of debris and functioning properly. Sand accumulation within the OCS is a sign there is an issue with the upstream stormwater treatment device. The OCS shall be inspected once per year. It may be necessary to clean the structure and the use of a vacuum truck may be necessary.

POROUS PAVERS:

For proper maintenance

- Post signs identifying porous paver areas
- Minimize salt use during winter months
- No winter sanding is allowed
- Keep landscaped areas well maintained to prevent soil form being transported onto the pavers
- Clean the surface using vacuum sweeping machines monthly. For paving stones, periodically, add joint material to replace material that has been transported
- Regularly monitor the paving surface to make sure it drains properly after storms
- Never reseal or repave with impermeable materials
- Inspect the surface annually for deterioration
- Attach rollers to the bottoms of snowplows to prevent them from catching on the edges of paving stones.

LEVEL SPREADER/PLUNGE POOL/ENERGY DISSIPATER AND DOWNSTREAM SLOPES:

The level spreader/plunge pool/energy dissipaters are utilized at the outlet pipes prior to discharge to the wetland to prevent erosion. The level spreader/plunge pool/energy dissipaters should be inspected at least once a year for sand accumulation and debris which may impact its effectiveness to slow water. Cleaning should take place during the early spring, although, additional inspections and cleaning may be needed.

In order to ensure that the level spreader systems are working, the outlets as well as slopes downstream for the first three years of operation, should be inspected after every storm of 1" or greater to assure no erosion of the slope. After the first three years, we recommend inspections after any large storm (25+ year event) for erosion. If no erosion is evident, then the stone size and level spreader design is adequate. Should there be erosion of the level spreader, stone size should be increased or additional large stones added to enhance energy dissipation of water. If downstream slopes exhibit signs of erosion, repairs to soils and slope should be made and then a treatment such as an erosion control matting should be instituted to reinforce soils until vegetative cover can be restored. We recommend that the aprons and downstream slopes be inspected and cleaned annually as part of the outlet maintenance to ensure future adequacy.

SPILL CONTROL:

Since the site is mainly a residential development, it is unlikely there will be a spill other than possibly petroleum products from a resident's vehicle. Thus, it is only a recommendation that a contingency plan to address the spillage/release of petroleum products and any hazardous material be implemented for the facility. The recommendation includes that the property manager have all MassDEP emergency spill response information posted on-site at all times. It is also recommended an emergency spill response kit including absorbent pillows be stored on-site along with instructions for the kit, a copy of applicable regulations regarding spills, and a list of individuals to contact (local and state officials) in the event of a spill.

Spills or leaks will be treated properly according to material type, volume of spillage and location of spill. Mitigation will include preventing further spillage, containing the spilled material in the smallest practical area, removing spilled material in a safe and environmentally friendly manner, and remediating any damage to the environment.

LONG-TERM OPERATION AND MAINTENANCE BUDGET:

Consistent with Standard 9 of the Massachusetts Department of Environmental Protection Stormwater Handbook (February 2008) the approximate cost of inspections and maintenance based on the abovementioned post-construction activities and frequencies is as follows:

- Street Sweeping - $2,500 per year based on annual sweepings.
- Deep Sump Catch Basins - inspection/cleaning - $200 per year/per catch basin based on annual inspections and sediment removal of both single and double grate deep sump catch basins.
- Underground Detention Systems - inspection - $1,000 per year based on semi-annual inspections. Cleaning/debris removal - $1,000 per year for accumulated sediment and trash removal.

Additional costs may be incurred if it is determined during routine inspections of the BMP's that further corrective actions are necessary.

LONG TERM STRUCTURAL BEST MANAGEMENT PRACTICE INSPECTION & MAINTENANCE MATRIX AFTER CONSTRUCTION

Note: BMP's shall be visually inspected and repaired by a qualified party in accordance with the following chart. Note these are minimum inspection criteria/frequencies and should be adjusted throughout the project lifespan as required to maintain effectiveness. Refer to maintenance standards for drainage facilities and structural best management practices in the "Recommended Long-Term Stormwater Pollution Prevention Plan."

Conventional & LID Best Management Practices	Recommended Minimum Inspection & Maintenance Frequency	Erosion/Scouring	Tree Growth Hazards	Differential Settlement/Seepage	Structural Damage/Obstructions	Trash & Debris	Removal of Accumulated Sediment	Slope Integrity	*Mow Vegetation/Poor Vegetation Coverage	Remove/Reset Filter Fabric & Stone As Required	Remove & Replace Hardwood mulch/media	Vac Truck Sediment & Contaminants	Remove/Reset Riprap as Required
Catch Basin/Area Drain	Annually		☑	☑	☑	☑	☑					☑	
Energy Dissipaters	Annually	☑	☑	☑		☑	☑		☑	☑			
Drainage Swales	Semi-Annual	☑				☑		☑	☑				☑
Outlet Structure	Semi-Annual	☑		☑	☑	☑	☑			☑			☑
Water Quality Inlet	Semi-Annual			☑	☑	☑						☑	
Detention/Infiltration System w/ Isolator Row	Semi-Annual	☑	☑	☑	☑	☑	☑					☑	
Permeable Pavers	Annually/As Needed				☑	☑	☑						
Level Spreader	Annually	☑	☑			☑			☑	☑			☑
Plunge Pool	Annually	☑				☑	☑		☑	☑			☑

Stormwater BMP Inspection and Maintenance Log

Facility Name	
Address	
Begin Date	End Date

Date	BMP ID#	BMP Description	Inspected by:	Cause for Inspection	Exceptions Noted	Comments and Actions Taken

Instructions: Record all inspections and maintenance for all treatment BMPs on this form. Use additional log sheets and/or attach extended comments or documentation as necessary.

- BMP ID# — Always use ID# from the Operation and Maintenance Manual or Approved Plans.
- Inspected by — Note all inspections and maintenance on this form, including the required independent annual inspection.
- Cause for inspection — Note if the inspection is routine, pre-rainy-season, post-storm, annual, or in response to a noted problem or complaint.
- Exceptions noted — Note any condition that requires correction or indicates a need for maintenance.
- Comments and actions taken — Describe any maintenance done and need for follow-up.

StormTech®

Detention • Retention • Water Quality

A division of ADS®

Save Valuable Land and Protect Water Resources

Isolator® Row O&M Manual

StormTech® Chamber System for Stormwater Management

1.0 The Isolator® Row

1.1 INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a patented technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

1.2 THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

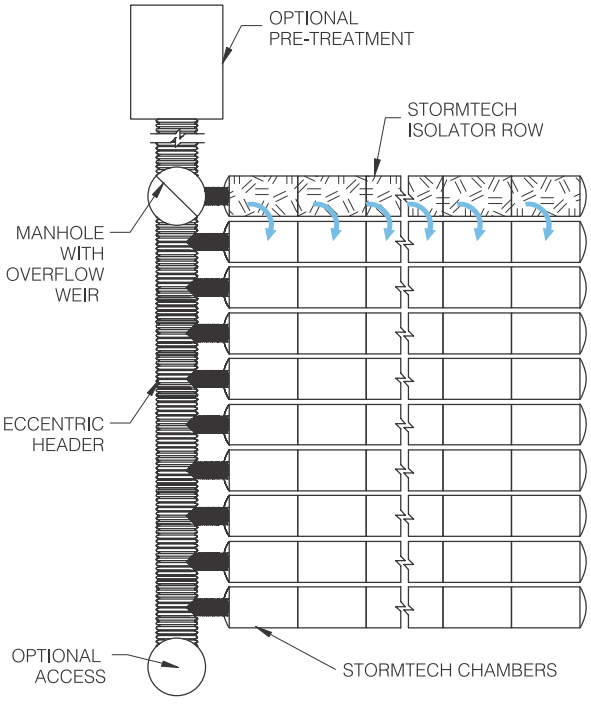
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

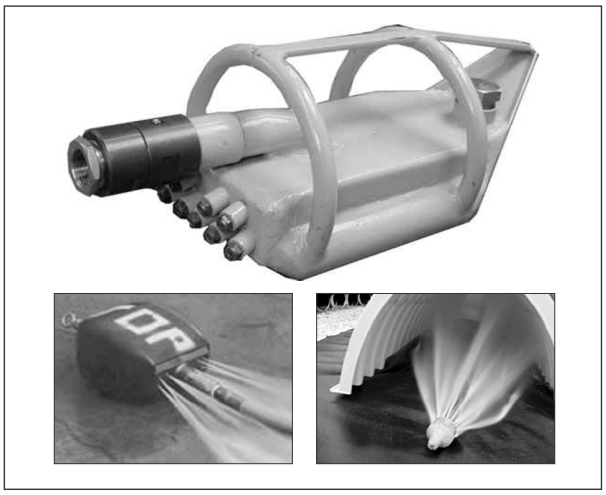
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

2.2 MAINTENANCE

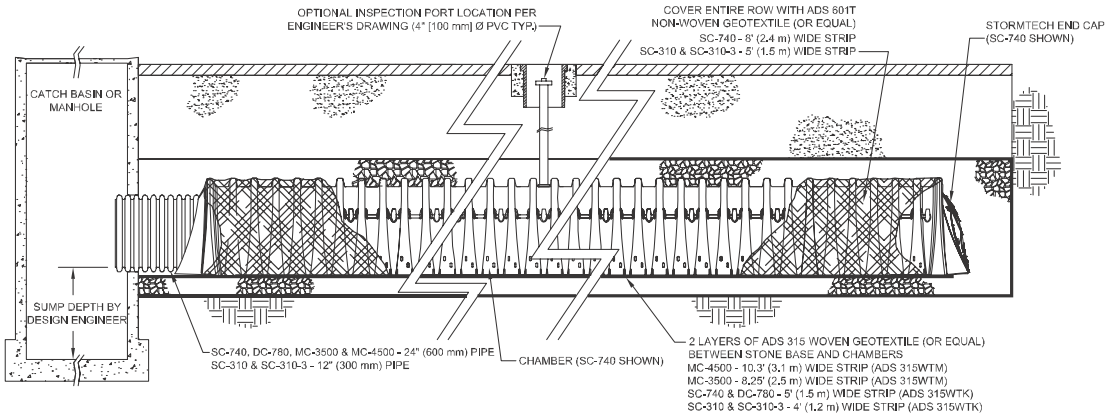
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)



NOTE: NON-WOVEN FABRIC IS ONLY REQUIRED OVER THE INLET PIPE CONNECTION INTO THE END CAP FOR DC-780, MC-3500 AND MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

3.0 Isolator Row Step By Step Maintenance Procedures

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

i. Remove lid from floor box frame

ii. Remove cap from inspection riser

iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.

iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.

B) All Isolator Rows

i. Remove cover from manhole at upstream end of Isolator Row

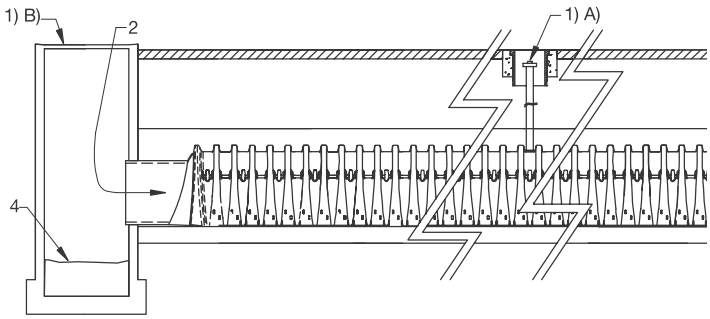
ii. Using a flashlight, inspect down Isolator Row through outlet pipe

1. Mirrors on poles or cameras may be used to avoid a confined space entry

2. Follow OSHA regulations for confined space entry if entering manhole

iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable

B) Apply multiple passes of JetVac until backflush water is clean

C) Vacuum manhole sump as required

Step 3) Replace all caps, lids and covers, record observations and actions

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system

Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1) - (2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in Isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm

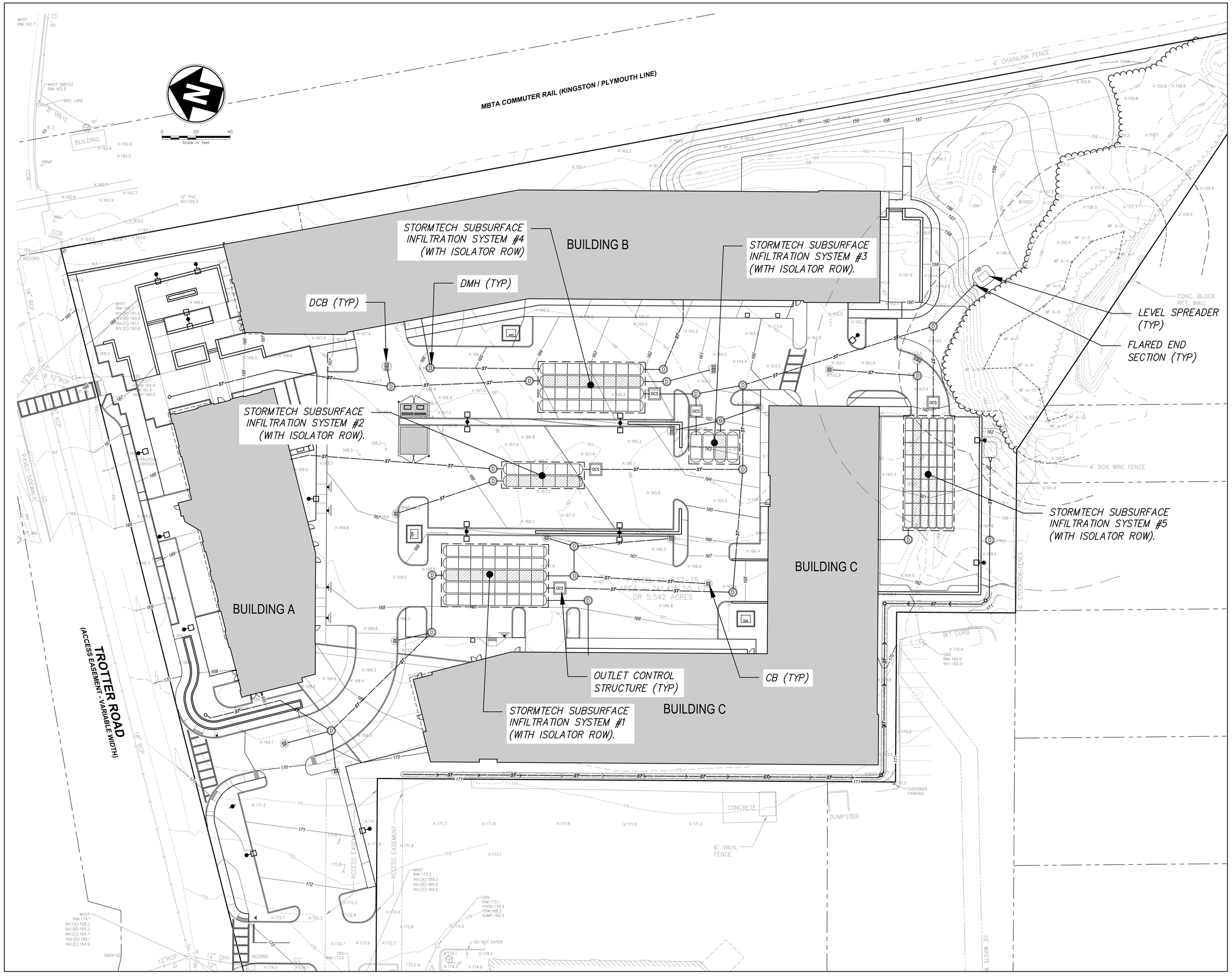
StormTech®

Detention • Retention • Water Quality

A division of ADS

70 Inwood Road, Suite 3 | Rocky Hill | Connecticut | 06067

860.529.8188 | 888.892.2694 | fax 866.328.8401 | www.stormtech.com



THE RESIDENCES AT 1500 MAIN
1500 MAIN STREET
WEYMOUTH, MA 02190
PROJECT

JOHN M. CORCORAN & CO. LLC
100 GRANDVIEW ROAD, SUITE 203
BRAINTREE, MA 02184
P 781 849.0011
OWNER

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BLW ENGINEERS
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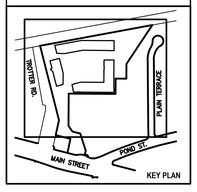

KEY PLAN

STAMP

DATE	REVISION
NOVEMBER 5, 2018	BZA SUBMISSION

REVISIONS ON SHEET

SCALE

UTILE PROJECT NUMBER
1839

OPERATION AND MAINTENANCE PLAN

O&M

10/22/2018 2:17:14 PM

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Section 3.0

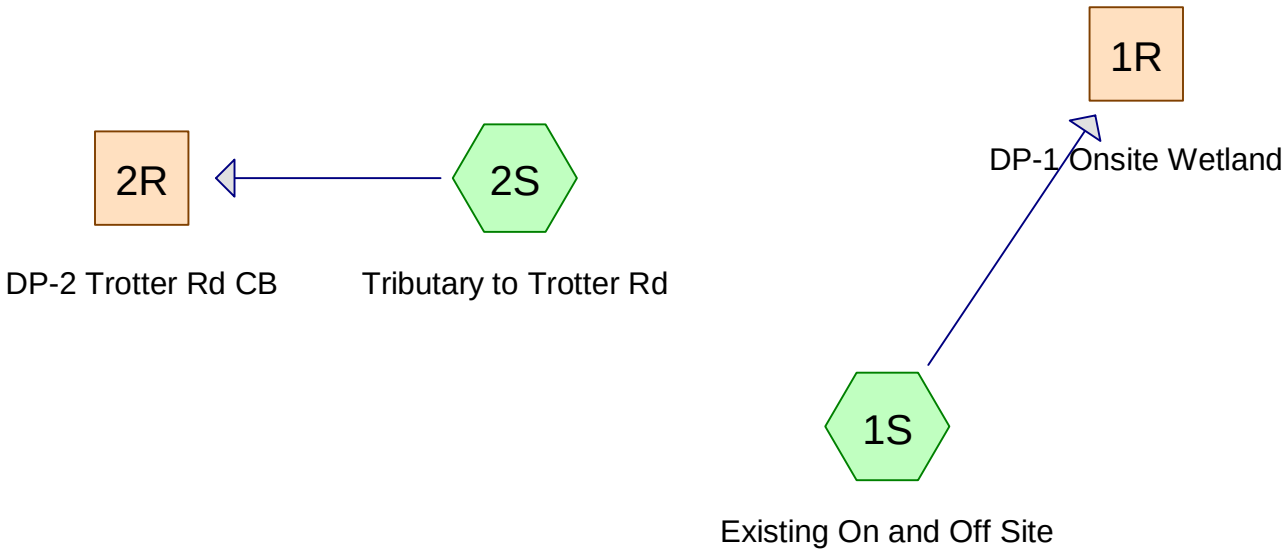
Hydrology and Hydraulic Modeling

Section 3.1

HydroCAD Site Hydrology Calculation

Section 3.1.1

Pre-Developed Stormwater



Subcat Reach Pond Link

Routing Diagram for 34672 - Weymouth PRE
Prepared by CHA, Printed 11/2/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.057	74	>75% Grass cover, Good, HSG C (1S)
0.526	87	Dirt roads, HSG C (1S)
1.984	98	Paved parking, HSG C (1S, 2S)
0.551	98	Roofs, HSG C (1S, 2S)
2.722	70	Woods, Good, HSG C (1S)
5.840	**84**	**TOTAL AREA**

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing On and Off Site Runoff Area=245,020 sf 41.25% Impervious Runoff Depth=1.61"
Flow Length=380' Tc=15.6 min CN=83 Runoff=7.89 cfs 0.754 af

Subcatchment 2S: Tributary to Trotter Rd Runoff Area=9,360 sf 100.00% Impervious Runoff Depth=2.97"
Tc=6.0 min CN=98 Runoff=0.67 cfs 0.053 af

Reach 1R: DP-1 Onsite Wetland Inflow=7.89 cfs 0.754 af
Outflow=7.89 cfs 0.754 af

Reach 2R: DP-2 Trotter Rd CB Inflow=0.67 cfs 0.053 af
Outflow=0.67 cfs 0.053 af

Total Runoff Area = 5.840 ac Runoff Volume = 0.807 af Average Runoff Depth = 1.66"
56.59% Pervious = 3.305 ac 43.41% Impervious = 2.535 ac

Summary for Subcatchment 1S: Existing On and Off Site

Runoff = 7.89 cfs @ 12.22 hrs, Volume= 0.754 af, Depth= 1.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
118,550	70	Woods, Good, HSG C
2,490	74	>75% Grass cover, Good, HSG C
22,915	87	Dirt roads, HSG C
16,290	98	Roofs, HSG C
84,775	98	Paved parking, HSG C
245,020	83	Weighted Average
143,955		58.75% Pervious Area
101,065		41.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	40	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
5.6	250	0.0220	0.74		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.2	90	0.0670	1.29		**Shallow Concentrated Flow, C_D** Woodland Kv= 5.0 fps
15.6	380	Total			

Summary for Subcatchment 2S: Tributary to Trotter Rd

Runoff = 0.67 cfs @ 12.08 hrs, Volume= 0.053 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
7,720	98	Roofs, HSG C
1,640	98	Paved parking, HSG C
9,360	98	Weighted Average
9,360		100.00% Impervious Area

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

Summary for Reach 1R: DP-1 Onsite Wetland

Inflow Area = 5.625 ac, 41.25% Impervious, Inflow Depth = 1.61" for 2-Year event
Inflow = 7.89 cfs @ 12.22 hrs, Volume= 0.754 af
Outflow = 7.89 cfs @ 12.22 hrs, Volume= 0.754 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach 2R: DP-2 Trotter Rd CB

Inflow Area = 0.215 ac,100.00% Impervious, Inflow Depth = 2.97" for 2-Year event
Inflow = 0.67 cfs @ 12.08 hrs, Volume= 0.053 af
Outflow = 0.67 cfs @ 12.08 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing On and Off Site Runoff Area=245,020 sf 41.25% Impervious Runoff Depth=2.90"
Flow Length=380' Tc=15.6 min CN=83 Runoff=14.27 cfs 1.361 af

Subcatchment 2S: Tributary to Trotter Rd Runoff Area=9,360 sf 100.00% Impervious Runoff Depth=4.46"
Tc=6.0 min CN=98 Runoff=0.99 cfs 0.080 af

Reach 1R: DP-1 Onsite Wetland Inflow=14.27 cfs 1.361 af
Outflow=14.27 cfs 1.361 af

Reach 2R: DP-2 Trotter Rd CB Inflow=0.99 cfs 0.080 af
Outflow=0.99 cfs 0.080 af

Total Runoff Area = 5.840 ac Runoff Volume = 1.441 af Average Runoff Depth = 2.96"
56.59% Pervious = 3.305 ac 43.41% Impervious = 2.535 ac

Summary for Subcatchment 1S: Existing On and Off Site

Runoff = 14.27 cfs @ 12.22 hrs, Volume= 1.361 af, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
118,550	70	Woods, Good, HSG C
2,490	74	>75% Grass cover, Good, HSG C
22,915	87	Dirt roads, HSG C
16,290	98	Roofs, HSG C
84,775	98	Paved parking, HSG C
245,020	83	Weighted Average
143,955		58.75% Pervious Area
101,065		41.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	40	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
5.6	250	0.0220	0.74		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.2	90	0.0670	1.29		**Shallow Concentrated Flow, C_D** Woodland Kv= 5.0 fps
15.6	380	Total			

Summary for Subcatchment 2S: Tributary to Trotter Rd

Runoff = 0.99 cfs @ 12.08 hrs, Volume= 0.080 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
7,720	98	Roofs, HSG C
1,640	98	Paved parking, HSG C
9,360	98	Weighted Average
9,360		100.00% Impervious Area

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

Summary for Reach 1R: DP-1 Onsite Wetland

Inflow Area = 5.625 ac, 41.25% Impervious, Inflow Depth = 2.90" for 10-Year event
Inflow = 14.27 cfs @ 12.22 hrs, Volume= 1.361 af
Outflow = 14.27 cfs @ 12.22 hrs, Volume= 1.361 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach 2R: DP-2 Trotter Rd CB

Inflow Area = 0.215 ac,100.00% Impervious, Inflow Depth = 4.46" for 10-Year event
Inflow = 0.99 cfs @ 12.08 hrs, Volume= 0.080 af
Outflow = 0.99 cfs @ 12.08 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing On and Off Site Runoff Area=245,020 sf 41.25% Impervious Runoff Depth=3.63"
Flow Length=380' Tc=15.6 min CN=83 Runoff=17.74 cfs 1.701 af

Subcatchment 2S: Tributary to Trotter Rd Runoff Area=9,360 sf 100.00% Impervious Runoff Depth=5.26"
Tc=6.0 min CN=98 Runoff=1.16 cfs 0.094 af

Reach 1R: DP-1 Onsite Wetland Inflow=17.74 cfs 1.701 af
Outflow=17.74 cfs 1.701 af

Reach 2R: DP-2 Trotter Rd CB Inflow=1.16 cfs 0.094 af
Outflow=1.16 cfs 0.094 af

Total Runoff Area = 5.840 ac Runoff Volume = 1.796 af Average Runoff Depth = 3.69"
56.59% Pervious = 3.305 ac 43.41% Impervious = 2.535 ac

Summary for Subcatchment 1S: Existing On and Off Site

Runoff = 17.74 cfs @ 12.21 hrs, Volume= 1.701 af, Depth= 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
118,550	70	Woods, Good, HSG C
2,490	74	>75% Grass cover, Good, HSG C
22,915	87	Dirt roads, HSG C
16,290	98	Roofs, HSG C
84,775	98	Paved parking, HSG C
245,020	83	Weighted Average
143,955		58.75% Pervious Area
101,065		41.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	40	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
5.6	250	0.0220	0.74		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.2	90	0.0670	1.29		**Shallow Concentrated Flow, C_D** Woodland Kv= 5.0 fps
15.6	380	Total			

Summary for Subcatchment 2S: Tributary to Trotter Rd

Runoff = 1.16 cfs @ 12.08 hrs, Volume= 0.094 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
7,720	98	Roofs, HSG C
1,640	98	Paved parking, HSG C
9,360	98	Weighted Average
9,360		100.00% Impervious Area

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

Summary for Reach 1R: DP-1 Onsite Wetland

Inflow Area = 5.625 ac, 41.25% Impervious, Inflow Depth = 3.63" for 25-Year event
Inflow = 17.74 cfs @ 12.21 hrs, Volume= 1.701 af
Outflow = 17.74 cfs @ 12.21 hrs, Volume= 1.701 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach 2R: DP-2 Trotter Rd CB

Inflow Area = 0.215 ac,100.00% Impervious, Inflow Depth = 5.26" for 25-Year event
Inflow = 1.16 cfs @ 12.08 hrs, Volume= 0.094 af
Outflow = 1.16 cfs @ 12.08 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing On and Off Site Runoff Area=245,020 sf 41.25% Impervious Runoff Depth=4.75"
Flow Length=380' Tc=15.6 min CN=83 Runoff=23.01 cfs 2.224 af

Subcatchment 2S: Tributary to Trotter Rd Runoff Area=9,360 sf 100.00% Impervious Runoff Depth=6.46"
Tc=6.0 min CN=98 Runoff=1.41 cfs 0.116 af

Reach 1R: DP-1 Onsite Wetland Inflow=23.01 cfs 2.224 af
Outflow=23.01 cfs 2.224 af

Reach 2R: DP-2 Trotter Rd CB Inflow=1.41 cfs 0.116 af
Outflow=1.41 cfs 0.116 af

Total Runoff Area = 5.840 ac Runoff Volume = 2.340 af Average Runoff Depth = 4.81"
56.59% Pervious = 3.305 ac 43.41% Impervious = 2.535 ac

Summary for Subcatchment 1S: Existing On and Off Site

Runoff = 23.01 cfs @ 12.21 hrs, Volume= 2.224 af, Depth= 4.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
118,550	70	Woods, Good, HSG C
2,490	74	>75% Grass cover, Good, HSG C
22,915	87	Dirt roads, HSG C
16,290	98	Roofs, HSG C
84,775	98	Paved parking, HSG C
245,020	83	Weighted Average
143,955		58.75% Pervious Area
101,065		41.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	40	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
5.6	250	0.0220	0.74		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.2	90	0.0670	1.29		**Shallow Concentrated Flow, C_D** Woodland Kv= 5.0 fps
15.6	380	Total			

Summary for Subcatchment 2S: Tributary to Trotter Rd

Runoff = 1.41 cfs @ 12.08 hrs, Volume= 0.116 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
7,720	98	Roofs, HSG C
1,640	98	Paved parking, HSG C
9,360	98	Weighted Average
9,360		100.00% Impervious Area

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

Summary for Reach 1R: DP-1 Onsite Wetland

Inflow Area = 5.625 ac, 41.25% Impervious, Inflow Depth = 4.75" for 100-Year event
Inflow = 23.01 cfs @ 12.21 hrs, Volume= 2.224 af
Outflow = 23.01 cfs @ 12.21 hrs, Volume= 2.224 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

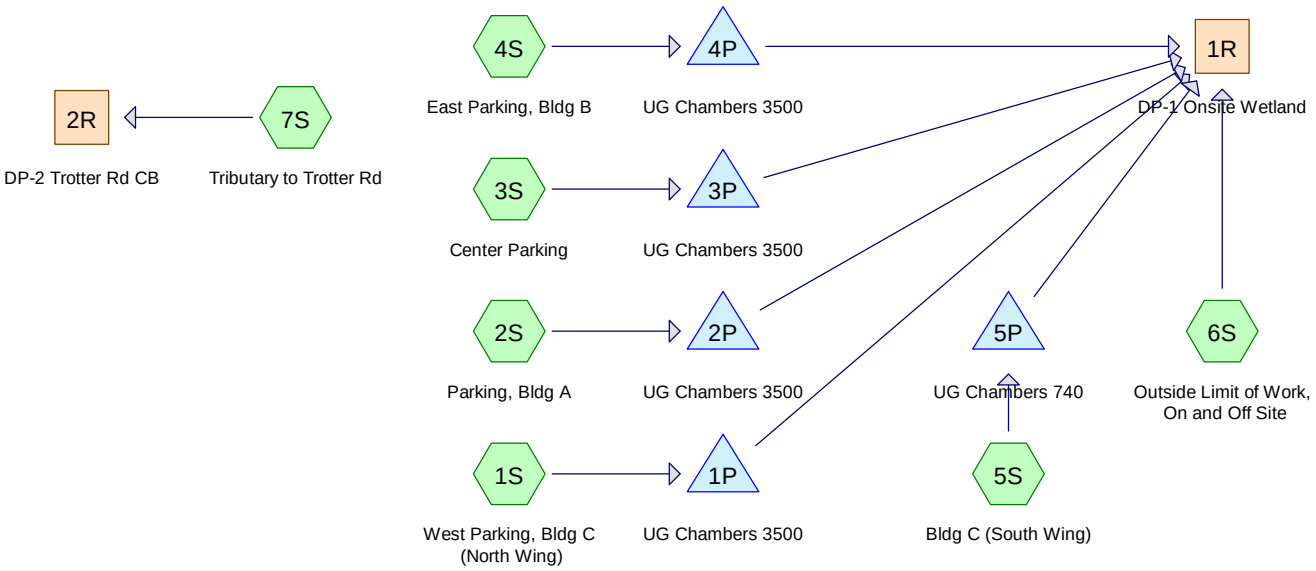
Summary for Reach 2R: DP-2 Trotter Rd CB

Inflow Area = 0.215 ac,100.00% Impervious, Inflow Depth = 6.46" for 100-Year event
Inflow = 1.41 cfs @ 12.08 hrs, Volume= 0.116 af
Outflow = 1.41 cfs @ 12.08 hrs, Volume= 0.116 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Section 3.1.2

Post-Developed Stormwater



Subcat Reach Pond Link

Routing Diagram for 34672 - Weymouth POST
Prepared by CHA, Printed 11/2/2018
HydroCAD® 10.00-20 s/n 09222 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.932	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S, 4S, 5S, 6S, 7S)
0.016	89	Gravel roads, HSG C (6S)
2.662	98	Paved parking, HSG C (1S, 2S, 3S, 4S, 5S, 6S, 7S)
0.178	70	Pervious Pavers (6S, 7S)
1.401	98	Roofs, HSG C (1S, 2S, 4S, 5S)
0.650	70	Woods, Good, HSG C (6S)
5.839	**90**	**TOTAL AREA**

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: West Parking, Bldg C (North Runoff Area=50,440 sf 89.63% Impervious Runoff Depth=2.75"
Tc=6.0 min CN=96 Runoff=3.47 cfs 0.265 af

Subcatchment 2S: Parking, Bldg A Runoff Area=12,390 sf 98.51% Impervious Runoff Depth=2.97"
Tc=6.0 min CN=98 Runoff=0.88 cfs 0.070 af

Subcatchment 3S: Center Parking Runoff Area=15,930 sf 95.54% Impervious Runoff Depth=2.86"
Tc=6.0 min CN=97 Runoff=1.12 cfs 0.087 af

Subcatchment 4S: East Parking, Bldg B Runoff Area=47,820 sf 91.27% Impervious Runoff Depth=2.75"
Tc=6.0 min CN=96 Runoff=3.29 cfs 0.251 af

Subcatchment 5S: Bldg C (South Wing) Runoff Area=28,190 sf 92.12% Impervious Runoff Depth=2.75"
Tc=6.0 min CN=96 Runoff=1.94 cfs 0.148 af

Subcatchment 6S: Outside Limit of Work, On Runoff Area=92,478 sf 36.08% Impervious Runoff Depth=1.47"
Flow Length=210' Tc=14.4 min CN=81 Runoff=2.78 cfs 0.260 af

Subcatchment 7S: Tributary to Trotter Rd Runoff Area=7,085 sf 18.98% Impervious Runoff Depth=1.15"
Tc=6.0 min CN=76 Runoff=0.21 cfs 0.016 af

Reach 1R: DP-1 Onsite Wetland Inflow=7.87 cfs 0.643 af
Outflow=7.87 cfs 0.643 af

Reach 2R: DP-2 Trotter Rd CB Inflow=0.21 cfs 0.016 af
Outflow=0.21 cfs 0.016 af

Pond 1P: UG Chambers 3500 Peak Elev=162.63' Storage=4,100 cf Inflow=3.47 cfs 0.265 af
Discarded=0.06 cfs 0.139 af Primary=1.70 cfs 0.126 af Outflow=1.75 cfs 0.265 af

Pond 2P: UG Chambers 3500 Peak Elev=160.41' Storage=1,171 cf Inflow=0.88 cfs 0.070 af
Discarded=0.02 cfs 0.043 af Primary=0.30 cfs 0.027 af Outflow=0.31 cfs 0.070 af

Pond 3P: UG Chambers 3500 Peak Elev=158.48' Storage=1,213 cf Inflow=1.12 cfs 0.087 af
Discarded=0.01 cfs 0.042 af Primary=0.75 cfs 0.045 af Outflow=0.76 cfs 0.087 af

Pond 4P: UG Chambers 3500 Peak Elev=158.00' Storage=3,452 cf Inflow=3.29 cfs 0.251 af
Discarded=0.04 cfs 0.114 af Primary=2.00 cfs 0.138 af Outflow=2.05 cfs 0.251 af

Pond 5P: UG Chambers 740 Peak Elev=156.91' Storage=2,532 cf Inflow=1.94 cfs 0.148 af
Discarded=0.05 cfs 0.101 af Primary=0.59 cfs 0.048 af Outflow=0.64 cfs 0.148 af

Total Runoff Area = 5.839 ac Runoff Volume = 1.098 af Average Runoff Depth = 2.26"
30.42% Pervious = 1.776 ac 69.58% Impervious = 4.062 ac

Summary for Subcatchment 1S: West Parking, Bldg C (North Wing)

Runoff = 3.47 cfs @ 12.08 hrs, Volume= 0.265 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
5,230	74	>75% Grass cover, Good, HSG C
30,270	98	Paved parking, HSG C
14,940	98	Roofs, HSG C
50,440	96	Weighted Average
5,230		10.37% Pervious Area
45,210		89.63% Impervious Area

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

Summary for Subcatchment 2S: Parking, Bldg A

Runoff = 0.88 cfs @ 12.08 hrs, Volume= 0.070 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
185	74	>75% Grass cover, Good, HSG C
1,930	98	Paved parking, HSG C
10,275	98	Roofs, HSG C
12,390	98	Weighted Average
185		1.49% Pervious Area
12,205		98.51% Impervious Area

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

Summary for Subcatchment 3S: Center Parking

Runoff = 1.12 cfs @ 12.08 hrs, Volume= 0.087 af, Depth= 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
710	74	>75% Grass cover, Good, HSG C
15,220	98	Paved parking, HSG C
15,930	97	Weighted Average
710		4.46% Pervious Area
15,220		95.54% Impervious Area

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

Summary for Subcatchment 4S: East Parking, Bldg B

Runoff = 3.29 cfs @ 12.08 hrs, Volume= 0.251 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
4,175	74	>75% Grass cover, Good, HSG C
19,410	98	Paved parking, HSG C
24,235	98	Roofs, HSG C
47,820	96	Weighted Average
4,175		8.73% Pervious Area
43,645		91.27% Impervious Area

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

Summary for Subcatchment 5S: Bldg C (South Wing)

Runoff = 1.94 cfs @ 12.08 hrs, Volume= 0.148 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
2,220	74	>75% Grass cover, Good, HSG C
14,400	98	Paved parking, HSG C
11,570	98	Roofs, HSG C
28,190	96	Weighted Average
2,220		7.88% Pervious Area
25,970		92.12% Impervious Area

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

Summary for Subcatchment 6S: Outside Limit of Work, On and Off Site

Runoff = 2.78 cfs @ 12.21 hrs, Volume= 0.260 af, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
*	3,136	70	Pervious Pavers
	26,964	74	>75% Grass cover, Good, HSG C
	697	89	Gravel roads, HSG C
	33,367	98	Paved parking, HSG C
	28,314	70	Woods, Good, HSG C
	92,478	81	Weighted Average
	59,111		63.92% Pervious Area
	33,367		36.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	90	0.0300	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
3.2	120	0.0080	0.63		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
14.4	210	Total			

Summary for Subcatchment 7S: Tributary to Trotter Rd

Runoff = 0.21 cfs @ 12.09 hrs, Volume= 0.016 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
	1,130	74	>75% Grass cover, Good, HSG C
*	4,610	70	Pervious Pavers
	1,345	98	Paved parking, HSG C
	7,085	76	Weighted Average
	5,740		81.02% Pervious Area
	1,345		18.98% Impervious Area

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

Summary for Reach 1R: DP-1 Onsite Wetland

Inflow Area = 5.676 ac, 71.03% Impervious, Inflow Depth = 1.36" for 2-Year event
Inflow = 7.87 cfs @ 12.21 hrs, Volume= 0.643 af
Outflow = 7.87 cfs @ 12.21 hrs, Volume= 0.643 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach 2R: DP-2 Trotter Rd CB

Inflow Area = 0.163 ac, 18.98% Impervious, Inflow Depth = 1.15" for 2-Year event
Inflow = 0.21 cfs @ 12.09 hrs, Volume= 0.016 af
Outflow = 0.21 cfs @ 12.09 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: UG Chambers 3500

Inflow Area = 1.158 ac, 89.63% Impervious, Inflow Depth = 2.75" for 2-Year event
Inflow = 3.47 cfs @ 12.08 hrs, Volume= 0.265 af
Outflow = 1.75 cfs @ 12.22 hrs, Volume= 0.265 af, Atten= 50%, Lag= 8.4 min
Discarded = 0.06 cfs @ 7.80 hrs, Volume= 0.139 af
Primary = 1.70 cfs @ 12.22 hrs, Volume= 0.126 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 162.63' @ 12.22 hrs Surf.Area= 2,338 sf Storage= 4,100 cf
Flood Elev= 164.50' Surf.Area= 2,338 sf Storage= 6,639 cf

Plug-Flow detention time= 265.0 min calculated for 0.265 af (100% of inflow)
Center-of-Mass det. time= 265.0 min (1,039.1 - 774.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	160.00'	2,910 cf	**37.08'W x 63.06'L x 5.50'H Field A** 12,862 cf Overall - 4,547 cf Embedded = 8,315 cf x 35.0% Voids
#2A	160.75'	4,547 cf	**ADS_StormTech MC-3500 d +Cap** x 40 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 5 Rows of 8 Chambers Cap Storage= +14.9 cf x 2 x 5 rows = 149.0 cf
		7,457 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	160.75'	**18.0" Round Culvert** L= 97.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 160.75' / 158.80' S= 0.0201 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	161.80'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	164.50'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	160.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.06 cfs @ 7.80 hrs HW=160.02' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=1.69 cfs @ 12.22 hrs HW=162.63' (Free Discharge)
└**1=Culvert** (Passes 1.69 cfs of 9.05 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 1.69 cfs @ 3.11 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: UG Chambers 3500

Inflow Area = 0.284 ac, 98.51% Impervious, Inflow Depth = 2.97" for 2-Year event
Inflow = 0.88 cfs @ 12.08 hrs, Volume= 0.070 af
Outflow = 0.31 cfs @ 12.34 hrs, Volume= 0.070 af, Atten= 64%, Lag= 15.3 min
Discarded = 0.02 cfs @ 7.70 hrs, Volume= 0.043 af
Primary = 0.30 cfs @ 12.34 hrs, Volume= 0.027 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 160.41' @ 12.34 hrs Surf.Area= 759 sf Storage= 1,171 cf
Flood Elev= 162.50' Surf.Area= 759 sf Storage= 2,092 cf

Plug-Flow detention time= 268.8 min calculated for 0.070 af (100% of inflow)
Center-of-Mass det. time= 268.8 min (1,025.2 - 756.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	158.00'	979 cf	**15.58'W x 48.72'L x 5.50'H Field A** 4,176 cf Overall - 1,379 cf Embedded = 2,797 cf x 35.0% Voids
#2A	158.75'	1,379 cf	**ADS_StormTech MC-3500 d +Cap** x 12 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 2 Rows of 6 Chambers Cap Storage= +14.9 cf x 2 x 2 rows = 59.6 cf
		2,358 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	158.60'	**12.0" Round Culvert** L= 82.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 158.60' / 156.96' S= 0.0200 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	159.75'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	162.50'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	158.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 7.70 hrs HW=158.02' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.30 cfs @ 12.34 hrs HW=160.41' (Free Discharge)
└**1=Culvert** (Passes 0.30 cfs of 4.34 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.30 cfs @ 3.40 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: UG Chambers 3500

Inflow Area = 0.366 ac, 95.54% Impervious, Inflow Depth = 2.86" for 2-Year event
Inflow = 1.12 cfs @ 12.08 hrs, Volume= 0.087 af
Outflow = 0.76 cfs @ 12.17 hrs, Volume= 0.087 af, Atten= 32%, Lag= 5.0 min
Discarded = 0.01 cfs @ 6.76 hrs, Volume= 0.042 af
Primary = 0.75 cfs @ 12.17 hrs, Volume= 0.045 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 158.48' @ 12.17 hrs Surf.Area= 600 sf Storage= 1,213 cf

Plug-Flow detention time= 297.6 min calculated for 0.087 af (100% of inflow)
Center-of-Mass det. time= 297.7 min (1,063.7 - 766.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.25'	805 cf	**29.92'W x 20.04'L x 5.50'H Field A** 3,297 cf Overall - 999 cf Embedded = 2,299 cf x 35.0% Voids
#2A	156.00'	999 cf	**ADS_StormTech MC-3500 d +Cap** x 8 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 4 Rows of 2 Chambers Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		1,803 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.00'	**12.0" Round Culvert** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.00' / 155.90' S= 0.0200 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	157.60'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	159.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	155.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 6.76 hrs HW=155.27' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.75 cfs @ 12.17 hrs HW=158.48' (Free Discharge)
└**1=Culvert** (Passes 0.75 cfs of 5.32 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.75 cfs @ 3.82 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4P: UG Chambers 3500

Inflow Area = 1.098 ac, 91.27% Impervious, Inflow Depth = 2.75" for 2-Year event
Inflow = 3.29 cfs @ 12.08 hrs, Volume= 0.251 af
Outflow = 2.05 cfs @ 12.18 hrs, Volume= 0.251 af, Atten= 38%, Lag= 5.9 min
Discarded = 0.04 cfs @ 7.37 hrs, Volume= 0.114 af
Primary = 2.00 cfs @ 12.18 hrs, Volume= 0.138 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 158.00' @ 12.18 hrs Surf.Area= 1,887 sf Storage= 3,452 cf

Plug-Flow detention time= 224.9 min calculated for 0.251 af (100% of inflow)
Center-of-Mass det. time= 225.0 min (999.0 - 774.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.25'	2,358 cf	**29.92'W x 63.06'L x 5.50'H Field A** 10,376 cf Overall - 3,638 cf Embedded = 6,738 cf x 35.0% Voids
#2A	156.00'	3,638 cf	**ADS_StormTech MC-3500 d +Cap** x 32 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 4 Rows of 8 Chambers Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		5,996 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.81'	**18.0" Round Culvert** L= 20.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.81' / 156.61' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	157.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	159.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	155.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 7.37 hrs HW=155.27' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=2.00 cfs @ 12.18 hrs HW=158.00' (Free Discharge)
└**1=Culvert** (Passes 2.00 cfs of 4.58 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 2.00 cfs @ 3.67 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 5P: UG Chambers 740

Inflow Area = 0.647 ac, 92.12% Impervious, Inflow Depth = 2.75" for 2-Year event
Inflow = 1.94 cfs @ 12.08 hrs, Volume= 0.148 af
Outflow = 0.64 cfs @ 12.37 hrs, Volume= 0.148 af, Atten= 67%, Lag= 17.2 min
Discarded = 0.05 cfs @ 8.75 hrs, Volume= 0.101 af
Primary = 0.59 cfs @ 12.37 hrs, Volume= 0.048 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 156.91' @ 12.37 hrs Surf.Area= 2,031 sf Storage= 2,532 cf

Plug-Flow detention time= 267.9 min calculated for 0.148 af (100% of inflow)
Center-of-Mass det. time= 267.9 min (1,041.9 - 774.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.00'	1,620 cf	**30.00'W x 67.70'L x 3.50'H Field A** 7,108 cf Overall - 2,481 cf Embedded = 4,627 cf x 35.0% Voids
#2A	155.50'	2,481 cf	**ADS_StormTech SC-740 +Cap** x 54 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 6 Rows of 9 Chambers
		4,100 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	155.50'	**18.0" Round Culvert** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 155.50' / 155.26' S= 0.0060 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	156.45'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	158.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	155.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 8.75 hrs HW=155.01' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.59 cfs @ 12.37 hrs HW=156.91' (Free Discharge)
└**1=Culvert** (Passes 0.59 cfs of 5.69 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.59 cfs @ 2.31 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: West Parking, Bldg C (North Runoff Area=50,440 sf 89.63% Impervious Runoff Depth=4.23"
Tc=6.0 min CN=96 Runoff=5.22 cfs 0.409 af

Subcatchment 2S: Parking, Bldg A Runoff Area=12,390 sf 98.51% Impervious Runoff Depth=4.46"
Tc=6.0 min CN=98 Runoff=1.31 cfs 0.106 af

Subcatchment 3S: Center Parking Runoff Area=15,930 sf 95.54% Impervious Runoff Depth=4.35"
Tc=6.0 min CN=97 Runoff=1.67 cfs 0.133 af

Subcatchment 4S: East Parking, Bldg B Runoff Area=47,820 sf 91.27% Impervious Runoff Depth=4.23"
Tc=6.0 min CN=96 Runoff=4.95 cfs 0.387 af

Subcatchment 5S: Bldg C (South Wing) Runoff Area=28,190 sf 92.12% Impervious Runoff Depth=4.23"
Tc=6.0 min CN=96 Runoff=2.92 cfs 0.228 af

Subcatchment 6S: Outside Limit of Work, On Runoff Area=92,478 sf 36.08% Impervious Runoff Depth=2.72"
Flow Length=210' Tc=14.4 min CN=81 Runoff=5.21 cfs 0.482 af

Subcatchment 7S: Tributary to Trotter Rd Runoff Area=7,085 sf 18.98% Impervious Runoff Depth=2.29"
Tc=6.0 min CN=76 Runoff=0.44 cfs 0.031 af

Reach 1R: DP-1 Onsite Wetland Inflow=14.06 cfs 1.263 af
Outflow=14.06 cfs 1.263 af

Reach 2R: DP-2 Trotter Rd CB Inflow=0.44 cfs 0.031 af
Outflow=0.44 cfs 0.031 af

Pond 1P: UG Chambers 3500 Peak Elev=163.42' Storage=5,363 cf Inflow=5.22 cfs 0.409 af
Discarded=0.06 cfs 0.152 af Primary=2.88 cfs 0.257 af Outflow=2.93 cfs 0.409 af

Pond 2P: UG Chambers 3500 Peak Elev=161.31' Storage=1,638 cf Inflow=1.31 cfs 0.106 af
Discarded=0.02 cfs 0.048 af Primary=0.50 cfs 0.058 af Outflow=0.51 cfs 0.106 af

Pond 3P: UG Chambers 3500 Peak Elev=159.20' Storage=1,458 cf Inflow=1.67 cfs 0.133 af
Discarded=0.01 cfs 0.045 af Primary=1.10 cfs 0.088 af Outflow=1.11 cfs 0.133 af

Pond 4P: UG Chambers 3500 Peak Elev=158.70' Storage=4,347 cf Inflow=4.95 cfs 0.387 af
Discarded=0.04 cfs 0.122 af Primary=2.97 cfs 0.265 af Outflow=3.02 cfs 0.387 af

Pond 5P: UG Chambers 740 Peak Elev=157.53' Storage=3,321 cf Inflow=2.92 cfs 0.228 af
Discarded=0.05 cfs 0.114 af Primary=1.45 cfs 0.115 af Outflow=1.50 cfs 0.228 af

Total Runoff Area = 5.839 ac Runoff Volume = 1.775 af Average Runoff Depth = 3.65"
30.42% Pervious = 1.776 ac 69.58% Impervious = 4.062 ac

Summary for Subcatchment 1S: West Parking, Bldg C (North Wing)

Runoff = 5.22 cfs @ 12.08 hrs, Volume= 0.409 af, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
5,230	74	>75% Grass cover, Good, HSG C
30,270	98	Paved parking, HSG C
14,940	98	Roofs, HSG C
50,440	96	Weighted Average
5,230		10.37% Pervious Area
45,210		89.63% Impervious Area

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

Summary for Subcatchment 2S: Parking, Bldg A

Runoff = 1.31 cfs @ 12.08 hrs, Volume= 0.106 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
185	74	>75% Grass cover, Good, HSG C
1,930	98	Paved parking, HSG C
10,275	98	Roofs, HSG C
12,390	98	Weighted Average
185		1.49% Pervious Area
12,205		98.51% Impervious Area

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

Summary for Subcatchment 3S: Center Parking

Runoff = 1.67 cfs @ 12.08 hrs, Volume= 0.133 af, Depth= 4.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
710	74	>75% Grass cover, Good, HSG C
15,220	98	Paved parking, HSG C
15,930	97	Weighted Average
710		4.46% Pervious Area
15,220		95.54% Impervious Area

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

Summary for Subcatchment 4S: East Parking, Bldg B

Runoff = 4.95 cfs @ 12.08 hrs, Volume= 0.387 af, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
4,175	74	>75% Grass cover, Good, HSG C
19,410	98	Paved parking, HSG C
24,235	98	Roofs, HSG C
47,820	96	Weighted Average
4,175		8.73% Pervious Area
43,645		91.27% Impervious Area

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

Summary for Subcatchment 5S: Bldg C (South Wing)

Runoff = 2.92 cfs @ 12.08 hrs, Volume= 0.228 af, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
2,220	74	>75% Grass cover, Good, HSG C
14,400	98	Paved parking, HSG C
11,570	98	Roofs, HSG C
28,190	96	Weighted Average
2,220		7.88% Pervious Area
25,970		92.12% Impervious Area

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

Summary for Subcatchment 6S: Outside Limit of Work, On and Off Site

Runoff = 5.21 cfs @ 12.20 hrs, Volume= 0.482 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
*	3,136	70	Pervious Pavers
	26,964	74	>75% Grass cover, Good, HSG C
	697	89	Gravel roads, HSG C
	33,367	98	Paved parking, HSG C
	28,314	70	Woods, Good, HSG C
	92,478	81	Weighted Average
	59,111		63.92% Pervious Area
	33,367		36.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	90	0.0300	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
3.2	120	0.0080	0.63		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
14.4	210	Total			

Summary for Subcatchment 7S: Tributary to Trotter Rd

Runoff = 0.44 cfs @ 12.09 hrs, Volume= 0.031 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
	1,130	74	>75% Grass cover, Good, HSG C
*	4,610	70	Pervious Pavers
	1,345	98	Paved parking, HSG C
	7,085	76	Weighted Average
	5,740		81.02% Pervious Area
	1,345		18.98% Impervious Area

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

Summary for Reach 1R: DP-1 Onsite Wetland

Inflow Area = 5.676 ac, 71.03% Impervious, Inflow Depth = 2.67" for 10-Year event
Inflow = 14.06 cfs @ 12.20 hrs, Volume= 1.263 af
Outflow = 14.06 cfs @ 12.20 hrs, Volume= 1.263 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach 2R: DP-2 Trotter Rd CB

Inflow Area = 0.163 ac, 18.98% Impervious, Inflow Depth = 2.29" for 10-Year event
Inflow = 0.44 cfs @ 12.09 hrs, Volume= 0.031 af
Outflow = 0.44 cfs @ 12.09 hrs, Volume= 0.031 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: UG Chambers 3500

Inflow Area = 1.158 ac, 89.63% Impervious, Inflow Depth = 4.23" for 10-Year event
Inflow = 5.22 cfs @ 12.08 hrs, Volume= 0.409 af
Outflow = 2.93 cfs @ 12.20 hrs, Volume= 0.409 af, Atten= 44%, Lag= 6.9 min
Discarded = 0.06 cfs @ 6.21 hrs, Volume= 0.152 af
Primary = 2.88 cfs @ 12.20 hrs, Volume= 0.257 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 163.42' @ 12.20 hrs Surf.Area= 2,338 sf Storage= 5,363 cf
Flood Elev= 164.50' Surf.Area= 2,338 sf Storage= 6,639 cf

Plug-Flow detention time= 198.1 min calculated for 0.409 af (100% of inflow)
Center-of-Mass det. time= 198.1 min (962.0 - 763.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	160.00'	2,910 cf	**37.08'W x 63.06'L x 5.50'H Field A** 12,862 cf Overall - 4,547 cf Embedded = 8,315 cf x 35.0% Voids
#2A	160.75'	4,547 cf	**ADS_StormTech MC-3500 d +Cap** x 40 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 5 Rows of 8 Chambers Cap Storage= +14.9 cf x 2 x 5 rows = 149.0 cf
		7,457 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	160.75'	**18.0" Round Culvert** L= 97.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 160.75' / 158.80' S= 0.0201 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	161.80'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	164.50'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	160.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.06 cfs @ 6.21 hrs HW=160.02' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=2.88 cfs @ 12.20 hrs HW=163.42' (Free Discharge)
└**1=Culvert** (Passes 2.88 cfs of 11.78 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 2.88 cfs @ 5.27 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: UG Chambers 3500

Inflow Area = 0.284 ac, 98.51% Impervious, Inflow Depth = 4.46" for 10-Year event
Inflow = 1.31 cfs @ 12.08 hrs, Volume= 0.106 af
Outflow = 0.51 cfs @ 12.30 hrs, Volume= 0.106 af, Atten= 61%, Lag= 13.0 min
Discarded = 0.02 cfs @ 6.13 hrs, Volume= 0.048 af
Primary = 0.50 cfs @ 12.30 hrs, Volume= 0.058 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 161.31' @ 12.30 hrs Surf.Area= 759 sf Storage= 1,638 cf
Flood Elev= 162.50' Surf.Area= 759 sf Storage= 2,092 cf

Plug-Flow detention time= 214.2 min calculated for 0.106 af (100% of inflow)
Center-of-Mass det. time= 214.3 min (963.4 - 749.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	158.00'	979 cf	**15.58'W x 48.72'L x 5.50'H Field A** 4,176 cf Overall - 1,379 cf Embedded = 2,797 cf x 35.0% Voids
#2A	158.75'	1,379 cf	**ADS_StormTech MC-3500 d +Cap** x 12 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 2 Rows of 6 Chambers Cap Storage= +14.9 cf x 2 x 2 rows = 59.6 cf
		2,358 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	158.60'	**12.0" Round Culvert** L= 82.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 158.60' / 156.96' S= 0.0200 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	159.75'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	162.50'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	158.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 6.13 hrs HW=158.02' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.50 cfs @ 12.30 hrs HW=161.31' (Free Discharge)
└**1=Culvert** (Passes 0.50 cfs of 5.63 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.50 cfs @ 5.69 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: UG Chambers 3500

Inflow Area = 0.366 ac, 95.54% Impervious, Inflow Depth = 4.35" for 10-Year event
Inflow = 1.67 cfs @ 12.08 hrs, Volume= 0.133 af
Outflow = 1.11 cfs @ 12.17 hrs, Volume= 0.133 af, Atten= 33%, Lag= 5.2 min
Discarded = 0.01 cfs @ 4.72 hrs, Volume= 0.045 af
Primary = 1.10 cfs @ 12.17 hrs, Volume= 0.088 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 159.20' @ 12.17 hrs Surf.Area= 600 sf Storage= 1,458 cf

Plug-Flow detention time= 214.9 min calculated for 0.132 af (100% of inflow)
Center-of-Mass det. time= 215.0 min (972.1 - 757.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.25'	805 cf	**29.92'W x 20.04'L x 5.50'H Field A** 3,297 cf Overall - 999 cf Embedded = 2,299 cf x 35.0% Voids
#2A	156.00'	999 cf	**ADS_StormTech MC-3500 d +Cap** x 8 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 4 Rows of 2 Chambers Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		1,803 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.00'	**12.0" Round Culvert** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.00' / 155.90' S= 0.0200 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	157.60'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	159.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	155.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 4.72 hrs HW=155.27' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=1.10 cfs @ 12.17 hrs HW=159.20' (Free Discharge)
└**1=Culvert** (Passes 1.10 cfs of 6.21 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.10 cfs @ 5.59 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4P: UG Chambers 3500

Inflow Area = 1.098 ac, 91.27% Impervious, Inflow Depth = 4.23" for 10-Year event
Inflow = 4.95 cfs @ 12.08 hrs, Volume= 0.387 af
Outflow = 3.02 cfs @ 12.18 hrs, Volume= 0.387 af, Atten= 39%, Lag= 6.0 min
Discarded = 0.04 cfs @ 5.62 hrs, Volume= 0.122 af
Primary = 2.97 cfs @ 12.18 hrs, Volume= 0.265 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 158.70' @ 12.18 hrs Surf.Area= 1,887 sf Storage= 4,347 cf

Plug-Flow detention time= 166.0 min calculated for 0.387 af (100% of inflow)
Center-of-Mass det. time= 166.1 min (930.0 - 763.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.25'	2,358 cf	**29.92'W x 63.06'L x 5.50'H Field A** 10,376 cf Overall - 3,638 cf Embedded = 6,738 cf x 35.0% Voids
#2A	156.00'	3,638 cf	**ADS_StormTech MC-3500 d +Cap** x 32 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 4 Rows of 8 Chambers Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		5,996 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.81'	**18.0" Round Culvert** L= 20.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.81' / 156.61' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	157.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	159.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	155.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 5.62 hrs HW=155.27' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=2.97 cfs @ 12.18 hrs HW=158.70' (Free Discharge)
└**1=Culvert** (Passes 2.97 cfs of 8.46 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 2.97 cfs @ 5.45 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 5P: UG Chambers 740

Inflow Area = 0.647 ac, 92.12% Impervious, Inflow Depth = 4.23" for 10-Year event
Inflow = 2.92 cfs @ 12.08 hrs, Volume= 0.228 af
Outflow = 1.50 cfs @ 12.22 hrs, Volume= 0.228 af, Atten= 49%, Lag= 8.1 min
Discarded = 0.05 cfs @ 7.33 hrs, Volume= 0.114 af
Primary = 1.45 cfs @ 12.22 hrs, Volume= 0.115 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 157.53' @ 12.22 hrs Surf.Area= 2,031 sf Storage= 3,321 cf

Plug-Flow detention time= 208.7 min calculated for 0.228 af (100% of inflow)
Center-of-Mass det. time= 208.8 min (972.7 - 763.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.00'	1,620 cf	**30.00'W x 67.70'L x 3.50'H Field A** 7,108 cf Overall - 2,481 cf Embedded = 4,627 cf x 35.0% Voids
#2A	155.50'	2,481 cf	**ADS_StormTech SC-740 +Cap** x 54 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 6 Rows of 9 Chambers
		4,100 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	155.50'	**18.0" Round Culvert** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 155.50' / 155.26' S= 0.0060 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	156.45'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	158.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	155.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 7.33 hrs HW=155.01' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=1.45 cfs @ 12.22 hrs HW=157.53' (Free Discharge)
└**1=Culvert** (Passes 1.45 cfs of 8.32 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.45 cfs @ 4.16 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: West Parking, Bldg C (North Runoff Area=50,440 sf 89.63% Impervious Runoff Depth=5.03"
Tc=6.0 min CN=96 Runoff=6.15 cfs 0.485 af

Subcatchment 2S: Parking, Bldg A Runoff Area=12,390 sf 98.51% Impervious Runoff Depth=5.26"
Tc=6.0 min CN=98 Runoff=1.53 cfs 0.125 af

Subcatchment 3S: Center Parking Runoff Area=15,930 sf 95.54% Impervious Runoff Depth=5.15"
Tc=6.0 min CN=97 Runoff=1.96 cfs 0.157 af

Subcatchment 4S: East Parking, Bldg B Runoff Area=47,820 sf 91.27% Impervious Runoff Depth=5.03"
Tc=6.0 min CN=96 Runoff=5.83 cfs 0.460 af

Subcatchment 5S: Bldg C (South Wing) Runoff Area=28,190 sf 92.12% Impervious Runoff Depth=5.03"
Tc=6.0 min CN=96 Runoff=3.44 cfs 0.271 af

Subcatchment 6S: Outside Limit of Work, On Runoff Area=92,478 sf 36.08% Impervious Runoff Depth=3.43"
Flow Length=210' Tc=14.4 min CN=81 Runoff=6.55 cfs 0.607 af

Subcatchment 7S: Tributary to Trotter Rd Runoff Area=7,085 sf 18.98% Impervious Runoff Depth=2.95"
Tc=6.0 min CN=76 Runoff=0.56 cfs 0.040 af

Reach 1R: DP-1 Onsite Wetland Inflow=16.93 cfs 1.610 af
Outflow=16.93 cfs 1.610 af

Reach 2R: DP-2 Trotter Rd CB Inflow=0.56 cfs 0.040 af
Outflow=0.56 cfs 0.040 af

Pond 1P: UG Chambers 3500 Peak Elev=163.82' Storage=5,930 cf Inflow=6.15 cfs 0.485 af
Discarded=0.06 cfs 0.156 af Primary=3.32 cfs 0.329 af Outflow=3.38 cfs 0.485 af

Pond 2P: UG Chambers 3500 Peak Elev=161.81' Storage=1,864 cf Inflow=1.53 cfs 0.125 af
Discarded=0.02 cfs 0.050 af Primary=0.58 cfs 0.075 af Outflow=0.60 cfs 0.125 af

Pond 3P: UG Chambers 3500 Peak Elev=159.70' Storage=1,582 cf Inflow=1.96 cfs 0.157 af
Discarded=0.01 cfs 0.045 af Primary=1.28 cfs 0.111 af Outflow=1.30 cfs 0.157 af

Pond 4P: UG Chambers 3500 Peak Elev=159.10' Storage=4,802 cf Inflow=5.83 cfs 0.460 af
Discarded=0.04 cfs 0.125 af Primary=3.41 cfs 0.335 af Outflow=3.46 cfs 0.460 af

Pond 5P: UG Chambers 740 Peak Elev=157.95' Storage=3,711 cf Inflow=3.44 cfs 0.271 af
Discarded=0.05 cfs 0.119 af Primary=1.82 cfs 0.152 af Outflow=1.87 cfs 0.271 af

Total Runoff Area = 5.839 ac Runoff Volume = 2.145 af Average Runoff Depth = 4.41"
30.42% Pervious = 1.776 ac 69.58% Impervious = 4.062 ac

Summary for Subcatchment 1S: West Parking, Bldg C (North Wing)

Runoff = 6.15 cfs @ 12.08 hrs, Volume= 0.485 af, Depth= 5.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
5,230	74	>75% Grass cover, Good, HSG C
30,270	98	Paved parking, HSG C
14,940	98	Roofs, HSG C
50,440	96	Weighted Average
5,230		10.37% Pervious Area
45,210		89.63% Impervious Area

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

Summary for Subcatchment 2S: Parking, Bldg A

Runoff = 1.53 cfs @ 12.08 hrs, Volume= 0.125 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
185	74	>75% Grass cover, Good, HSG C
1,930	98	Paved parking, HSG C
10,275	98	Roofs, HSG C
12,390	98	Weighted Average
185		1.49% Pervious Area
12,205		98.51% Impervious Area

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

Summary for Subcatchment 3S: Center Parking

Runoff = 1.96 cfs @ 12.08 hrs, Volume= 0.157 af, Depth= 5.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
710	74	>75% Grass cover, Good, HSG C
15,220	98	Paved parking, HSG C
15,930	97	Weighted Average
710		4.46% Pervious Area
15,220		95.54% Impervious Area

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

Summary for Subcatchment 4S: East Parking, Bldg B

Runoff = 5.83 cfs @ 12.08 hrs, Volume= 0.460 af, Depth= 5.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
4,175	74	>75% Grass cover, Good, HSG C
19,410	98	Paved parking, HSG C
24,235	98	Roofs, HSG C
47,820	96	Weighted Average
4,175		8.73% Pervious Area
43,645		91.27% Impervious Area

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

Summary for Subcatchment 5S: Bldg C (South Wing)

Runoff = 3.44 cfs @ 12.08 hrs, Volume= 0.271 af, Depth= 5.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
2,220	74	>75% Grass cover, Good, HSG C
14,400	98	Paved parking, HSG C
11,570	98	Roofs, HSG C
28,190	96	Weighted Average
2,220		7.88% Pervious Area
25,970		92.12% Impervious Area

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

Summary for Subcatchment 6S: Outside Limit of Work, On and Off Site

Runoff = 6.55 cfs @ 12.20 hrs, Volume= 0.607 af, Depth= 3.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
*	3,136	70	Pervious Pavers
	26,964	74	>75% Grass cover, Good, HSG C
	697	89	Gravel roads, HSG C
	33,367	98	Paved parking, HSG C
	28,314	70	Woods, Good, HSG C
	92,478	81	Weighted Average
	59,111		63.92% Pervious Area
	33,367		36.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	90	0.0300	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
3.2	120	0.0080	0.63		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
14.4	210	Total			

Summary for Subcatchment 7S: Tributary to Trotter Rd

Runoff = 0.56 cfs @ 12.09 hrs, Volume= 0.040 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
	1,130	74	>75% Grass cover, Good, HSG C
*	4,610	70	Pervious Pavers
	1,345	98	Paved parking, HSG C
	7,085	76	Weighted Average
	5,740		81.02% Pervious Area
	1,345		18.98% Impervious Area

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

Summary for Reach 1R: DP-1 Onsite Wetland

Inflow Area = 5.676 ac, 71.03% Impervious, Inflow Depth = 3.40" for 25-Year event
Inflow = 16.93 cfs @ 12.20 hrs, Volume= 1.610 af
Outflow = 16.93 cfs @ 12.20 hrs, Volume= 1.610 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach 2R: DP-2 Trotter Rd CB

Inflow Area = 0.163 ac, 18.98% Impervious, Inflow Depth = 2.95" for 25-Year event
Inflow = 0.56 cfs @ 12.09 hrs, Volume= 0.040 af
Outflow = 0.56 cfs @ 12.09 hrs, Volume= 0.040 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: UG Chambers 3500

Inflow Area = 1.158 ac, 89.63% Impervious, Inflow Depth = 5.03" for 25-Year event
Inflow = 6.15 cfs @ 12.08 hrs, Volume= 0.485 af
Outflow = 3.38 cfs @ 12.20 hrs, Volume= 0.485 af, Atten= 45%, Lag= 7.2 min
Discarded = 0.06 cfs @ 5.23 hrs, Volume= 0.156 af
Primary = 3.32 cfs @ 12.20 hrs, Volume= 0.329 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 163.82' @ 12.20 hrs Surf.Area= 2,338 sf Storage= 5,930 cf
Flood Elev= 164.50' Surf.Area= 2,338 sf Storage= 6,639 cf

Plug-Flow detention time= 175.6 min calculated for 0.485 af (100% of inflow)
Center-of-Mass det. time= 175.7 min (935.9 - 760.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	160.00'	2,910 cf	**37.08'W x 63.06'L x 5.50'H Field A** 12,862 cf Overall - 4,547 cf Embedded = 8,315 cf x 35.0% Voids
#2A	160.75'	4,547 cf	**ADS_StormTech MC-3500 d +Cap** x 40 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 5 Rows of 8 Chambers Cap Storage= +14.9 cf x 2 x 5 rows = 149.0 cf
		7,457 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	160.75'	**18.0" Round Culvert** L= 97.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 160.75' / 158.80' S= 0.0201 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	161.80'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	164.50'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	160.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.06 cfs @ 5.23 hrs HW=160.02' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=3.32 cfs @ 12.20 hrs HW=163.82' (Free Discharge)
└**1=Culvert** (Passes 3.32 cfs of 12.95 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 3.32 cfs @ 6.09 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: UG Chambers 3500

Inflow Area = 0.284 ac, 98.51% Impervious, Inflow Depth = 5.26" for 25-Year event
Inflow = 1.53 cfs @ 12.08 hrs, Volume= 0.125 af
Outflow = 0.60 cfs @ 12.30 hrs, Volume= 0.125 af, Atten= 61%, Lag= 13.2 min
Discarded = 0.02 cfs @ 4.96 hrs, Volume= 0.050 af
Primary = 0.58 cfs @ 12.30 hrs, Volume= 0.075 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 161.81' @ 12.30 hrs Surf.Area= 759 sf Storage= 1,864 cf
Flood Elev= 162.50' Surf.Area= 759 sf Storage= 2,092 cf

Plug-Flow detention time= 194.9 min calculated for 0.125 af (100% of inflow)
Center-of-Mass det. time= 195.0 min (941.5 - 746.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	158.00'	979 cf	**15.58'W x 48.72'L x 5.50'H Field A** 4,176 cf Overall - 1,379 cf Embedded = 2,797 cf x 35.0% Voids
#2A	158.75'	1,379 cf	**ADS_StormTech MC-3500 d +Cap** x 12 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 2 Rows of 6 Chambers Cap Storage= +14.9 cf x 2 x 2 rows = 59.6 cf
		2,358 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	158.60'	**12.0" Round Culvert** L= 82.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 158.60' / 156.96' S= 0.0200 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	159.75'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	162.50'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	158.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 4.96 hrs HW=158.02' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.58 cfs @ 12.30 hrs HW=161.81' (Free Discharge)
└**1=Culvert** (Passes 0.58 cfs of 6.13 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.58 cfs @ 6.63 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: UG Chambers 3500

Inflow Area = 0.366 ac, 95.54% Impervious, Inflow Depth = 5.15" for 25-Year event
Inflow = 1.96 cfs @ 12.08 hrs, Volume= 0.157 af
Outflow = 1.30 cfs @ 12.17 hrs, Volume= 0.157 af, Atten= 34%, Lag= 5.2 min
Discarded = 0.01 cfs @ 3.89 hrs, Volume= 0.045 af
Primary = 1.28 cfs @ 12.17 hrs, Volume= 0.111 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 159.70' @ 12.17 hrs Surf.Area= 600 sf Storage= 1,582 cf

Plug-Flow detention time= 188.7 min calculated for 0.157 af (100% of inflow)
Center-of-Mass det. time= 188.8 min (942.7 - 753.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.25'	805 cf	**29.92'W x 20.04'L x 5.50'H Field A** 3,297 cf Overall - 999 cf Embedded = 2,299 cf x 35.0% Voids
#2A	156.00'	999 cf	**ADS_StormTech MC-3500 d +Cap** x 8 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 4 Rows of 2 Chambers Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		1,803 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.00'	**12.0" Round Culvert** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.00' / 155.90' S= 0.0200 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	157.60'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	159.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	155.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 3.89 hrs HW=155.27' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=1.28 cfs @ 12.17 hrs HW=159.69' (Free Discharge)
└**1=Culvert** (Passes 1.28 cfs of 6.76 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.28 cfs @ 6.54 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4P: UG Chambers 3500

Inflow Area = 1.098 ac, 91.27% Impervious, Inflow Depth = 5.03" for 25-Year event
Inflow = 5.83 cfs @ 12.08 hrs, Volume= 0.460 af
Outflow = 3.46 cfs @ 12.19 hrs, Volume= 0.460 af, Atten= 41%, Lag= 6.3 min
Discarded = 0.04 cfs @ 4.70 hrs, Volume= 0.125 af
Primary = 3.41 cfs @ 12.19 hrs, Volume= 0.335 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 159.10' @ 12.19 hrs Surf.Area= 1,887 sf Storage= 4,802 cf

Plug-Flow detention time= 147.0 min calculated for 0.460 af (100% of inflow)
Center-of-Mass det. time= 147.1 min (907.3 - 760.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.25'	2,358 cf	**29.92'W x 63.06'L x 5.50'H Field A** 10,376 cf Overall - 3,638 cf Embedded = 6,738 cf x 35.0% Voids
#2A	156.00'	3,638 cf	**ADS_StormTech MC-3500 d +Cap** x 32 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 4 Rows of 8 Chambers Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		5,996 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.81'	**18.0" Round Culvert** L= 20.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.81' / 156.61' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	157.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	159.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	155.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 4.70 hrs HW=155.27' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=3.41 cfs @ 12.19 hrs HW=159.10' (Free Discharge)
└**1=Culvert** (Passes 3.41 cfs of 10.35 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 3.41 cfs @ 6.25 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 5P: UG Chambers 740

Inflow Area = 0.647 ac, 92.12% Impervious, Inflow Depth = 5.03" for 25-Year event
Inflow = 3.44 cfs @ 12.08 hrs, Volume= 0.271 af
Outflow = 1.87 cfs @ 12.21 hrs, Volume= 0.271 af, Atten= 46%, Lag= 7.3 min
Discarded = 0.05 cfs @ 6.68 hrs, Volume= 0.119 af
Primary = 1.82 cfs @ 12.21 hrs, Volume= 0.152 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 157.95' @ 12.21 hrs Surf.Area= 2,031 sf Storage= 3,711 cf

Plug-Flow detention time= 189.0 min calculated for 0.271 af (100% of inflow)
Center-of-Mass det. time= 189.1 min (949.3 - 760.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.00'	1,620 cf	**30.00'W x 67.70'L x 3.50'H Field A** 7,108 cf Overall - 2,481 cf Embedded = 4,627 cf x 35.0% Voids
#2A	155.50'	2,481 cf	**ADS_StormTech SC-740 +Cap** x 54 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 6 Rows of 9 Chambers
		4,100 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	155.50'	**18.0" Round Culvert** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 155.50' / 155.26' S= 0.0060 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	156.45'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	158.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	155.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 6.68 hrs HW=155.01' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=1.82 cfs @ 12.21 hrs HW=157.95' (Free Discharge)
└**1=Culvert** (Passes 1.82 cfs of 10.36 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.82 cfs @ 5.21 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: West Parking, Bldg C (North Runoff Area=50,440 sf 89.63% Impervious Runoff Depth=6.22"
Tc=6.0 min CN=96 Runoff=7.54 cfs 0.601 af

Subcatchment 2S: Parking, Bldg A Runoff Area=12,390 sf 98.51% Impervious Runoff Depth=6.46"
Tc=6.0 min CN=98 Runoff=1.87 cfs 0.153 af

Subcatchment 3S: Center Parking Runoff Area=15,930 sf 95.54% Impervious Runoff Depth=6.34"
Tc=6.0 min CN=97 Runoff=2.39 cfs 0.193 af

Subcatchment 4S: East Parking, Bldg B Runoff Area=47,820 sf 91.27% Impervious Runoff Depth=6.22"
Tc=6.0 min CN=96 Runoff=7.14 cfs 0.569 af

Subcatchment 5S: Bldg C (South Wing) Runoff Area=28,190 sf 92.12% Impervious Runoff Depth=6.22"
Tc=6.0 min CN=96 Runoff=4.21 cfs 0.336 af

Subcatchment 6S: Outside Limit of Work, On Runoff Area=92,478 sf 36.08% Impervious Runoff Depth=4.53"
Flow Length=210' Tc=14.4 min CN=81 Runoff=8.59 cfs 0.801 af

Subcatchment 7S: Tributary to Trotter Rd Runoff Area=7,085 sf 18.98% Impervious Runoff Depth=3.99"
Tc=6.0 min CN=76 Runoff=0.76 cfs 0.054 af

Reach 1R: DP-1 Onsite Wetland Inflow=22.88 cfs 2.143 af
Outflow=22.88 cfs 2.143 af

Reach 2R: DP-2 Trotter Rd CB Inflow=0.76 cfs 0.054 af
Outflow=0.76 cfs 0.054 af

Pond 1P: UG Chambers 3500 Peak Elev=164.57' Storage=6,700 cf Inflow=7.54 cfs 0.601 af
Discarded=0.06 cfs 0.160 af Primary=4.43 cfs 0.441 af Outflow=4.49 cfs 0.601 af

Pond 2P: UG Chambers 3500 Peak Elev=162.56' Storage=2,107 cf Inflow=1.87 cfs 0.153 af
Discarded=0.02 cfs 0.051 af Primary=0.95 cfs 0.102 af Outflow=0.97 cfs 0.153 af

Pond 3P: UG Chambers 3500 Peak Elev=159.88' Storage=1,621 cf Inflow=2.39 cfs 0.193 af
Discarded=0.01 cfs 0.046 af Primary=2.30 cfs 0.147 af Outflow=2.31 cfs 0.193 af

Pond 4P: UG Chambers 3500 Peak Elev=159.86' Storage=5,410 cf Inflow=7.14 cfs 0.569 af
Discarded=0.04 cfs 0.128 af Primary=4.84 cfs 0.441 af Outflow=4.88 cfs 0.569 af

Pond 5P: UG Chambers 740 Peak Elev=158.19' Storage=3,882 cf Inflow=4.21 cfs 0.336 af
Discarded=0.05 cfs 0.124 af Primary=3.64 cfs 0.211 af Outflow=3.69 cfs 0.336 af

Total Runoff Area = 5.839 ac Runoff Volume = 2.707 af Average Runoff Depth = 5.56"
30.42% Pervious = 1.776 ac 69.58% Impervious = 4.062 ac

Summary for Subcatchment 1S: West Parking, Bldg C (North Wing)

Runoff = 7.54 cfs @ 12.08 hrs, Volume= 0.601 af, Depth= 6.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
5,230	74	>75% Grass cover, Good, HSG C
30,270	98	Paved parking, HSG C
14,940	98	Roofs, HSG C
50,440	96	Weighted Average
5,230		10.37% Pervious Area
45,210		89.63% Impervious Area

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

Summary for Subcatchment 2S: Parking, Bldg A

Runoff = 1.87 cfs @ 12.08 hrs, Volume= 0.153 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
185	74	>75% Grass cover, Good, HSG C
1,930	98	Paved parking, HSG C
10,275	98	Roofs, HSG C
12,390	98	Weighted Average
185		1.49% Pervious Area
12,205		98.51% Impervious Area

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

Summary for Subcatchment 3S: Center Parking

Runoff = 2.39 cfs @ 12.08 hrs, Volume= 0.193 af, Depth= 6.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
710	74	>75% Grass cover, Good, HSG C
15,220	98	Paved parking, HSG C
15,930	97	Weighted Average
710		4.46% Pervious Area
15,220		95.54% Impervious Area

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

Summary for Subcatchment 4S: East Parking, Bldg B

Runoff = 7.14 cfs @ 12.08 hrs, Volume= 0.569 af, Depth= 6.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
4,175	74	>75% Grass cover, Good, HSG C
19,410	98	Paved parking, HSG C
24,235	98	Roofs, HSG C
47,820	96	Weighted Average
4,175		8.73% Pervious Area
43,645		91.27% Impervious Area

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

Summary for Subcatchment 5S: Bldg C (South Wing)

Runoff = 4.21 cfs @ 12.08 hrs, Volume= 0.336 af, Depth= 6.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
2,220	74	>75% Grass cover, Good, HSG C
14,400	98	Paved parking, HSG C
11,570	98	Roofs, HSG C
28,190	96	Weighted Average
2,220		7.88% Pervious Area
25,970		92.12% Impervious Area

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

Summary for Subcatchment 6S: Outside Limit of Work, On and Off Site

Runoff = 8.59 cfs @ 12.19 hrs, Volume= 0.801 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

	Area (sf)	CN	Description
*	3,136	70	Pervious Pavers
	26,964	74	>75% Grass cover, Good, HSG C
	697	89	Gravel roads, HSG C
	33,367	98	Paved parking, HSG C
	28,314	70	Woods, Good, HSG C
	92,478	81	Weighted Average
	59,111		63.92% Pervious Area
	33,367		36.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	90	0.0300	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
3.2	120	0.0080	0.63		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
14.4	210	Total			

Summary for Subcatchment 7S: Tributary to Trotter Rd

Runoff = 0.76 cfs @ 12.09 hrs, Volume= 0.054 af, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

	Area (sf)	CN	Description
	1,130	74	>75% Grass cover, Good, HSG C
*	4,610	70	Pervious Pavers
	1,345	98	Paved parking, HSG C
	7,085	76	Weighted Average
	5,740		81.02% Pervious Area
	1,345		18.98% Impervious Area

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

Summary for Reach 1R: DP-1 Onsite Wetland

Inflow Area = 5.676 ac, 71.03% Impervious, Inflow Depth = 4.53" for 100-Year event
Inflow = 22.88 cfs @ 12.17 hrs, Volume= 2.143 af
Outflow = 22.88 cfs @ 12.17 hrs, Volume= 2.143 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Reach 2R: DP-2 Trotter Rd CB

Inflow Area = 0.163 ac, 18.98% Impervious, Inflow Depth = 3.99" for 100-Year event
Inflow = 0.76 cfs @ 12.09 hrs, Volume= 0.054 af
Outflow = 0.76 cfs @ 12.09 hrs, Volume= 0.054 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: UG Chambers 3500

Inflow Area = 1.158 ac, 89.63% Impervious, Inflow Depth = 6.22" for 100-Year event
Inflow = 7.54 cfs @ 12.08 hrs, Volume= 0.601 af
Outflow = 4.49 cfs @ 12.19 hrs, Volume= 0.601 af, Atten= 40%, Lag= 6.3 min
Discarded = 0.06 cfs @ 4.13 hrs, Volume= 0.160 af
Primary = 4.43 cfs @ 12.19 hrs, Volume= 0.441 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 164.57' @ 12.19 hrs Surf.Area= 2,338 sf Storage= 6,700 cf
Flood Elev= 164.50' Surf.Area= 2,338 sf Storage= 6,639 cf

Plug-Flow detention time= 151.6 min calculated for 0.601 af (100% of inflow)
Center-of-Mass det. time= 151.7 min (907.6 - 755.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	160.00'	2,910 cf	**37.08'W x 63.06'L x 5.50'H Field A** 12,862 cf Overall - 4,547 cf Embedded = 8,315 cf x 35.0% Voids
#2A	160.75'	4,547 cf	**ADS_StormTech MC-3500 d +Cap** x 40 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 5 Rows of 8 Chambers Cap Storage= +14.9 cf x 2 x 5 rows = 149.0 cf
		7,457 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	160.75'	**18.0" Round Culvert** L= 97.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 160.75' / 158.80' S= 0.0201 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	161.80'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	164.50'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	160.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.06 cfs @ 4.13 hrs HW=160.02' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=4.43 cfs @ 12.19 hrs HW=164.57' (Free Discharge)
└**1=Culvert** (Passes 4.43 cfs of 14.92 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 4.03 cfs @ 7.39 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.39 cfs @ 0.89 fps)

Summary for Pond 2P: UG Chambers 3500

Inflow Area = 0.284 ac, 98.51% Impervious, Inflow Depth = 6.46" for 100-Year event
Inflow = 1.87 cfs @ 12.08 hrs, Volume= 0.153 af
Outflow = 0.97 cfs @ 12.22 hrs, Volume= 0.153 af, Atten= 48%, Lag= 8.0 min
Discarded = 0.02 cfs @ 3.73 hrs, Volume= 0.051 af
Primary = 0.95 cfs @ 12.22 hrs, Volume= 0.102 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 162.56' @ 12.22 hrs Surf.Area= 759 sf Storage= 2,107 cf
Flood Elev= 162.50' Surf.Area= 759 sf Storage= 2,092 cf

Plug-Flow detention time= 171.7 min calculated for 0.153 af (100% of inflow)
Center-of-Mass det. time= 171.8 min (915.4 - 743.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	158.00'	979 cf	**15.58'W x 48.72'L x 5.50'H Field A** 4,176 cf Overall - 1,379 cf Embedded = 2,797 cf x 35.0% Voids
#2A	158.75'	1,379 cf	**ADS_StormTech MC-3500 d +Cap** x 12 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 2 Rows of 6 Chambers Cap Storage= +14.9 cf x 2 x 2 rows = 59.6 cf
		2,358 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	158.60'	**12.0" Round Culvert** L= 82.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 158.60' / 156.96' S= 0.0200 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	159.75'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	162.50'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	158.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 3.73 hrs HW=158.02' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.94 cfs @ 12.22 hrs HW=162.56' (Free Discharge)
└**1=Culvert** (Passes 0.94 cfs of 6.69 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.68 cfs @ 7.82 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.26 cfs @ 0.77 fps)

Summary for Pond 3P: UG Chambers 3500

Inflow Area = 0.366 ac, 95.54% Impervious, Inflow Depth = 6.34" for 100-Year event
Inflow = 2.39 cfs @ 12.08 hrs, Volume= 0.193 af
Outflow = 2.31 cfs @ 12.11 hrs, Volume= 0.193 af, Atten= 3%, Lag= 1.4 min
Discarded = 0.01 cfs @ 3.01 hrs, Volume= 0.046 af
Primary = 2.30 cfs @ 12.11 hrs, Volume= 0.147 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 159.88' @ 12.11 hrs Surf.Area= 600 sf Storage= 1,621 cf

Plug-Flow detention time= 160.5 min calculated for 0.193 af (100% of inflow)
Center-of-Mass det. time= 160.7 min (910.8 - 750.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.25'	805 cf	**29.92'W x 20.04'L x 5.50'H Field A** 3,297 cf Overall - 999 cf Embedded = 2,299 cf x 35.0% Voids
#2A	156.00'	999 cf	**ADS_StormTech MC-3500 d +Cap** x 8 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 4 Rows of 2 Chambers Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		1,803 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.00'	**12.0" Round Culvert** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.00' / 155.90' S= 0.0200 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf
#2	Device 1	157.60'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	159.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	155.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 3.01 hrs HW=155.27' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=2.29 cfs @ 12.11 hrs HW=159.88' (Free Discharge)
└**1=Culvert** (Passes 2.29 cfs of 6.95 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.35 cfs @ 6.86 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.94 cfs @ 1.19 fps)

Summary for Pond 4P: UG Chambers 3500

Inflow Area = 1.098 ac, 91.27% Impervious, Inflow Depth = 6.22" for 100-Year event
Inflow = 7.14 cfs @ 12.08 hrs, Volume= 0.569 af
Outflow = 4.88 cfs @ 12.17 hrs, Volume= 0.569 af, Atten= 32%, Lag= 5.0 min
Discarded = 0.04 cfs @ 3.71 hrs, Volume= 0.128 af
Primary = 4.84 cfs @ 12.17 hrs, Volume= 0.441 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 159.86' @ 12.17 hrs Surf.Area= 1,887 sf Storage= 5,410 cf

Plug-Flow detention time= 126.8 min calculated for 0.569 af (100% of inflow)
Center-of-Mass det. time= 126.8 min (882.7 - 755.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.25'	2,358 cf	**29.92'W x 63.06'L x 5.50'H Field A** 10,376 cf Overall - 3,638 cf Embedded = 6,738 cf x 35.0% Voids
#2A	156.00'	3,638 cf	**ADS_StormTech MC-3500 d +Cap** x 32 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 4 Rows of 8 Chambers Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		5,996 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.81'	**18.0" Round Culvert** L= 20.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.81' / 156.61' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	157.00'	**10.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	159.75'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	155.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 3.71 hrs HW=155.27' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=4.82 cfs @ 12.17 hrs HW=159.86' (Free Discharge)
└**1=Culvert** (Passes 4.82 cfs of 12.90 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 4.11 cfs @ 7.53 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.71 cfs @ 1.09 fps)

Summary for Pond 5P: UG Chambers 740

Inflow Area = 0.647 ac, 92.12% Impervious, Inflow Depth = 6.22" for 100-Year event
Inflow = 4.21 cfs @ 12.08 hrs, Volume= 0.336 af
Outflow = 3.69 cfs @ 12.13 hrs, Volume= 0.336 af, Atten= 12%, Lag= 2.7 min
Discarded = 0.05 cfs @ 5.76 hrs, Volume= 0.124 af
Primary = 3.64 cfs @ 12.13 hrs, Volume= 0.211 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 158.19' @ 12.13 hrs Surf.Area= 2,031 sf Storage= 3,882 cf

Plug-Flow detention time= 165.3 min calculated for 0.336 af (100% of inflow)
Center-of-Mass det. time= 165.4 min (921.3 - 755.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	155.00'	1,620 cf	**30.00'W x 67.70'L x 3.50'H Field A** 7,108 cf Overall - 2,481 cf Embedded = 4,627 cf x 35.0% Voids
#2A	155.50'	2,481 cf	**ADS_StormTech SC-740 +Cap** x 54 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 6 Rows of 9 Chambers
		4,100 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	155.50'	**18.0" Round Culvert** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 155.50' / 155.26' S= 0.0060 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	156.45'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	158.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	155.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 5.76 hrs HW=155.01' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=3.63 cfs @ 12.13 hrs HW=158.19' (Free Discharge)
└**1=Culvert** (Passes 3.63 cfs of 11.36 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.99 cfs @ 5.71 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 1.64 cfs @ 1.43 fps)

Section 3.2

Proposed Pipe Hydraulic Calculations

STORM SEWER DESIGN

Design Assumptions

Project No. 34672
Project The Residences at 1500 Main
Location 1500 Main Street
Weymouth, Massachusetts

25 Year Storm
5 Minute Duration
6 in/hr Intensity for Boston County IDF Curve

Pipe Coefficient "n" 0.013

SHEET 1 OF 1
COMPUTED BY DR DATE 11/2/2018
DATE
DATE
CHECKED BY AV DATE

DRAINAGE STRUCTURE		TRIBUTRARY AREA		RUNOFF COEFFICIENT	RUNOFF RATIONAL METHOD Q=Ca x C x i x A							PIPE							FROM
							TIME OF FLOW		RAINFALL INTENSITY	DISCHARGE (Q_D)					MANNING'S EQUATION FULL FLOW	MEAN VELOCITY	AVAILABLE CAPACITY			STRUCTURE
FROM STRUCT.	TO STRUCT.	INCREM. (AC)	TOTAL	"C"	"Ca"	"Ca" X "C" X "A"	TC(MIN)	TF(MIN)	(IN/HR)	INCREM (CFS)	TOTAL (CFS)	LENGTH (FT)	DIA (IN)	SLOPE (FT/FT)	Q_F (CFS)	VF (FT/S)	(Q_F - Q_D)	FROM INVERT	TO INVERT	RIM
AD-1	DMH-1	0.03		0.90	1.1	0.03	6		6	0.20		78	12	0.005	2.52	3.21	2.32	164.15	163.76	168.15
CB-1	DMH-1	0.21		0.90	1.1	0.21	6		6	1.25		25	12	0.006	2.86	3.64	1.61	165.70	165.54	169.70
CB-2	DMH-1	0.17		0.90	1.1	0.17	6		6	1.02		20	12	0.023	5.41	6.89	4.39	166.00	165.54	170.20
DMH-1	DMH-2		0.42		1.1			6	6		2.48	79	18	0.010	10.52	5.96	8.05	163.66	162.87	170.50
CB-3	DMH-2	0.11		0.90	1.1	0.11	6		6	0.66		18	12	0.010	3.57	4.55	2.91	164.50	164.32	168.50
DMH-2	DMH-3		0.53		1.1			6	6		3.13	30	18	0.010	10.52	5.96	7.39	162.77	162.47	168.30
DMH-3	UG-1		0.53		1.1			6	6		3.13	5	18	0.010	10.52	5.96	7.39	160.80	160.75	167.75
RDC1	DMH-6	0.27		0.90	1.1	0.26	6		6	1.58		31	12	0.020	5.05	6.43	3.47	161.72	161.10	
DMH-6	UG-1		0.27		1.1			6	6		1.58	23	12	0.011	3.72	4.74	2.14	161.00	160.75	167.85
CB-4	DMH-4	0.13		0.90	1.1	0.13	6		6	0.79		14	12	0.020	5.05	6.43	4.26	163.00	162.72	167.00
CB-5	DMH-4	0.12		0.90	1.1	0.12	6		6	0.71		54	12	0.005	2.52	3.21	1.81	162.60	162.33	166.60
DMH-4	DMH-5		0.25		1.1			6	6		1.50	14	12	0.005	2.52	3.21	1.03	162.33	162.26	167.95
CB-6	DMH-5	0.07		0.90	1.1	0.07	6		6	0.44		76	12	0.012	3.84	4.89	3.40	163.78	162.90	167.28
DMH-5	UG-1		0.33		1.1				6		1.93	14	18	0.015	12.89	7.30	10.96	160.96	160.75	167.50
OCS-1	DMH-7								6		4.43	97	18	0.020	14.92	8.45	10.49	160.75	158.80	167.75
DMH-7	DMH-8								6		4.43	69	18	0.020	14.88	8.43	10.45	158.70	157.32	167.40
RDA1	DMH-12	0.24		0.90	1.1	0.23	6		6	1.40		118	12	0.015	4.37	5.57	2.97	163.50	161.73	
DMH-12	UG-2		0.24		1.1			6	6		1.40	4	12	0.013	3.99	5.08	2.59	158.80	158.75	165.70
CB-7	DMH-11	0.05		0.90	1.1	0.05	6		6	0.29		57	12	0.018	4.73	6.02	4.44	162.80	161.80	166.80
DMH-11	UG-2				1.1			6	6		0.29	4	12	0.013	3.99	5.08	3.70	158.80	158.75	165.80
OCS-2	DMH-8								6		0.95	82	12	0.020	5.05	6.43	4.10	158.60	156.96	164.80
DMH-8	DMH-9								6		5.38	46	18	0.010	10.64	6.02	5.26	156.96	156.49	163.48
DCB-8	DMH-13	0.22		0.90	1.1	0.22	6		6	1.34		25	12	0.016	4.51	5.75	3.18	158.20	157.80	163.20
CB-9	DMH-13	0.14		0.90	1.1	0.14	6		6	0.83		32	12	0.005	2.52	3.21	1.70	157.30	157.14	161.30
DMH-13	UG-3		0.36		1.1			6	6		2.16	5	12	0.020	5.05	6.43	2.88	156.20	156.10	161.60
OCS-3	DMH-19								6		2.30	6	12	0.010	3.57	4.55	1.27	156.67	156.61	161.90
AD-2	DMH-14	0.05		0.90	1.1	0.05	6		6	0.27		131	12	0.020	5.05	6.43	4.77	163.50	160.88	167.50
DCB-10	DMH-14	0.33		0.90	1.1	0.33	6		6	1.95		8	12	0.040	7.14	9.09	5.19	162.00	161.68	166.00
DMH-14	DMH15		0.37		1.1			6	6		2.22	78	18	0.020	14.88	8.43	12.66	160.78	159.22	166.25
DMH-15	UG-4		0.37		1.1			6	6		2.22	5	18	0.020	14.88	8.43	12.66	156.20	156.10	165.80
RDB1	DMH-16	0.25		0.90	1.1	0.25	6		6	1.47		28	12	0.020	5.05	6.43	3.57	157.92	157.36	
DMH-16	UG-4		0.25		1.1			6	6		1.47	63	12	0.020	5.05	6.43	3.57	157.26	156.00	164.17

	RDB2	DMH-17	0.31		0.90	1.1	0.31	6		6	1.84		42	12	0.010	3.57	4.55	1.73	158.00	157.58	
	DMH-17	UG-4		0.31		1.1			6	6		1.84	10	12	0.020	5.05	6.43	3.21	156.30	156.10	161.63
	DCB-11	DMH-18	0.23		0.90	1.1	0.23	6		6	1.40		20	12	0.015	4.37	5.57	2.98	156.71	156.41	160.71
	DMH-18	UG-4		0.23		1.1			6	6		1.40	12	12	0.018	4.72	6.01	3.33	156.31	156.10	161.75
	OCS-4	DMH-19				1.1		6				4.84	20	18	0.010	10.52	5.96	5.68	156.81	156.61	162.10
	DMH-19	DMH-9				1.1			6			7.14	24	18	0.024	16.36	9.26	9.22	156.51	155.93	161.45
	DMH-9	DMH-10				1.1			6			12.52	114	24	0.005	16.03	5.10	3.51	155.83	155.26	160.60
	CB-12	DMH-20	0.17		0.90	1.1	0.17	6		6	1.03		48	12	0.059	8.68	11.06	7.65	158.47	155.63	159.25
	DCB-13	DMH-20	0.21		0.90	1.1	0.20	6		6	1.23		5	12	0.020	5.05	6.43	3.82	155.73	155.63	159.00
	DMH-20	UG-5		0.38					6			2.26	23	12	0.005	2.58	3.28	0.32	155.62	155.50	159.36
	RDC2	DMH-21	0.27		0.90	1.1	0.26	6		6	1.58		16	12	0.020	5.05	6.43	5.05	155.62	155.30	
	DMH-21	UG-5		0.27		1.1			6			1.58	5	12	0.020	5.05	6.43	3.47	155.20	155.10	159.90
	OCS-5	DMH-10										3.64	40	18	0.006	8.15	4.62	4.51	155.50	155.26	159.90
	DMH-10	FES-1										16.16	34	24	0.008	19.82	6.31	3.66	155.26	155.00	159.70
	DMH-22	FES-2										6.00	47	18	0.015	12.84	7.27	6.84	164.70	164.00	168.90

Section 3.3

Drainage Area Plans

THE RESIDENCES AT 1500 MAIN

1500 MAIN STREET
WEYMOUTH, MA 02190
PROJECT

JOHN M. CORCORAN & CO. LLC
100 GRANDVIEW ROAD, SUITE 203
BRAINTREE, MA 02184
P 781 849.0011
OWNER

utile
ARCHITECTURE + URBAN DESIGN
115 KINGSTON ST
BOSTON, MA 02111
P 617 423.7200 F 617 423.1414
utiledesign.com
ARCHITECT

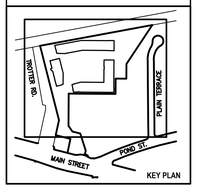
CHA COMPANIES
141 LONGWATER DRIVE, SUITE 104
NORWELL, MA 02061
P 781 982.5400
CIVIL & LANDSCAPE

BLW ENGINEERS
311 GREAT ROAD
LITTLETON, MA 01460
P 978 486.4301
MEPFP

VEITAS AND VEITAS
639 GRANITE ST
BRAINTREE, MA 02184
P 781 849.2065
STRUCTURAL

VANASSE & ASSOCIATES
35 NEW ENGLAND BUS CENTER DR.
SUITE 140
ANDOVER, MA 01810
P 978 474.8800
TRAFFIC

McPHAIL ASSOCIATES
2269 MASSACHUSETTS AVE.
CAMBRIDGE, MA 02140
P 617 868.1420
GEOTECH



KEY PLAN

STAMP

DATE	REVISION
NOVEMBER 5, 2018	BZA SUBMISSION

REVISIONS ON SHEET

SCALE
UTILE PROJECT NUMBER
1839

PRE-DEVELOPMENT DRAINAGE SUBCATCHMENT PLAN

DR-1

MBTA OLD COLONY COMMUTER RAIL
6' CHAINLINK FENCE
PLAIN TERRACE (PUBLIC - 40' WIDE)
TROTTER ROAD (PRIVATE - VARIABLE WIDTH)
DP1
DP2
1
2
EXISTING BUILDING
BUILDING HEIGHT=28.5'
BUILDING HEIGHT=14.2'
BUILDING HEIGHT=21.0'
PARCEL 61-627-25
AREA = 241,415 SQ. FT
OR 5.542 ACRES
FFE 168.7'
FEMA ZONE (A)
FEMA ZONE (X)
ACCESS EASEMENT BK. 18918, PG. 567
PARKING EASEMENT
10' WASTE WATER & SEWER EASEMENT BOOK 6996, PAGE 277
CVS PHARMACY
N/F HIGH ROCK 1502 MAIN, LLC BOOK 25989, PAGE 370 PARCEL ID 61-627-1 1502 MAIN ST.
N/F TRICO REE, LLC BOOK 28694, PAGE 464 PARCEL ID 61-627-2 533 POND ST.
N/F THOMAS C. ORLOWSKI BOOK 8331, PAGE 663 PARCEL ID 61-627-23 50 PLAIN TER.
N/F KENNETH W. & FRANCES A. HALE LIFE ESTATE BOOK 21922, PAGE 351 PARCEL ID 61-627-3 36 PLAIN TER.
N/F PATRICIA A. CARDINAL FIFE ESTATE BOOK 24605, PAGE 439 PARCEL ID 61-627-19 30 PLAIN TER.
N/F MERLE J. BOOK 30477, PARCEL ID 6 57 PLAIN
N/F UNION POINT RESIDENTIAL, LLC BOOK 35463, PAGE 307 PARCEL ID 57-597-37 0 TROTTER RD.
N/F PUBLIC STORAGE, INC. BOOK 14821, PAGE 198 PARCEL ID 57-626-8 1470 MAIN ST.
N/F MASS BAY TRANSPORTATION AUTHORITY BOOK 10722, PAGE 490 PARCEL ID 57-626-5 0 MAIN ST.
TBM #1 X-CUT IN HYDRANT BONNET BOLT LEFT OF "OPEN" ELEV. = 175.93' (WEYMOUTH BASE)
TBM #2 X-CUT IN HYDRANT BONNET BOLT ELEV. = 167.89' (WEYMOUTH BASE)
TBM #3 N.E. CORNER OF ELECTRIC CABINET PAD ELEV. = 180.25' (WEYMOUTH BASE)
TEMPORARY BENCHMARK ELEV. 170.05'
CONCRETE SIDEWALK
GRANITE CURB
CONCRETE
6' VINYL FENCE
CUSTOMER PARKING
DUMPSTER
CONC. BLOCK RET. WALL
4' BOX WIRE FENCE
CONC. RET. WALL W/ 4' CLF
DO NOT ENTER
STOP
EXIT
ENTER
ROADWORK
RAILROAD CROSSING
TROTTER ROAD
ONE WAY
NO PARKING
BIKE LANE
CROSSWALK
RAILROAD CROSSING
MHST (MBTA) RIM: 163.3
BUILDING
ABANDONED PIPE INV:159.0
12" PVC INV:159.3
MHST (MBTA) RIM:162.9
COMMUTER RAIL CROSSING
MASS BAY TRANSPORTATION AUTHORITY
MHST RIM:165.7 INV.(A):161.0 INV.(B):160.8 INV.(C):161.1 INV.(D):160.8
CBS RIM:164.1 HOOD:161.7 TOW:160.4 SUMP:158.5
CBS RIM:164.4 HOOD:162.0 TOW:160.7 SUMP:158.7
CBS RIM:165.7 FILLED WITH DEBRIS
CBS RIM:165.7 HOOD:162.4 TOW:161.5 SUMP:160.3
CBS RIM:173.8 HOOD:166.4 SUMP:164.7
CBDH-E
MHST RIM:165.1 INV.(A):168.2 INV.(B):165.2 INV.(C):164.7 INV.(D):165.1 INV.(E):164.9
CBS RIM:173.0 INV.:169.1
MHST RIM:173.8 INV.A):170.3 INV.(B):170.1 INV.(C):169.6 INV.(D):169.6
MHST RIM:173.3 INV.:169.4
CBS RIM:175.4 INV.:171.8
CBS RIM:174.6 HOOD:170.8 TOW:169.6 SUMP:166.9
CBS RIM:175.5
CBS RIM:173.1 HOOD:170.5 TOW:168.3 SUMP:166.5
CBS RIM:169.9 INV.:165.9
MHST RIM:173.2 INV.(A):169.3 INV.(B):169.2 INV.(C):169.2
MHST RIM:173.8 INV.A):170.3 INV.(B):170.1 INV.(C):169.6 INV.(D):169.6
HWAY
HWAY BND
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B-4 (OW)
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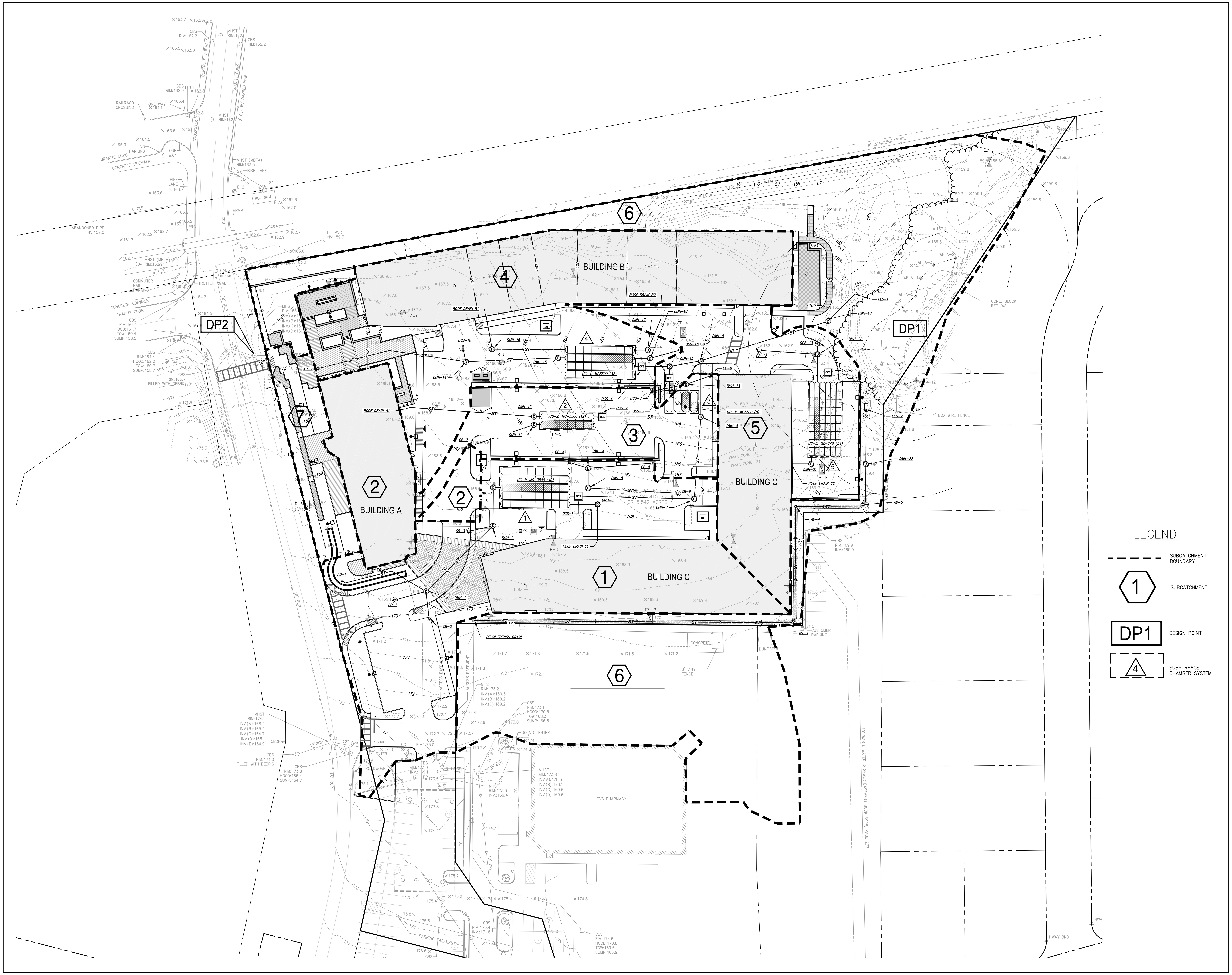
TP-6
TP-7
TP-8
TP-9
TP-10
TP-11
TP-12
MW
BOL
EOP
PAVED SIDEWALK
ACCESS EASEMENT
FEMA ZONE (A)
FEMA ZONE (X)
N
MSPCS
0 30 60
Scale in feet

LEGEND
SUBCATCHMENT BOUNDARY
1 SUBCATCHMENT
DP1 DESIGN POINT
4 SUBSURFACE CHAMBER SYSTEM

File: \\CHA-LLP.COM\PROJ\PROJECTS\ANYVX4\34672\CADD_ACAD\CIVIL_MODEL FILES\34672_DRAINAGE.DWG Saved: 11/2/2018 11:59:59 AM Plotted: 11/2/2018 1:05:11 PM Current User: Vitale, Anthony LastSavedBy: 4338

10/23/2018 2:17:14 PM



THE RESIDENCES AT 1500 MAIN

1500 MAIN STREET
WEYMOUTH, MA 02190

PROJECT

JOHN M. CORCORAN & CO. LLC

100 GRANDVIEW ROAD, SUITE 203
BRAINTREE, MA 02184
P 781 849.0011

OWNER

utile

ARCHITECTURE + URBAN DESIGN

115 KINGSTON ST
BOSTON, MA 02111
P 617 423.7200 F 617 423.1414
utiledesign.com

ARCHITECT

CHA COMPANIES

141 LONGWATER DRIVE, SUITE 104
NORWELL, MA 02061
P 781 982.5400

CIVIL & LANDSCAPE

BLW ENGINEERS

311 GREAT ROAD
LITTLETON, MA 01460
P 978 486.4301

MEPFP

VEITAS AND VEITAS

639 GRANITE ST
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P 781 849.2065

STRUCTURAL

VANASSE & ASSOCIATES

35 NEW ENGLAND BUS CENTER DR.
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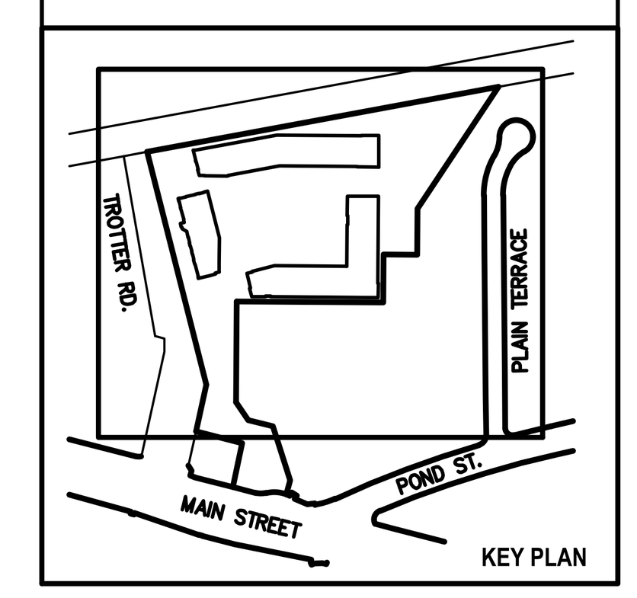
TRAFFIC

McPHAIL ASSOCIATES

2269 MASSACHUSETTS AVE.
CAMBRIDGE, MA 02140
P 617 868.1420

GEOTECH



STAMP

DATE	REVISION
NOVEMBER 5, 2018	BZA SUBMISSION

REVISIONS ON SHEET

SCALE

UTILE PROJECT NUMBER
1839

POST-DEVELOPMENT DRAINAGE SUBCATCHMENT PLAN

DR-2

Section 4.0

Stormwater Management Calculations

Section 4.1

TSS Calculations

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: Porous Pavement

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Porous Pavers	**0.80**	**1.00**	**0.80**	**0.20**

Total TSS Removal = **80%**

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

Project: **The Residences at 1500 Main**

Prepared By: **AV**

Date: **11/2/2018**

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

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: UG-1 through 5

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Proprietary - Isolator Row	**0.69**	**0.75**	**0.52**	**0.23**
Subsurface Infiltration Chambers	**0.80**	**0.23**	**0.18**	**0.05**

Total TSS Removal = **95%**

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

Project: **The Residences at 1500 Main**

Prepared By: **AV**

Date: **11/2/2018**

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

Section 4.2

Required Recharge Volume

RECHARGE NARRATIVE

The calculation for the *Required Recharge Volume* is done using the equation in the 2008 Massachusetts Stormwater Handbook. The *Required Recharge Volume* equals a depth of runoff corresponding to the soil type times the new impervious areas covering that soil type at the post-development site. The *Required Recharge Volume* is based on the *Static* method. The infiltration BMPs proposed are five subsurface infiltration chamber systems.

Rv = F x impervious area (Equation 1) Volume 3, Ch 1, page 15

Rv = Required Recharge Volume, expressed in cubic feet, cubic yards, or acre-feet
F = Target Depth Factor associated with each Hydrologic Soil Group (HSG)
Impervious Area = new pavement and new rooftop area

F for A soils = 0.60 inches (Table 2.3.2) Volume 3, Ch 1, page 16
F for B soils = 0.35 inches
***F* for C soils = 0.25 inches**
F for D soils = 0.10 inches

Using the formula above, the following table shows the site's proposed impervious surface area overlying particular Hydrologic Soil Groups and the calculated *Required Recharge Volume*. The majority of the soil explorations across the site indicate Urban Fill (Gravely Sand w/Trace Silt, HSG C characteristics). The southern portion of the site has underlaying fine sandy loam HSG B, but the presence of a wetland indicate it is slow draining. For consistency in the stormwater runoff calculations, the Hydrologic Soil Group for this analysis has been assumed in aggregate as HSG C. The *Required Recharge Volume* will consider the net increase in impervious area in the calculation. The proposed design will, at a minimum, approximate the annual recharge from the pre-developed conditions. The totals below are from the tributary watershed areas which extend beyond the project's property lines. There is a large portion of off-site impervious area tributary to the onsite wetland design point that will be conveyed around the proposed development. All of the proposed impervious surfaces on-site are directed to infiltration BMPs.

Total Existing Impervious	= 110,425 sq. ft.	= 2.535 ac.
Total Proposed Impervious	= 184,710 sq. ft.	= 4.240 ac.
Increase	= 74,313 sq. ft.	= 1.705 ac.

Required Recharge Volume

Rv = F x Imp
Rv = 0.25 in x (1.705 ac) x 1 ft/12 in
Rv = **0.036 ac-ft or 1,547 cu. ft.**

Impervious Areas Tributary to Infiltration BMPs

UG-1 = 45,210 sq. ft. = 1.038 ac.
UG-2 = 12,205 sq. ft. = 0.280 ac.
UG-3 = 15,220 sq. ft. = 0.349 ac
UG-4 = 43,645 sq. ft. = 1.002 ac

UG-5 = 25,970 sq. ft. = 0.596 ac
Porous Pavers 6S = 3,136 sq. ft. = 0.072 ac
Porous Pavers 7S = 4,610 sq. ft. = 0.106 ac

Total = 149,996 sq. ft. = 3.443 ac.

Storage volume for Recharge (below lowest orifice invert) calculated in HydroCAD:

UG-1 = 2,614 cu. ft.
UG-2 = 789 cu. ft.
UG-3 = 859 cu. ft.
UG-4 = 2,012 cu. ft.
UG-5 = 1,865 cu. ft.

Total = 8,139 cu. ft. = 0.187 ac. Ft.

The storage available in UG-1 through 5 is more than the Required Recharge Volume

8,139 cu. ft. > 1,547 cu. ft.

Conclusion:

The recharge provided by the proposed underground systems exceeds the required recharge for the proposed impervious on the site. The proposed design exceeds the requirements in Standard 3 of the MassDEP Stormwater regulations.

Section 4.3

Water Quality Calculations

Sizing using the equivalent water quality flow from 1.0" rainfall depth

Discharge Point	Structure	Tributary Area (acres)	Tributary Area (sq miles)	% Impervious	CN Value (Estimated)	WQV (Watershed Inches)	Tc (min)	qu (csm/in)	WQF = qu A Q (cfs)	Unit	Unit's Max Capacity (cfs)
Isolator Row	UG-1	0.69	0.0011	100%	98	1.00	5	795	0.86	ISO MC-3500	See Sizing Below
Isolator Row	UG-2	0.04	0.0001	100%	98	1.00	5	795	0.06	ISO MC-3500	See Sizing Below
Isolator Row	UG-3	0.35	0.0005	100%	98	1.00	5	795	0.43	ISO MC-3500	See Sizing Below
Isolator Row	UG-4	0.45	0.0007	100%	98	1.00	5	795	0.55	ISO MC-3500	See Sizing Below
Isolator Row	UG-5	0.33	0.0005	100%	98	1.00	5	795	0.41	ISO SC-740	See Sizing Below

* Abbreviations
ISO Isolator Row

StormTech Isolator Row Sizing	Unit Type	Chamber Area (SF)	Treated flow per unit** (CFS)	Flow Required WQF	Number of Units Req.	Number of Units Provided	Treated Flow
UG-1-ISO	MC-3500	43.2	0.24	0.86	4	8	1.92
UG-2-ISO	MC-3500	43.2	0.24	0.06	1	6	1.44
UG-3-ISO	MC-3500	43.2	0.24	0.43	2	2	0.48
UG-4-ISO	MC-3500	43.2	0.24	0.55	3	8	1.92
UG-5-ISO	SC-740	27.8	0.15	0.41	3	9	1.35

**Treatment Flow Capacity
2.5 GPM/SF NJCAT verified treated flow rate
(2.5 GPM=0.0055 CFS)

StormTech®

Detention • Retention • Water Quality

Division of ADS

STORMTECH ISOLATOR ROW SIZING CHART					
	SC-310	SC-740	DC-780	MC-3500	MC-4500
Chamber Area (Sq.Ft.)	20	27.8	27.8	43.2	30.1
Treated Flow Rate per chamber (CFS)	0.11	0.15	0.15	0.24	0.17

NOTE: *Testing of the Isolator Row completed by Tennesse Tech has been verified by NJCAT and it has shown to have a TSS removal efficiency of 84% for SIL-CO-SIL 250*

NJCAT verified Treated Flow Rate (GPM / Sq.Ft.) 2.5

Performance Evaluation

Back to Profile

StormTech Isolator Row :: A product from STORMTECH LLC ::

Performance information: (This product was evaluated in at least one third-party study. See MASTEP Evaluation Summary.)

The StormTech Isolator Row was tested several times at a laboratory at Tennessee Tech University and also in the field by the UNH Stormwater Center (initially reported on in 2008, expanded and updated in a 2010 report). UNH analyzed runoff from a 9 acre parking lot for TSS, TPH, nitrogen as nitrate (DIN), TZn, and TP. Samples were collected during 23 events (13.2" rainfall) from 2007- 2009. The following pollutants were monitored, with results obtained: TSS (81% Efficiency Ratio (ER), 69% mean Removal Efficiency (RE), 83% median RE); SSC (only 5 storms monitored (94% ER, 93% mean RE, 91% median RE); Zinc (61% ER, 60% mean RE, 57% median RE); Total Phosphorus (53% ER, 29% mean RE, 33% median RE); Dissolved Inorganic Nitrogen(-74% ER, -97% mean RE, -80% median RE); Total Petroleum Hydrocarbons (79% ER, 81% mean RE, 91% median RE). A full scale StormTech SC-740 isolator Row was tested in the laboratory at Tennessee Tech University. Three different influent mixes were used in the testing including a SIL-CO-SIL 106, SIL-CO-SIL250 and US Silica OK-110. The SIL-CO-SIL106 had a median particle size of 22 microns and was tested at a hydraulic loading rate of 3.2gpm/ft2 of filter area. The SIL-CO-SIL 250 had a median particle size of 45 microns and was tested at 3.2 and 1.7 gpm/ft2 of filter area. The OK-110 influent slurry had a median particle size of 110 microns and was tested at rates up to 4.8 and 8.1 gpm/ft2 in the four and two chamber configurations. Five runs were done with the SIL-CO-SIL 106 influent at 3.2gpm/ft2 (125% of treatment operating rate). One run was done with the SIL-CO-SIL 250 slurry at each of the two hydraulic loading rates (3.2, 1.7gpm/ft2-62.5% of treatment operating rate). Each run lasted 15 detention times, allowing 3 detention times prior to collecting samples. OK-110 tests were run for 11 treatment flows from 44.9-539gpm (0.1-1.2cfs) or hydraulic loading rates of 0.4-4.8gpm/ft2 with a four chamber Isolator row. They also ran tests with a two chamber model at 0.4, 1.0, and 1.2 cfs, up to a hydraulic loading rate of 8.1gpm/ft2. Results of SIL-CO-SIL 106 runs show an average influent of 270 +/-59mg/l (range 139-361mg/l). This influent was higher than expected and due to recirculation of sediments that were not trapped in the filter sock at the outlet. Average removal efficiency was 60% across all samples but average removal by sample number (1-5) shows that removal efficiency decreased with increasing detention time from 66% at sample 1 to 58% at sample 5. Results for the SIL-CO-SIL 250 test at 3.2gpm/ft2 an average removal of 71%. Recirculation in these tests would have reduced the D50 below 45microns in the influent but a PSD was not done as it was with the SIL-CO-SIL 106 influent mix. Results for SIL-CO-SIL 250 at 1.7gpm/ft2 found an average removal of 88%. Compared to the demonstrated results for the SIL-CO-SIL106, these values appear reasonable since higher removal efficiencies are expected when the particle size distribution is greater. Results from OK-110 testing demonstrated an average removal of 99.14% from discrete samples and 98.06% from the grab samples across all flow rates tested.

Pollutants addressed	Manufacturer's Removal Efficiency claim	Minimum particle size	Tested removal efficiency (*)	Test Data Status (**)	Notes
Suspended sediment concentration	60-95%	-	60-95 %	2	average removal for all rates and influent types from Tenn Tech studies verified by NJCAT
Total suspended solids	66%	-	69-83 %	2	UNH Stormwater Center field studies, removal efficiency and efficiency ratio methods.
Zinc	50%	-	57-61 %	2	UNH Stormwater Center field studies, removal efficiency and efficiency ratio methods.
Hydrocarbons	78%	-	79-91 %	2	UNH Stormwater Center field studies, removal efficiency and efficiency ratio methods.
Total Phosphorus	37%	-	29-53 %	2	UNH Stormwater Center field studies, removal efficiency and efficiency ratio methods.

* - Pollution removal efficiency evaluated by MASTEP staff based on review of available performance evaluation reports.

** - **1** = sufficient credible data to be able to evaluate pollution removal efficiency claims. **2** = promising studies are underway. **3** = insufficient credible data be able to evaluate claims. **0** = data review not yet conducted.

Test reports: (click on link to view a summary of a test, click on disk icon to download the full report)

Title	Author / Agency	Date	TARP compliancy	Test protocol compliancy	Documents
Hydraulic Performance and Sediment Trap Efficiency for the StormTech SC-740 Isolator Row	Andrew Christensen and Vince Neary	02/23/2005	No	-	Hydraulic_Perf_Sed_Trap_Eff_StormTech_Isolator.pdf
PERFORMANCE EVALUATION OF SEDIMENT REMOVAL EFFICIENCY STORMTECH ISOLATOR ROW	Vincent Neary	10/20/2006	No	-	Tenn Tech Oct 2006 Report.pdf
NJCAT Technology Verification of the StormTech Isolotor Row	-	08/01/2007	No	-	NJCAT_Verification_StormTech_081507finalbdapprov-doc1.pdf
FINAL REPORT ON FIELD VERIFICATION TESTING OF THE STORMTECH ISOLATOR ROW TREATMENT UNIT	University of New Hampshire Stormwater Center	06/01/2008	No	The UNHSC QAPP was designed tobsubstantially comply with TARP and TAPE guidelines	UNHSC_StormTech Isolator Row_Final Report_6_08.pdf
Performance Evaluation Report of the StormTech Isolator Row Treatment Unit	Roseen et al	09/01/2010	No	TARP and TAPE	UNHSC_Stormtech PER_9_9_10-Final.pdf

Return to the Home Page

Section 4.4

Rip-Rap Sizing

RIP RAP SPLASH PAD

Rip rap splash pads are designed to dissipate energy, prevent scour at the stormwater outlet, and minimize the potential for downstream erosion. A riprap splash pad was sized for each of the outlets of the drainage system. Below is presented the evaluation of the riprap splash pads to prevent scour as required by the Standard 1 of Stormwater Management Checklist. The calculations below are in accordance with the methodology of the "2002 Connecticut Guidelines for Soil Erosion and Sediment Control" produced by The Connecticut Council on Soil and Water Conservation.

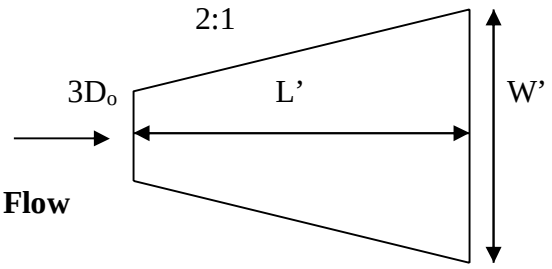
Apron Length

$L_a = 1.7Q/(Do^{3/2}) + 8\ D_o$ L_a = Length of Apron.

D_o= Maximum inside culvert width.

Apron Width

$W = 3D_o + L_a$



Stone Diameter

$d_{50} = 0.02/TW * (Q/ D_o)^{4/3}$ d_{50} = median diameter size of rip-rap stone (inches)

TW = tail water, assumed to be 0.3

Outlet	**Pipe Diameter (feet)**	**Q Flow (cfs)*** 100-yr	**La (Length of Apron - feet)**	**W (Width of Apron – feet)**	**d_{50} (inches)**
FES-1	2.0	14.4	24.68	30.68	11.16**
FES-2	1.5	6.0	17.58	22.08	5.11**

*This is the actual 100-year flow as calculated through basin design software (HydroCAD)

**A minimum rip-rap size of 6" should be utilized

Preformed Scour Hole Calculation Results

Outlet	Pipe Diameter (feet)	Q Flow * (cfs) 100-yr	Tail Water ** (ft) 25-yr	Depression (ft.)	C (ft.)	3SP (ft.)	B (ft.)	2SP (ft.)	***d_{50} (inches)
FES-1	2.0	14.4	0.30	1.0	12.0	6.0	10.0	4.0	6.96
FES-2	1.5	6.0	0.30	0.75	9.0	4.5	7.5	3.0	3.19

*This is the actual 100-year flow as calculated through basin design software (HydroCAD)
**A conservative tail-water of 0.30 was utilized.
***A minimum rip-rap size of 6" should be utilized

Conclusion:

As shown in the first table above, the proposed flows from the 100-year storm event result in rip-rap aprons which are adequately sized to dissipate the runoff discharge energy without causing scour but are extremely long and would cause more disruption and/or be difficult to construct.

To reduce the amount of rip-rap as well as provide enhanced scour protection, we are proposing a different mechanism of slowing the water as we feel additional slowing of the water over the calculated rip-rap pads would be beneficial. The detail provided is a combination of a Level spreader/Plunge Pool/ Energy Dissipater. The detail uses large stones (500 lb. min) to dissipate the energy and the plunge pool and level spreader to disperse the water to prevent erosion. The calculations for the flared ends presented above are for a preformed scour hole. The calculations were performed in accordance with the ConnDOT Drainage Manual (instructions included). As the system is multi-faceted (large stones, plunge pool, rip-rap, and level spreader), we feel it is more than adequately designed to prevent scour at the outlets.

In order to ensure that the rip rap / level spreader systems are working, the outlets should be inspected after the first large storm 10+ year event to inspect for erosion. If no erosion is evident, then the stone size is adequate. We recommend that the aprons be inspected and cleaned annually as part of the outlet maintenance to ensure future adequacy.

Section 4.5

Drawdown Time Calculations

DRAWDOWN TIME

Below are the drawdown time calculations for the recharge systems proposed on the site. The calculation uses an estimated hydraulic conductivity value "*K*" of 1.02 inches per hour, corresponding to Sandy Loam, HSG B in the Rawls Rate table. The predominate soil classification found on the site found from the NRCS soil data is Urban Land with a portion of Sudbury fine sandy loam located on the south end of the site. Based on the boring logs and test pits, from the Foundation Engineering Report by McPhail Associates LLC, it was determined that there is glacial outwash underneath the fill layer. The proposed infiltration systems have design inverts at or below the top of glacial outwash. The outwash has been described in the report as "medium to coarse grain gravely sand, trace silt.

The formula below is the recommended method of calculating drawdown times from the Massachusetts Stormwater Management Handbook

DRAWDOWN TIME CALCULATION

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

Where:
Rv = *Required Recharge* Storage Volume
K = Saturated Hydraulic Conductivity, Rawls Rate
Bottom Area = Bottom Area of Recharge BMP

The drawdown time is the time it takes to drain the BMP down from the lowest outlet invert. The infiltration rate has been assumed at 1.02 in/hr (the Rawls Rate for HSG B, Sandy Loam)

See the following Drawdown Calculation table for volume, infiltration rate, bottom area, and drawdown time.

Recharge BMP	*Storage in System below lowest orifice (cf)*	*Infiltration Rate (in/hr)*	*Square Footage of Basin (sf)*	*Drawdown Time (hrs)*
UG-1	2,614	1.02	2,338	**13.2**
UG-2	789	1.02	759	**12.2**
UG-3	859	1.02	600	**16.9**
UG-4	2,012	1.02	1,887	**12.5**
UG-5	1,865	1.02	2,031	**10.8**

Conclusion:

The calculations show that the infiltration BMP draws down in less than 72 hours, as required.

Section 4.6

Illicit Discharge Statement

ILLICIT DISCHARGE COMPLIANCE STATEMENT

Standard 10: Massachusetts Stormwater Standards Handbook

Illicit discharges are defined as discharges into waters of the State or municipal separate stormwater system (MS4) that are not entirely comprised of stormwater. Exclusions for non-stormwater discharges into drainage systems include activities or facilities for firefighting, water line flushing, landscape irrigation, uncontaminated groundwater discharge, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, water used to clean residential buildings without detergents, water used for street washing, and flows from riparian habitats/wetlands. These exclusions are subject to change and are under the discretion of the local governing authority.

To the best of our knowledge and professional belief no illicit discharges to the stormwater system, surface waters, or wetland resource areas will remain on the site after construction. We will agree to implement a pollution prevention plan to prevent illicit discharges into the stormwater management system. The design of the site based on the plans prepared by CHA, 141 Longwater Drive, Norwell, Massachusetts show a separation and no direct connection between the stormwater management systems and the wastewater and/ or groundwater on the site. To the maximum extent practicable, the design prevents entry of illicit discharges into the stormwater management system.

Engineer's Name: KELLY KILLEEN
(please print)

Engineer's Signature: _____ Date: 11.2.18

Company: CHA

Section 5.0

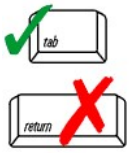
Stormwater Checklist

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Kelly Killeen, P.E.
CHA
141 Longwater Drive
Norwell, MA 02061
(781) 982-5400

Signature and Date 11.2.18

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): Subsurface Drainage Systems

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

Appendix A

Soils

DRAFT

FOUNDATION ENGINEERING REPORT

1500 MAIN STREET

SOUTH WEYMOUTH, MASSACHUSETTS

SEPTEMBER 14, 2018

Prepared For:

John M. Corcoran & Co., LLC
100 Grandview Road, Suite 203
Braintree, MA 02184

McPHAIL ASSOCIATES, LLC
2269 Massachusetts Avenue
Cambridge, MA 02140
www.mcphailgeo.com
(617) 868-1420

PROJECT NO. 6649

DRAFT

September 14, 2018

John M. Corcoran & Co., LLC
100 Grandview Road, Suite 203
Braintree, MA 02184

Attention: Mr. Peter Mahoney

Reference: 1500 Main Street: South Weymouth, Massachusetts
Foundation Engineering Report

Ladies and Gentlemen:

Enclosed herein is our Foundation Engineering Report for the proposed development at 1500 Main Street located in South Weymouth, Massachusetts. The geotechnical services were conducted in accordance with our proposal to John M. Corcoran & Co., LLC (Corcoran) for geotechnical engineering services dated July 30, 2018 and the subsequent authorization of Mr. Peter Mahoney.

Based on information provided to us by Corcoran, the proposed development at 1500 Main Street is understood to include the construction of three (3) structures having a combined 58,700 square-foot footprint. It is understood that two (2) of these structures will have four- to five-stories and will consist of residential space with the first floor constructed "podium style". The third building is proposed to have three stories and will contain retail and residential space. It is understood that no below grade space is proposed for the development.

A subsurface exploration program consisting of fourteen (14) borings and twelve (12) test pits was recently conducted at the site by McPhail Associates, LLC (McPhail) to obtain supplemental subsurface information for foundation design of the proposed structures. Based on our current understanding of the proposed development as described above and the subsurface soil and groundwater conditions encountered at the site, it is recommended that the proposed structures be founded on conventional spread footing foundations with soil-supported slabs on-grade for the lowest level slabs. The three proposed buildings should bear on compacted structural fill placed over the natural glacial outwash deposit following the removal of all existing fill and organic soils from within the building footprints. It is recommended that the footings be proportioned utilizing a maximum allowable design bearing pressure of 2 tons per square-foot.

Other detailed geotechnical engineering recommendations and criteria for foundation design are documented in the report, as well as foundation construction considerations such as the removal of the existing fill and organic soil, construction dewatering, processing and reuse of on-site excavated fill, preparation of foundation bearing surfaces, and off-site disposal of excess excavated soil. We look forward to continued participation with the Corcoran design team during the remainder of the project. Should you have any questions concerning the recommendations presented herein, please do not hesitate to call us.

GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERS
2269 Massachusetts Avenue
Cambridge, Massachusetts 02140
(617) 868-1420

Very truly yours,

McPHAIL ASSOCIATES, LLC

Bivian Reyes

Thomas J. Fennick, P.E., L.S.P.

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FIGURES:

APPENDICES:

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INTRODUCTION

This report documents the results of our subsurface exploration program and foundation design study for the proposed development at 1500 Main Street, South Weymouth, Massachusetts.

This report was prepared in accordance with our proposal dated July 30, 2018 and the subsequent authorization of Mr. Peter Mahoney of John M. Corcoran & Co., LLC (Corcoran). These services are subject to the limitations contained in **Appendix A**.

PURPOSE AND SCOPE

The purpose of the subsurface exploration program and foundation design study is to assess the subsurface soil and groundwater conditions at the site as they relate to foundation design and construction, and based on this information, to provide safe and economic foundation design recommendations for the proposed development.

Foundation design includes foundation support of the proposed buildings and their lowest level slabs, treatment of the lowest level slabs in consideration of groundwater, and seismic design considerations in accordance with the provisions of the Ninth Edition of the Massachusetts State Building Code (Code). Foundation construction considerations relating to geotechnical aspects of the proposed construction are also presented herein.

Concurrent with the foundation design study, McPhail Associates, LLC (McPhail) is also providing due-diligence geoenvironmental engineering services including the performance of Phase I and Phase II Environmental Site Assessments, which include a review of documents contained in municipal and Massachusetts Department of Environmental Protection (DEP) files, and chemical analysis of soil and groundwater samples that were collected from our subsurface exploration programs. The Phase I and II studies are documented in a separate report.

SITE DESCRIPTION

The location of the proposed development is bounded by a retail plaza that fronts onto Route 18 (Main Street) to the west, Trotter Road to the north, the MBTA Commuter Rail line to the east, and single-family residences to the south. Land beyond the MBTA Commuter Rail tracks to the east consists of the former South Weymouth Naval Air Station (NAS). Ground surface generally slopes downward towards the MBTA tracks to the east. Based on our review of on-line satellite images, and a preliminary site survey provided by John M. Corcoran & Company, LLC, the

northern portion of the site near Trotter Road is occupied by two existing commercial buildings associated with paved parking that up until recently were used by Allied Building Products. The portion of the subject site to the south of Allied Building Products consists of vegetated land, with evidence of previous re-grading activity.

PROPOSED DEVELOPMENT

The proposed development is understood to include the construction of three (3) structures. Two (2) of the structures are proposed have four- to five-stories of residential space, including a first floor which will be constructed "podium style", with wood-frame construction above. These two (2) buildings will have a combined footprint of approximately 40,500 square-feet. The third structure is a proposed three-story building which has a footprint of approximately 13,700 square-feet. The third structure is planned to include retail and residential space. It is understood that no below grade space is proposed for the development and The remainder of the site is planned to contain parking lots and open space.

RECENT SUBSURFACE EXPLORATION PROGRAM

A subsurface exploration consisting of fourteen (14) borings and twelve (12) test pits was conducted at the site. The borings (B-1 through B-14) were performed during the time period of August 23 to 27, 2018 by Carr-Dee Corp. of Medford, Massachusetts under contract to McPhail. The test pits were performed on August 21, 2018 by Rudy V Pompeo Inc. of Weymouth, Massachusetts under contract to John M. Corcoran and Co. Approximate plan locations of the borings and test pits are included on the enclosed Subsurface Exploration Plan (**Figure 2**). The boring logs and test pit logs prepared by the McPhail field representative on-site are included in Appendices B and C, respectively. Groundwater observation wells were installed in completed boreholes B-1, B-2, B-4, B-6 and B-12.

The borings were performed using either a track or a truck-mounted drill rig and advanced utilizing NW hollow stem augers and the wet rotary drilling method. Standard 2-inch O.D. split-spoon samples and standard penetration tests (SPTs) were obtained at minimum 5-foot intervals of depth in accordance with the standard procedures described in ASTM D1586. The borings were advanced to depths ranging from 5.5 feet to 27 feet below existing grade, and were terminated in a natural glacial outwash deposit.

The test pits and borings were monitored by a McPhail field representative who prepared field logs, obtained and visually classified soil samples, monitored groundwater conditions in the open test pits and boreholes, and determined the required exploration depths based upon the actual subsurface conditions encountered.

The existing ground surface elevation at each observation well location was determined using a level survey by a McPhail representative and all other elevations were determined using interpellation between surface contours from the plan.

The field locations of the test pits and borings were determined by SMC Surveying and Mapping Consultants of Braintree, Massachusetts under contract to Corcoran.

LABORATORY TESTING

At the completion of the field work, soil samples were returned to our laboratory for more detailed classification, analysis and testing. The laboratory testing consisted of sieve and hydrometer analyses to determine the gradations and confirm the visual classifications of the existing fill and glacial outwash deposit. Laboratory test procedures were in general accordance with applicable ASTM Standards. Results of the sieve analyses for the existing fill and glacial outwash deposit appear in **Figures 4** and **5** following the text of this report.

SUBSURFACE CONDITIONS

A detailed description of the subsurface conditions encountered at each of the borings and test pits is documented on the logs contained in **Appendix B** and **C**, respectively. Following is a discussion of the generalized subsurface conditions across the site which are inferred primarily from these explorations, but also from the site geology, and from our local foundation design and construction experience.

The borings and test pits indicate that the ground surface across the northern portion of the site is covered by a 3 to 6-inch layer of asphalt pavement, while the southern wooded areas are covered by a 6 to 24-inch layer of topsoil that was placed as fill consisting of a brown, silty sand, some gravel with roots.

Underlying the asphalt pavement or topsoil, a granular fill deposit was encountered ranging in thickness from1.5 to 11 feet. The fill material typically consists of a loose to compact, brown, silty sand and gravel to sand and gravel with trace to some silt, and

occasional brick, concrete, ash and cinders. Locally a 15-foot layer of fill was encountered in boring B-14, but this is due to previous excavation of petroleum affected soils at this location associated with RTN 4-25461. On average however, the thickness of the fill material ranges from 4 to 6 feet. Grain size distributions of typical samples of the fill are presented on the enclosed **Figure 4**.

An organic deposit was encountered beneath the fill at two (2) locations, in boring B-13 and test pit TP-7, located in the southeastern portion of the site. The organic material encountered in boring B-13 was 1 foot thick, extends to approximate Elevation +151.9, and consists of a very stiff to hard, black, organic silt with some peat and wood. The organic deposit encountered in test pit TP-7 was observed to be approximately 4 feet thick, as the test pit was terminated within the organic deposit at an approximate Elevation +154.5. This deposit was observed to consist of a light brown to brown organic silt with some peat. Peat and/or organic silt were not encountered at the other exploration locations.

Beneath the fill, and organic deposit in boring B-13, a natural inorganic glacial outwash deposit was encountered. The glacial outwash deposit generally consisted of a very dense to loose, light brown to brown, gravelly sand to sand and gravel with trace to some silt. The surface of the glacial outwash deposit was generally encountered between Elevations +166.6 to +151.9 as shown on the glacial outwash contour plan, **Figure 3A** and **3B**. All explorations, except for test pit TP-7, were terminated within the glacial outwash deposit at depths ranging between 6.5 and 27 feet below the ground surface. Grain size distributions of typical samples of the glacial outwash deposit are presented on the enclosed **Figure 5**.

Groundwater levels generally speaking ranged from a depth of 7 to 20 feet below ground surface and ranged from Elevation +155.8 to +151.4. It is anticipated that future groundwater levels across the site may vary from those reported herein due to factors such as normal seasonal changes, runoff during or following periods of heavy precipitation, and alterations to existing drainage patterns. Groundwater monitoring report or the observation wells is included in **Appendix D**.

FOUNDATION DESIGN RECOMMENDATIONS

Based on the scope of the proposed construction and the subsurface conditions encountered at the site, it is recommended that the proposed structures be founded on conventional footing foundations with soil-supported slabs-on-grade for the lowest level slabs. For all three buildings, the footings and slab should bear on compacted structural fill placed over the natural glacial outwash deposit following the removal of all existing fill and organic soils from within the building footprints. The plan limits of the unsuitable soils and replacement with structural fill for the structures should extend laterally beyond the edges of the building footprints a horizontal distance equal to the depth of overexcavation plus two feet.

Footings should be proportioned utilizing an allowable design bearing pressure of two (2) tons per square foot. The minimum footing width should be two (2) feet. All foundations should be designed in accordance with the Code.

Perimeter foundations and interior foundations below unheated areas should be provided with a minimum 4-foot thickness of soil cover as frost protection. Interior foundations below heated areas should be located such that the top of foundation concrete is a minimum of six inches below the underside of the lowest level slab. All foundations should be located such that they are below a theoretical line drawn upward and outward at 2 to 1 (horizontal to vertical) from the bottom exterior edge of all adjacent footings, structures and utilities.

Structural fill placed for support of the new foundations and the slabs on-grade should be a well-graded sand and gravel fill containing less than 8 percent passing the U.S. No. 200 sieve and a maximum particle size of 4 inches. As discussed later in this report, on-site existing fill material that is processed to render it suitable for reuse may also be used as structural fill. Structural fill should be placed in lifts having a maximum compacted thickness of 6 inches. Structural fill should be compacted to 95 percent of the material's maximum modified Proctor dry density.

The lowest level slab should be underlain by a minimum 6-inch thickness of compacted gravel fill having a maximum of 8 percent passing the U.S. No. 200 sieve. If a radon mitigation system is incorporated into the building design, it is anticipated that crushed stone would be specified for this purpose which is considered to be acceptable.

Since the proposed lowest level slab is understood to be located at or above the proposed finished grade, perimeter and underslab drainage are not considered necessary. All pits and depressions extending below the lowest level slab (i.e. elevator pits, etc.) should be waterproofed and provided with properly tied continuous waterstops at all construction joints.

Lateral forces can be transmitted from the structure to the soil by passive pressure on the footings utilizing an equivalent fluid density of 120 pounds per cubic-foot providing that these structural elements are designed to resist these pressures. Lateral forces can also be considered to be transmitted from the structure to the soil by fiction on the base of the footings using a frictional coefficient of 0.50 to which a factor of safety of 1.5 should be applied.

SEISMIC DESIGN CONSIDERATIONS

To determine the potential for liquefaction at the site, a site specific analysis was performed. This site specific analysis included the evaluation of the subsurface data such as the SPT N-values from the subsurface explorations, the fines content of the soil and the depth to the water table, as proposed by Youd, et al. at the 1996 workshop sponsored by the National Center for Earthquake Engineering Research (NCEER). The results of the site specific analysis indicated that the samples analyzed are not considered to be susceptible to liquefaction.

For the purposes of determining parameters for structural seismic design, this site is considered to be a Site Class D as defined in Section 1613.5 of the Code.

FOUNDATION CONSTRUCTION CONSIDERATIONS

The primary construction considerations include the removal of the existing fill and organic soils, construction dewatering, processing and reuse of on-site excavated fill, preparation of foundation bearing surfaces, and off-site disposal of excess excavated soil.

As indicated above, preparation of the building pad for the footings and lowest level slab in the proposed structures should include the removal of all existing pavement, topsoil, fill and organic soils from the entire building footprints to expose the surface of the underlying, undisturbed, natural glacial outwash deposit. The lateral limits of the excavations to the surface of the glacial outwash deposit should extend beyond the outside edge of the perimeter footings for a horizontal distance equal to the depth

of over-excavation plus two feet. Structural fill should then be placed and compacted as required for the footings and slabs-on-grade.

Based on the groundwater levels observed at the end of drilling, groundwater is generally present at approximate depths of 7 to 20 feet below the ground surface. Further, it is anticipated the removal of all existing fill and organic soils will require excavation from 3 to 10 feet below the existing ground surface. Construction dewatering is anticipated to be necessary when the removal of all existing fill and organic soils requires excavation below the groundwater table, and to remove trapped surface water, particularly after periods of heavy rain. In general, it is anticipated that construction dewatering may be performed by means of localized sumping.

It is anticipated that in general the excavated fill material will be suitable for reuse as structural fill provided that the excavated fill material is generally free of organics, debris, and material greater than 4-inch in largest diameter. This will require that oversized material greater than 4 inches shall be screened or "culled-out" to render the on-site fill suitable for reuse. The structural fill should be placed in the excavation in controlled lifts and be compacted to a minimum of 95 percent of the material's modified Proctor dry density. Excavated on-site fill material intended for re-use on-site should be protected from wet environments by covering with tarps. If the material becomes too wet and/or frozen after excavation, it will not be suitable for re-use.

Note that the composition of the existing fill deposit was noted to vary across the site. Fill material in some of the test pits were siltier in some areas compared to others. Further areas of organics were observed. Therefore, re-use of existing fill would be on a case by case basis using field judgement. Areas of less suitable fill should be segregated from more suitable fill. Material deemed to be not suitable for re-use or structural fill should be segregated and could possible be re-used as ordinary fill beneath landscaped and parking areas.

The final excavation of the footing subgrade should be accomplished using an excavator that is equipped with a smooth-edged bucket to avoid disturbance of the bearing surface. Further, it is recommended that as soon as the compacted structural fill or natural glacial outwash bearing surface is exposed, it be immediately covered with a minimum 3-inch thickness of compacted 3/4-inch crushed stone to prevent

disturbance of the subgrade during subsequent forming operations.

Current Department of Environmental Protection (DEP) policies and regulations for off-site disposal of excess excavated soil require environmental characterization of the excess excavated soil prior to its off-site disposal. In general, one full suite of chemical analyses per 500 cubic yards of fill material is typically required by the receiving facilities. Therefore, based on the actual volume of fill and organic soil that will be removed from the site, some chemical testing of soil samples may be required for the off-site disposal of excess excavated soil. If the existing fill is processed and reused as structural fill, the volume of soil required to be removed from the site would be greatly reduced.

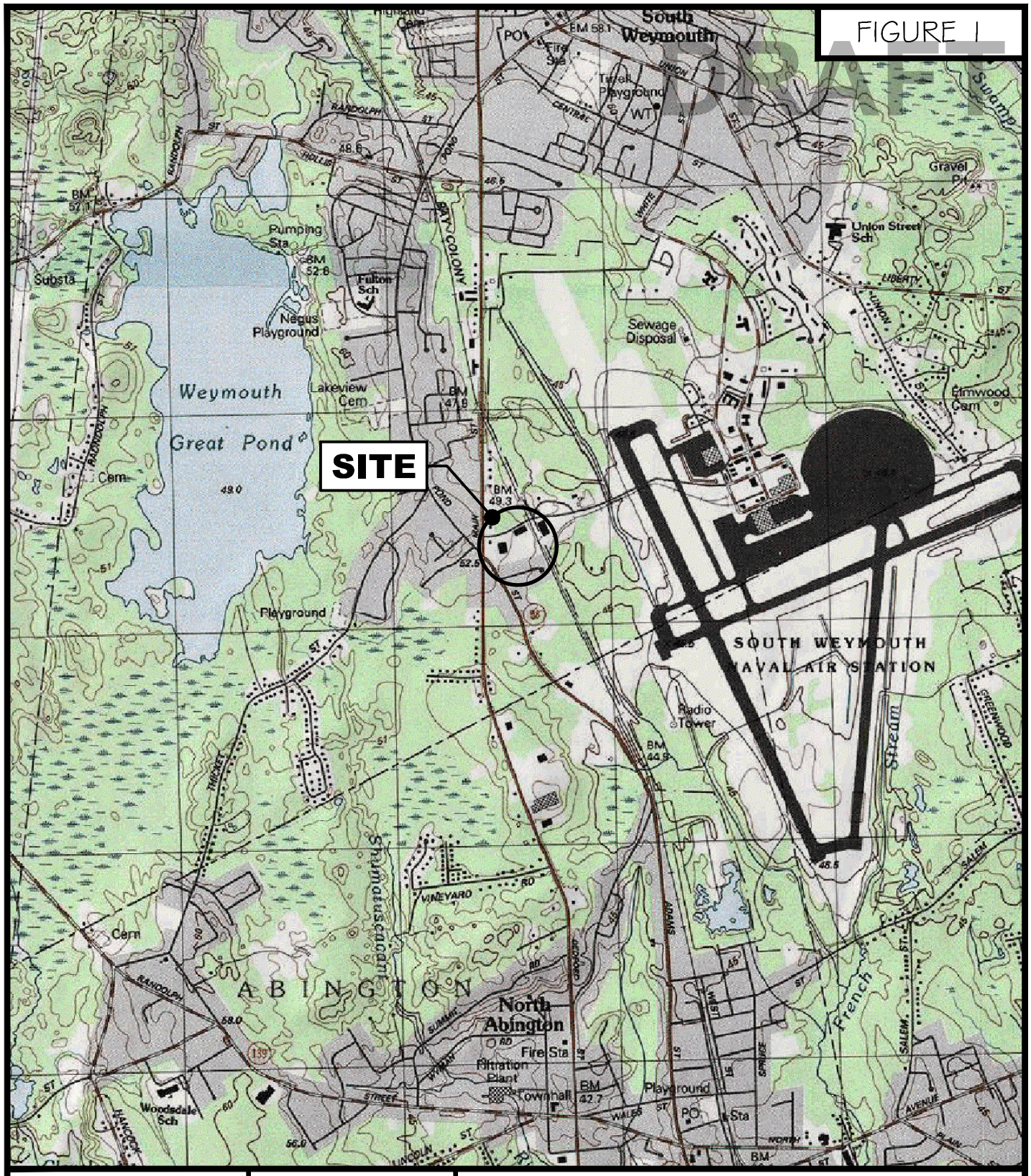
FINAL COMMENTS

Given that the building configurations and locations have been finalized since the completion of the subsurface exploration program, it is recommended that McPhail be retained to perform additional subsurface explorations within the proposed building footprints. The purpose of these explorations would be to obtain additional information on the anticipated subsurface conditions within the building footprints.

Under the terms of our contract, McPhail will provide design assistance to the design team during the final design phase of this project. The purpose of this involvement would be to review the structural foundation drawings and foundation notes for conformance with the recommendations presented herein and to prepare the earthwork specification section for inclusion into the Contract Documents for construction.

It is recommended that McPhail be retained during the construction period to observe final preparation of the foundation bearing surfaces and to monitor placement and compaction of fill materials in accordance with the provisions of the Code and the provisions of the Contract Documents. Our involvement during the construction phase of the work should minimize costly delays due to unanticipated field problems since our field engineer would be under the direct supervision of our project manager who was responsible for the subsurface exploration program and foundation design recommendations documented herein.

FIGURE 1



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617/868-1420
617/868-1423 (Fax)
www.mcphailgeo.com

N

SCALE 1:25,000

PROJECT LOCATION PLAN

1500 MAIN STREET

ROSLINDALE MASSACHUSETTS

DRAFT

MBTA OLD COLONY COMMUTER RAIL

TROTTER ROAD
(ACCESS EASEMENT BK. 18918, PG. 567)

PLAIN TERRACE
(PUBLIC - 40' WIDE)

APPROXIMATE LIMITS OF SUBJECT SITE

APPROXIMATE LIMITS OF PROPOSED BUILDINGS

APPROXIMATE LIMITS OF PROPOSED BUILDING

NORTH

TBM #2
X-CUT IN HYDRANT BONNET BOLT
ELEV. = 167.89' (WEYMOUTH BASE)

TBM #1
X-CUT IN HYDRANT BONNET BOLT
LEFT OF "OPEN"
ELEV. = 175.93' (WEYMOUTH BASE)

PARCEL 61-627-23
AREA = 241,415 SQ. FT
OR 5.542 ACRES

N/F
MASS BAY TRANSPORTATION AUTHORITY
BOOK 10722, PAGE 490
PARCEL ID 57-626-5
0 MAIN ST.

N/F
UNION POINT RESIDENTIAL, LLC
BOOK 35463, PAGE 307
PARCEL ID 57-597-37
0 TROTTER RD.

N/F
PUBLIC STORAGE, INC.
BOOK 14821, PAGE 198
PARCEL ID 57-626-8
1470 MAIN ST.

N/F
HIGH ROCK 1502 MAIN, LLC
BOOK 25989, PAGE 370
PARCEL ID 61-627-1
1502 MAIN ST.

N/F
TRICOLORE, LLC
BOOK 20684, PAGE 464
PARCEL ID 61-627-2
532 POND ST.

N/F
KENNETH W. & FRANCES A. HALE LIFE ESTATE
BOOK 21922, PAGE 351
PARCEL ID 61-627-3
36 PLAIN TER.

N/F
PATRICIA A. CARDINAL FIFE ESTATE
BOOK 24605, PAGE 439
PARCEL ID 61-627-19
30 PLAIN TER.

N/F
MERCY J. ESDALE
BOOK 20477, PAGE 247
PARCEL ID 61-627-22
57 PLAIN TER.

N/F
THOMAS C. ORLOWSKI
BOOK 8331, PAGE 663
PARCEL ID 61-627-23
50 PLAIN TER.

GRAPHIC SCALE
30 0 30 60 120

LEGEND

— APPROXIMATE LOCATION OF PROPOSED TEST PIT

— APPROXIMATE LOCATION OF PROPOSED BORING

(OW) — INDICATES OBSERVATION WELL INSTALLED WITHIN COMPLETED BOREHOLE

REFERENCE: THIS PLAN WAS PREPARED FROM A 30-SCALE DRAWING ENTITLED, "EXISTING CONDITIONS PLAN" UNDATED PREPARED BY CHA DESIGN / CONSTRUCTION SOLUTIONS

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1500 MAIN STREET

SOUTH WEYMOUTH MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN - DEVELOPMENT AREA

FOR

JOHN M. CORCORAN AND COMPANY

BY

McPHAIL ASSOCIATES, LLC

Date: SEPTEMBER 2018	Dwn: M.B.S.	Chkd: M.G.S.	Scale: 1" = 30'
Project No: 6649			FIGURE 2A

FILE NAME: N:\Acad\2018\6649\6649 F02A F028.dwg

NORTH

LEGEND

— APPROXIMATE LOCATION OF PROPOSED TEST PIT

— APPROXIMATE LOCATION OF PROPOSED BORING

(OW) — INDICATES OBSERVATION WELL INSTALLED WITHIN COMPLETED BOREHOLE

REFERENCE: THIS PLAN WAS PREPARED FROM A 30-SCALE DRAWING ENTITLED, "EXISTING CONDITIONS PLAN" UNDATED PREPARED BY CHA DESIGN / CONSTRUCTION SOLUTIONS

GRAPHIC SCALE

30 0 30 60 120

TROTTER ROAD (PRIVATE - VARIABLE WIDTH)

POND STREET (PUBLIC - VARIABLE WIDTH)

MAIN STREET (STATE HIGHWAY - 2016 LAYOUT #8326)

PLAIN TERRACE (PUBLIC - 40' WIDE)

APPROXIMATE LIMITS OF PROPOSED BUILDING

APPROXIMATE LIMITS OF SUBJECT SITE

PARCEL 61-627-25
AREA = 241,415 SQ. FT
OR 5.542 ACRES

TP-5 TP-9 TP-10 TP-8 TP-11 TP-12

B-14 B-6 (OW) B-8 B-7 B-11 B-9 B-10 B-12 (OW)

N/F
UNION POINT RESIDENTIAL, LLC
BOOK 35463, PAGE 307
PARCEL ID 57-597-37
0 TROTTER RD.

N/F
PUBLIC STORAGE, INC.
BOOK 14821, PAGE 198
PARCEL ID 57-626-8
1470 MAIN ST.

N/F
CHARLES WILSON
BOOK 32485, PAGE 341
PARCEL ID 61-627-7
1446 MAIN ST.

N/F
HIGH ROCK 1502 MAIN, LLC
BOOK 25989, PAGE 370
PARCEL ID 61-627-1
1502 MAIN ST.

N/F
TRICOLORE, LLC
BOOK 20684, PAGE 464
PARCEL ID 61-627-2
532 POND ST.

N/F
PATRICIA A. CARDINAL FIFE ESTATE
BOOK 24605, PAGE 439
PARCEL ID 61-627-19
30 PLAIN TER.

N/F
KENNETH W. & FRANCES A. HALE
LIFE ESTATE
BOOK 21922, PAGE 351
PARCEL ID 61-627-3
36 PLAIN TER.

TBM #1
X-CUT IN HYDRANT BONNET BOLT
LEFT OF "OPEN"
ELEV. = 175.93' (WEYMOUTH BASE)

TBM #2
N.E. CORNER OF ELECTRIC CABINET PAD
ELEV. = 180.25' (WEYMOUTH BASE)

1500 MAIN STREET

SOUTH WEYMOUTH MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN - ACESS EASEMENT AREA

FOR

JOHN M. CORCORAN AND COMPANY

BY

McPHAIL ASSOCIATES, LLC

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www.mcphailgeo.com

Date: SEPTEMBER 2018	Dwn: M.B.S.	Chkd: M.G.S.	Scale: 1" = 30'
Project No: 6649			FIGURE 2B

FILE NAME: N:\Acad\JOBS\6649\6649-FIG2A_FIG2B.dwg

DRAFT

MBTA OLD COLONY COMMUTER RAIL

TROTTER ROAD (ACCESS EASEMENT BK. 18918, PG. 567)

PLAIN TERRACE (PUBLIC - 40' WIDE)

APPROXIMATE LIMITS OF SUBJECT SITE

NORTH

TP-1 (+161.2)
TP-2 (+155.8)
TP-3 (+157.3)
TP-4 (+156.1)
TP-5 (+161.4)
TP-6 (+154.4)
TP-7 (+154.5)
TP-8 (+163.7)
TP-9 (+160.8)
TP-10 (+163.5)
TP-11 (+162.5)
TP-12 (+164.6)
TP-14 (+154.1)

B-1 (OW) (+156.9)
B-2 (OW) (+154.1)
B-3 (+154.7)
B-4 (OW) (+160.8)
B-5 (+156.9)
B-6 (OW) (+162.7)
B-7 (+164.9)
B-8 (+160.4)
B-9 (+164.0)
B-10 (+164.6)
B-11 (+165.4)
B-13 (+151.9)

APPROXIMATE LIMITS OF PROPOSED BUILDINGS

APPROXIMATE LIMITS OF PROPOSED BUILDING

REMEDIAL EXCAVATION PERFORMED TO 15' WITHIN THIS AREA

PARCEL 61-627-2
AREA = 241,415 SQ. FT
OR 5.542 ACRES

TBM #2
X-CUT IN HYDRANT BONNET BOLT
ELEV. = 167.89' (WEYMOUTH BASE)

TBM #1
X-CUT IN HYDRANT BONNET BOLT
LEFT OF "OPEN"
ELEV. = 175.93' (WEYMOUTH BASE)

N/F MASS BAY TRANSPORTATION AUTHORITY BOOK 10722, PAGE 490 PARCEL ID 57-626-5 0 MAIN ST.

N/F UNION POINT RESIDENTIAL, LLC BOOK 35463, PAGE 307 PARCEL ID 57-597-37 0 TROTTER RD.

N/F PUBLIC STORAGE, INC. BOOK 14821, PAGE 198 PARCEL ID 57-626-8 1470 MAIN ST.

N/F THOMAS C. ORLOWSKI BOOK 8331, PAGE 663 PARCEL ID 61-627-23 50 PLAIN TER.

N/F KENNETH W. & FRANCES A. HALE LIFE ESTATE BOOK 21922, PAGE 351 PARCEL ID 61-627-3 36 PLAIN TER.

N/F PATRICIA A. CARDINAL FIFE ESTATE BOOK 24605, PAGE 439 PARCEL ID 61-627-19 30 PLAIN TER.

N/F TRICOLORE, LLC BOOK 20684, PAGE 464 PARCEL ID 61-627-2 532 POND ST.

N/F HIGH ROCK 1502 MAIN, LLC BOOK 25989, PAGE 370 PARCEL ID 61-627-1 1502 MAIN ST.

GRAPHIC SCALE
30 0 30 60 120

LEGEND

- ⋈ — APPROXIMATE LOCATION OF PROPOSED TEST PIT
- ⊕ — APPROXIMATE LOCATION OF PROPOSED BORING
- (OW) — INDICATES OBSERVATION WELL INSTALLED WITHIN COMPLETED BOREHOLE
- +160 — ELEVATION CONTOUR OF THE TOP OF NATURAL GLACIAL OUTWASH
- (+161.2) — INDICATES APPROXIMATE ELEVATION OF TOP OF NATURAL GLACIAL OUTWASH ENCOUNTERED AT EXPLORATION LOCATION

NOTE:
ELEVATION CONTOURS OF THE TOP OF MARINE CLAY ARE BASED ON LINEAR INTERPOLATION BETWEEN EXPLORATION LOCATIONS AND ARE PRESENTED FOR THE PURPOSE OF INDICATING GENERAL TRENDS ONLY. THE ACTUAL FIELD CONDITIONS MAY VARY FROM THE INDICATED CONTOURS.

REFERENCE: THIS PLAN WAS PREPARED FROM A 30-SCALE DRAWING ENTITLED, "EXISTING CONDITIONS PLAN" UNDATED PREPARED BY CHA DESIGN / CONSTRUCTION SOLUTIONS

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1500 MAIN STREET

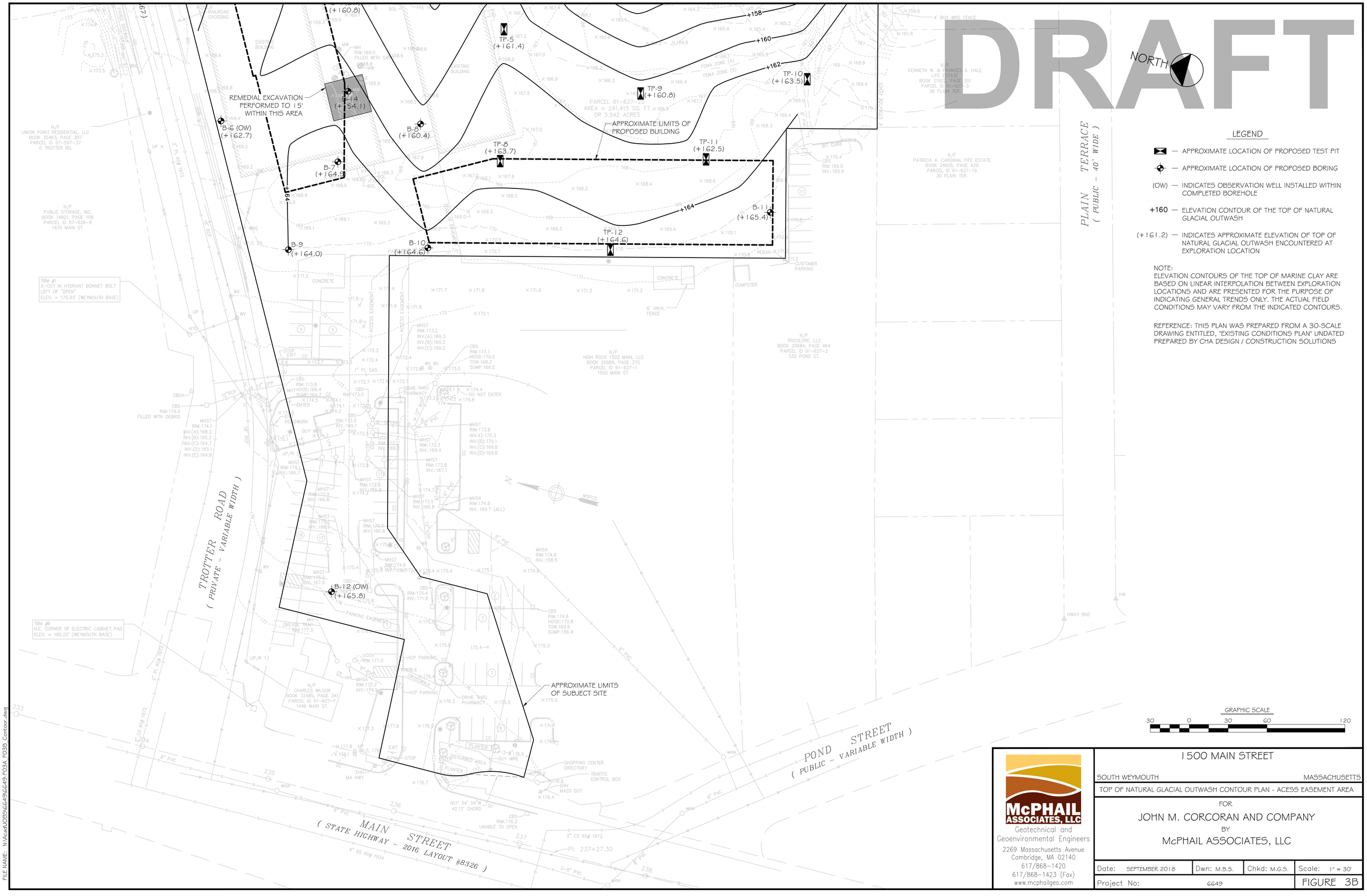
SOUTH WEYMOUTH MASSACHUSETTS

TOP OF NATURAL GLACIAL OUTWASH CONTOUR PLAN - DEVELOPMENT AREA

FOR
JOHN M. CORCORAN AND COMPANY
BY
McPHAIL ASSOCIATES, LLC

Date: SEPTEMBER 2018	Dwn: M.B.S.	Chkd: M.G.S.	Scale: 1" = 30'
Project No: 6649			FIGURE 3A

FILE NAME: N:\Cad\DWG\6649\6649 FIG3A FOR Contour.dwg



LEGEND

- ⋈ — APPROXIMATE LOCATION OF PROPOSED TEST PIT
- ⊕ — APPROXIMATE LOCATION OF PROPOSED BORING
- (OW) — INDICATES OBSERVATION WELL INSTALLED WITHIN COMPLETED BOREHOLE
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REFERENCE: THIS PLAN WAS PREPARED FROM A 30-SCALE DRAWING ENTITLED, "EXISTING CONDITIONS PLAN" UNDATED PREPARED BY CHA DESIGN / CONSTRUCTION SOLUTIONS

GRAPHIC SCALE
30 0 30 60 120

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1500 MAIN STREET

SOUTH WEYMOUTH MASSACHUSETTS

TOP OF NATURAL GLACIAL OUTWASH CONTOUR PLAN - ACESS EASEMENT AREA

FOR
JOHN M. CORCORAN AND COMPANY
BY
McPHAIL ASSOCIATES, LLC

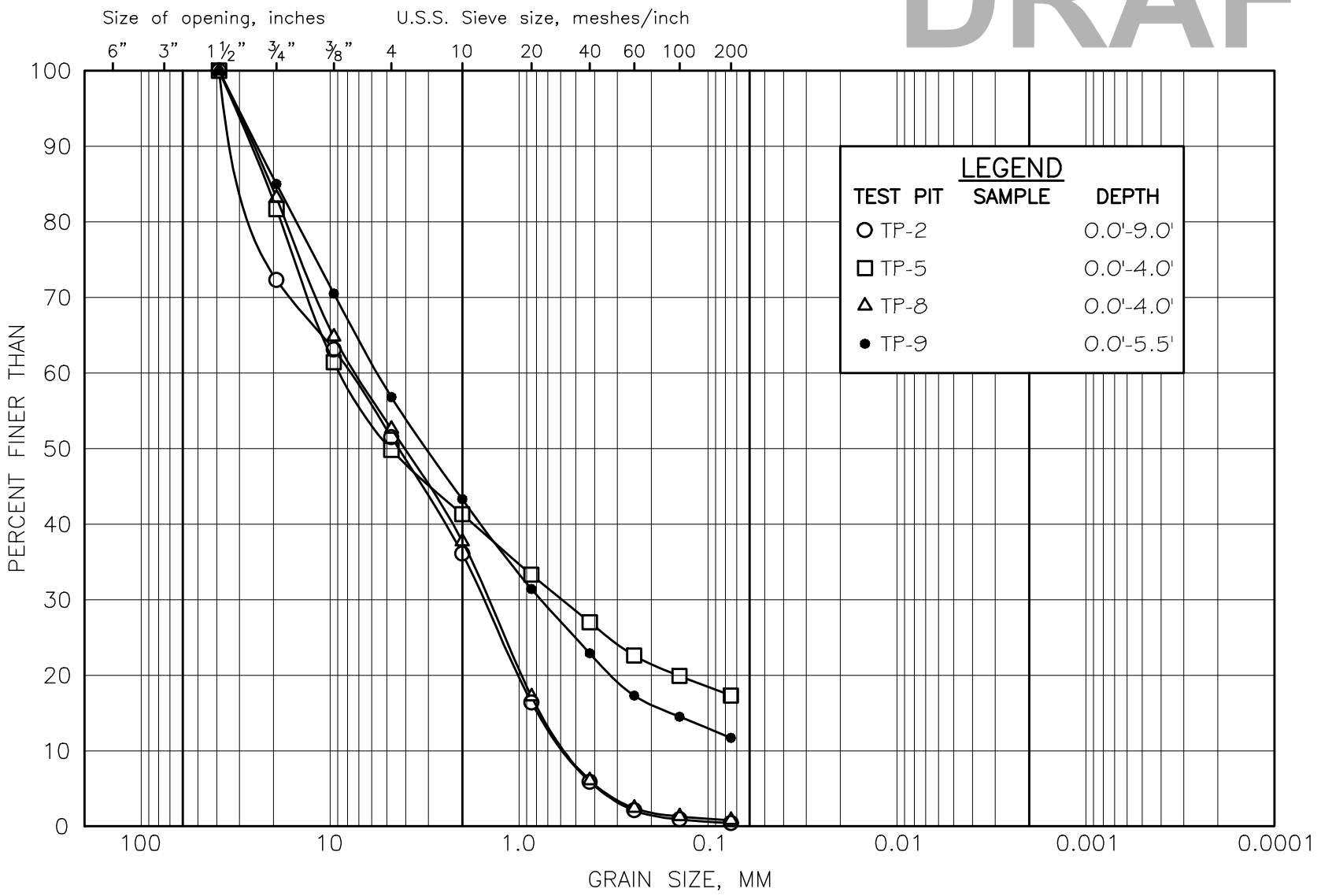
Date: SEPTEMBER 2018	Dwn: M.B.S.	Chkd: M.G.S.	Scale: 1" = 30'
Project No: 6649			FIGURE 3B

FILE NAME: N:\Acad\JOBS\6649\6649-FIG3A_FIG3B_Contour.dwg

FILE NAME: N:\Acad\JOBS\6649\6649-F04_Sieve.dwg

PROJECT No. 6649

M.I.T. GRAIN SIZE SCALE



COBBLE SIZE	GRAVEL SIZE			SAND SIZE			FINE GRAINED	
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

McPHAIL ASSOCIATES, LLC

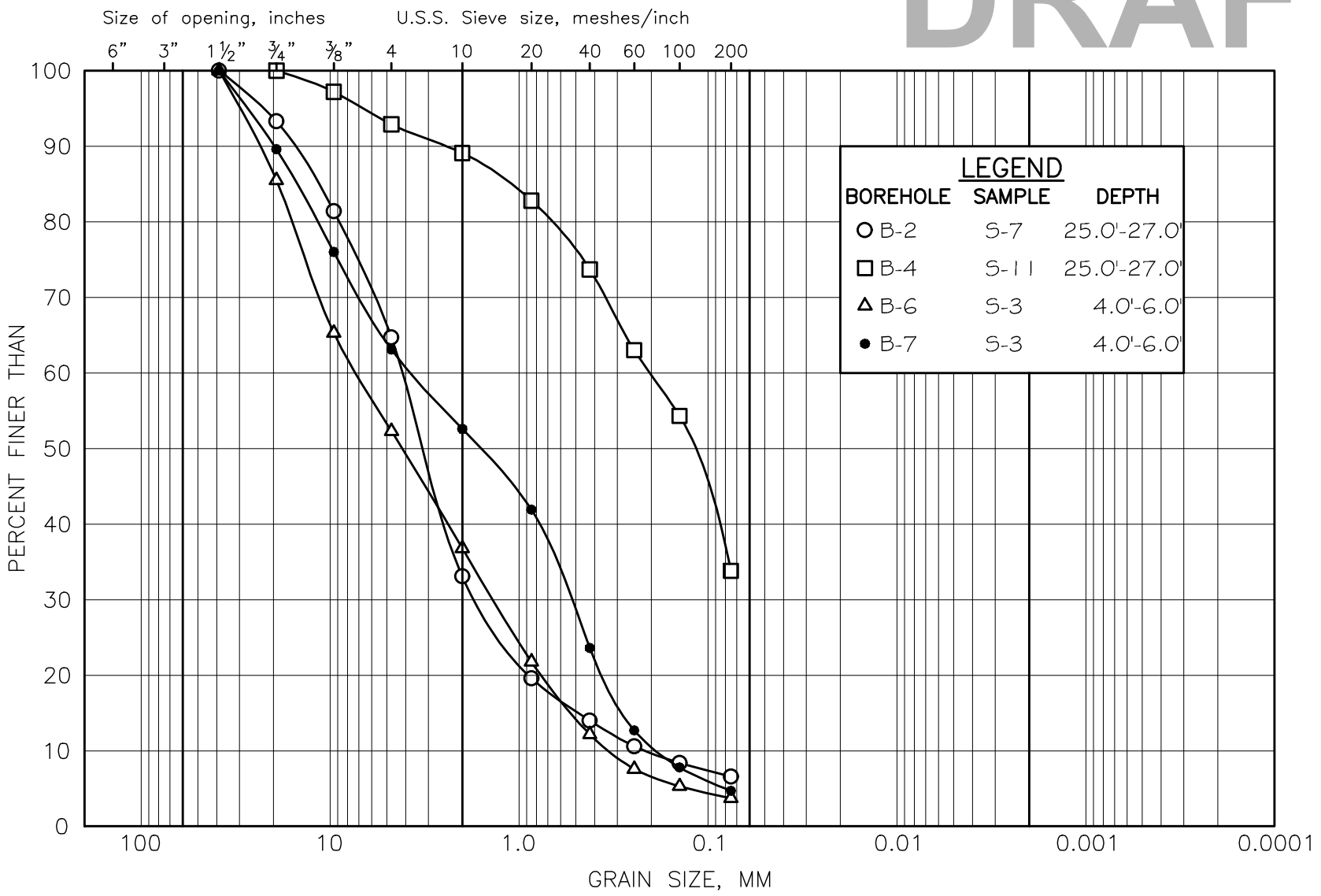
GRAIN SIZE DISTRIBUTION
FILL

FIGURE 4

FILE NAME: N:\Acad\JOBS\6649\6649-F05_Sieve.dwg

PROJECT No. 6649

M.I.T. GRAIN SIZE SCALE



COBBLE SIZE	GRAVEL SIZE			SAND SIZE			FINE GRAINED	
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

McPHAIL ASSOCIATES, LLC

GRAIN SIZE DISTRIBUTION
GLACIAL OUTWASH

FIGURE 5

DRAFT

APPENDIX A:

LIMITATIONS

DRAFT

LIMITATIONS

This report has been prepared on behalf of and for the exclusive use of John M. Corcoran & Co., LLC for specific application to the proposed development to be located at 1500 Main Street in South Weymouth, Massachusetts in accordance with generally accepted soil and geotechnical engineering practices. No other warranty, expressed or implied, is made.

In the event that any changes in nature or design of the proposed construction are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by McPhail Associates.

The analyses and recommendations presented in this report are based upon the data obtained from the subsurface explorations performed at the approximate locations indicated on the enclosed plan. If variations in the nature and extent of subsurface conditions between the widely spaced explorations become evident during the course of construction, it will be necessary for a re-evaluation of the recommendations of this report to be made after performing on-site observations during the construction period and noting the characteristics of any variations.

DRAFT

APPENDIX B:

BORING LOGS B-1 THROUGH B-14
PREPARED BY MCPHAIL

Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-23-18
Date Finished: 8-23-18

DRAFT

Boring No.
B-1 (OW)

Contractor: Carr-Dee
Driller/Helper: Joe/Jay
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 167.9

Casing Type/Depth (ft): 3"
Casing Hammer (lbs)/Drop (in): 300lb/24"
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations

Date	Depth	Elev.	Notes
8-23-18	15.7	152.2	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
			0.5 / 167.4	ASPHALT							
1	167				0.1	28	S1	18/12	0.5-2.0	12 10 18	Compact, brown, SAND and GRAVEL, some silt, w/ brick and ash & cinders. (Fill)
2	166										
3	165				0.1	15	S2	24/6	2.0-4.0	8 8 7 11	Compact, brown, SAND and GRAVEL, some silt, w/ ash & cinders. (Fill)
4	164										
5	163				0.0	7	S3	24/3	4.0-6.0	6 3 4 3	Loose, brown, SAND and GRAVEL, some silt, w/ ash & cinders. (Fill)
6	162			FILL							
7	161				0.7	5	S4	24/3	6.0-8.0	3 2 3 5	Loose, brown, GRAVELLY SAND, some silt, w/ brick and ash & cinders. (Fill)
8	160										
9	159				0.3	17	S5	24/7	8.0-10.0	5 5 12 13	Compact, brown, SAND and GRAVEL, some silt, w/ ash & cinders. (Fill)
10	158				0.1	35	S6	12/5	10.0-11.0	10 15	Compact to dense, brown, SAND and GRAVEL, trace silt. (Fill)
11	157		11.0 / 156.9		0.2	35	S6A	12/5	11.0-12.0	20 22	Dense, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
12	156										
13	155				0.3	39	S7	24/10	12.0-14.0	18 21 18 14	Dense, light brown, medium to coarse grain, SAND and GRAVEL, some silt. (Glacial Outwash)
14	154										
15	153			GLACIAL OUTWASH							
16	152				0.0	22	S8	24/6	15.0-17.0	8 10 12 6	Compact, brown, medium to coarse grain, GRAVELLY SAND, trace silt. (Glacial Outwash)
17	151										
18	150										
19	149										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
A 20 foot observation well installed with 10 feet of screen and 10 feet of solid.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Overcast
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-23-18
Date Finished: 8-23-18

DRAFT

Boring No.
B-1 (OW)

Contractor: Carr-Dee
Driller/Helper: Joe/Jay
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 167.9

Casing Type/Depth (ft): 3"
Casing Hammer (lbs)/Drop (in): 300lb/24"
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations

Date	Depth	Elev.	Notes
8-23-18	15.7	152.2	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
21	147			GLACIAL OUTWASH	0.3	7	S9	24/3	20.0-22.0	3 3 4 3	Loose, brown, medium to coarse grain, GRAVELLY SAND, trace silt. (Glacial Outwash)
22	146										
23	145					11	S10	24/0	22.0-24.0	4 6 5 6	No Recovery
24	144		24.0 / 143.9								
25	143			Bottom of borehole 24 feet below ground surface.							
26	142										
27	141										
28	140										
29	139										
30	138										
31	137										
32	136										
33	135										
34	134										
35	133										
36	132										
37	131										
38	130										
39	129										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
A 20 foot observation well installed with 10 feet of screen and 10 feet of solid.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Overcast
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-22-18
Date Finished: 8-22-18

DRAFT

Boring No.
B-2 (OW)

Contractor: Carr-Dee
Driller/Helper: Joe/Jay
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 159.1

Casing Type/Depth (ft): 3"
Casing Hammer (lbs)/Drop (in): 300lb/24"
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations

Date	Depth	Elev.	Notes
8-22-18	7	152.1	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
1	158				0.1	13	S1	24/6	0.0-2.0	2 5 8 8	Compact, brown, SAND and GRAVEL, some silt, w/ brick and ash & cinders. (Fill)
2	157				1.1	100/4"	S2	4/4	2.0-2.3	100/4"	Very dense, brown, SAND and GRAVEL, some silt, w/ brick and ash & cinders. (Fill)
3	156			FILL							
4	155										
5	154		5.0 / 154.1								
6	153				0.2	34	S3	24/3	5.0-7.0	17 16 18 13	Dense, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
7	152										
8	151										
9	150										
10	149				0.2	28	S4	24/8	10.0-12.0	9 10 18 19	Compact, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
11	148										
12	147			GLACIAL OUTWASH							
13	146										
14	145										
15	144				0.2	6	S5	24/8	15.0-17.0	8 4 2 3	Loose, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
16	143										
17	142										
18	141										
19	140										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
A 25 foot observation well installed with 10 feet of screen and 15 feet of solid.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Rain
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
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Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-22-18
Date Finished: 8-22-18

DRAFT

Boring No. B-2 (OW)

Contractor: Carr-Dee
Driller/Helper: Joe/Jay
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 159.1

Casing Type/Depth (ft): 3"
Casing Hammer (lbs)/Drop (in): 300lb/24"
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations

Date	Depth	Elev.	Notes
8-22-18	7	152.1	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
21	138			GLACIAL OUTWASH	0.5	17	S6	24/4	20.0-22.0	6 9 8 4	Compact, brown, medium to coarse grain, GRAVELLY SAND, trace silt. (Glacial Outwash)
22	137										
23	136										
24	135										
25	134										
26	133				0.2	10	S7	24/4	25.0-27.0	7 6 4 7	Loose to compact, brown, medium to coarse grain, SANDY GRAVEL, trace silt. (Glacial Outwash)
27	132		27.0 / 132.1	Bottom of borehole 27 feet below ground surface.							
28	131										
29	130										
30	129										
31	128										
32	127										
33	126										
34	125										
35	124										
36	123										
37	122										
38	121										
39	120										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
A 25 foot observation well installed with 10 feet of screen and 15 feet of solid.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Rain
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-27-18
Date Finished: 8-27-18

Boring No. **B-3**

Contractor: Carr-Dee
Driller/Helper: Jay/Neil
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 168.7

Casing Type/Depth (ft): 2.25" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
			0.3 / 168.4	ASPHALT							
1	168			FILL	0.3	25	S1	18/8	0.5-2.0	3 10 15	Compact, brown, GRAVELLY SAND, trace silt. (Fill)
2	167										
3	166				1.0	37	S2	24/8	2.0-4.0	17 16 21 28	Dense, brown, GRAVELLY SAND, trace silt. (Fill)
4	165		4.0 / 164.7								
5	164			GLACIAL OUTWASH	0.2	28	S3	24/6	4.0-6.0	8 11 17 13	Compact, brown, medium to coarse grain, GRAVELLY SAND, trace silt. (Glacial Outwash)
6	163										
7	162				0.4	31	S4	24/8	6.0-8.0	16 20 11 12	Dense, brown, medium to coarse grain, GRAVELLY SAND, trace silt. (Glacial Outwash)
8	161										
9	160				0.2	15	S5	24/10	8.0-10.0	12 9 6 7	Dense, brown, medium to coarse grain, GRAVELLY SAND, trace silt. (Glacial Outwash)
10	159		10.0 / 158.7								
11	158			Bottom of borehole 10 feet below ground surface.							
12	157										
13	156										
14	155										
15	154										
16	153										
17	152										
18	151										
19	150										
	149										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
No observed groundwater.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

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Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-23-18
Date Finished: 8-23-18

DRAFT

Boring No. B-4 (OW)

Contractor: Carr-Dee
Driller/Helper: Joe/Jay
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 168.8

Casing Type/Depth (ft): 3"
Casing Hammer (lbs)/Drop (in): 300lb/24"
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations			
Date	Depth	Elev.	Notes
8-23-18	15.5	153.3	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
			0.3 / 168.5	ASPHALT							
1	168			FILL	0.3	19	S1	18/4	0.5-2.0	15 12 7	Compact, brown, GRAVELLY SAND, some silt, w/ brick and ash & cinders. (Fill)
2	167										
3	166				0.3	8	S2	24/8	2.0-4.0	4 4 4 10	Loose, brown, GRAVELLY SAND, some silt, w/ brick and ash & cinders. (Fill)
4	165										
5	164				0.4	32	S3	24/10	4.0-6.0	8 16 16 28	Dense, brown, GRAVELLY SAND, trace silt, w/ brick and ash & cinders. (Fill)
6	163										
7	162				0.4	24	S4	24/12	6.0-8.0	10 11 13 21	Compact, light brown, SAND and GRVAEL, some silt, w/ brick and ash & cinders. (Fill)
8	161		8.0 / 160.8								
9	160			GLACIAL OUTWASH	0.3	24	S5	24/10	8.0-10.0	13 10 14 13	Compact, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
10	159										
11	158				0.2	40	S6	24/8	10.0-12.0	8 20 20 27	Dense, brown, medium to coarse grain, GRAVELLY SAND, trace silt. (Glacial Outwash)
12	157										
13	156										
14	155										
15	154										
16	153				0.3	19	S7	24/6	15.0-17.0	26 7 12 6	Compact, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
17	152										
18	151				0.1	7	S8	24/4	17.0-19.0	1 2 5 5	Loose, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
19	150										
	149										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
A 20 foot observation well installed with 10 feet of screen and 10 feet of solid.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Overcast
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project:	Trotter Road Development	**Job #:**	6649
Location:	1500 Main Street	**Date Started:**	8-23-18
City/State:	Weymouth, MA	**Date Finished:**	8-23-18

DRAFT

Boring No.
B-4 (OW)

Contractor: Carr-Dee
Driller/Helper: Joe/Jay
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 168.8

Casing Type/Depth (ft): 3"
Casing Hammer (lbs)/Drop (in): 300lb/24"
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations

Date	Depth	Elev.	Notes
8-23-18	15.5	153.3	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
21	148			GLACIAL OUTWASH	0.9	11	S9	24/3	20.0-22.0	8 8 3 3	Compact, brown, SAND and GRAVEL, trace silt. (Glacial Outwash)
22	147										
23	146				0.5	8	S10	24/4	22.0-24.0	6 4 4 3	Loose, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
24	145										
25	144										
26	143				0.4	5	S11	24/6	25.0-27.0	5 2 3 3	Loose, brown, medium to coarse grain, SILTY SAND, some gravel. (Glacial Outwash)
27	142		27.0 / 141.8	Bottom of borehole 27 feet below ground surface.							
28	141										
29	140										
30	139										
31	138										
32	137										
33	136										
34	135										
35	134										
36	133										
37	132										
38	131										
39	130										
	129										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
A 20 foot observation well installed with 10 feet of screen and 10 feet of solid.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Overcast
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-27-18
Date Finished: 8-27-18

DRAFT

Boring No. B-5

Contractor: Carr-Dee
Driller/Helper: Jay/Neil
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 166.9

Casing Type/Depth (ft): 2.25" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations			
Date	Depth	Elev.	Notes
8-27-18	15.5	151.4	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample: TVOC (ppm)	Sample: N-Value / RQD	Sample: No.	Sample: Pen./Rec. (in)	Sample: Depth (ft)	Sample: Blows/6" / Min/ft	Sample Description and Boring Notes
			0.5 / 166.4	ASPHALT							
1	166				0.2	9	S1	18/8	0.5-2.0	5 4 5	Loose, brown, GRAVELLY SAND, some silt, w/ brick and ash & cinders. (Fill)
2	165										
3	164				0.1	5	S2	24/4	2.0-4.0	3 2 3 4	Loose, brown, GRAVELLY SAND, some silt, w/ brick and ash & cinders. (Fill)
4	163										
5	162				0.0	7	S3	24/4	4.0-6.0	2 3 4 5	Loose, brown, GRAVELLY SAND, some silt, w/ brick and ash & cinders. (Fill)
6	161			FILL							
7	160				0.2	7	S4	24/4	6.0-8.0	4 5 2 2	Loose, brown, GRAVELLY SAND, some silt, w/ brick and ash & cinders. (Fill)
8	159										
9	158				0.4	7	S5	24/10	8.0-10.0	4 3 4 16	Loose, brown to black, GRAVELLY SAND, some silt. (Fill)
10	157		10.0 / 156.9								
11	156				0.2	44	S6	24/12	10.0-12.0	20 20 24 40	Dense, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
12	155										
13	154				0.2	75	S7	24/12	12.0-14.0	62 39 36 36	Very dense, brown, medium to coarse grain, SANDY GRAVEL, trace silt. (Glacial Outwash)
14	153			GLACIAL OUTWASH							
15	152										
16	151				0.3	24	S8	24/12	15.0-17.0	32 13 11 14	Compact, brown, coarse grain, SANDY GRAVEL, trace silt. (Glacial Outwash)
17	150		17.0 / 149.9								
18	149			Bottom of borehole 17 feet below ground surface.							
19	148										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
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Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-24-18
Date Finished: 8-24-18

DRAFT

Boring No. B-6 (OW)

Contractor: Carr-Dee
Driller/Helper: Joe/Jay
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 168.7

Casing Type/Depth (ft): 3"
Casing Hammer (lbs)/Drop (in): 300lb/24"
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations

Date	Depth	Elev.	Notes
8-24-18	16.5	152.2	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
			0.5 / 168.2	ASPHALT							
1	168				0.3	21	S1	18/4	0.5-2.0	9 12 9	Compact, brown, SAND and GRAVEL, trace silt. (Fill)
2	167			FILL							
3	166				0.3	21	S2	24/10	2.0-4.0	4 10 11 10	Compact, brown, SAND and GRAVEL, trace silt, w/ brick and ash & cinders. (Fill)
4	165		4.0 / 164.7								
5	164				0.3	38	S3	24/8	4.0-6.0	4 17 21 37	Dense, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
6	163										
7	162				0.2	67	S4	24/3	6.0-8.0	26 34 33 23	Very dense, brown to light brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
8	161										
9	160										
10	159										
11	158				0.4	76	S5	24/6	10.0-12.0	36 35 41 23	Very dense, brown to light brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
12	157			GLACIAL OUTWASH							
13	156										
14	155										
15	154										
16	153				0.3	23	S6	24/8	15.0-17.0	15 13 10 9	Compact, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
17	152										
18	151										
19	150										
	149										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
A 20 foot observation well installed with 10 feet of screen and 10 feet of solid.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
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CAMBRIDGE, MA 02140
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Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-24-18
Date Finished: 8-24-18

DRAFT

Boring No. B-6 (OW)

Contractor: Carr-Dee
Driller/Helper: Joe/Jay
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 168.7

Casing Type/Depth (ft): 3"
Casing Hammer (lbs)/Drop (in): 300lb/24"
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations

Date	Depth	Elev.	Notes
8-24-18	16.5	152.2	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
21	148			GLACIAL OUTWASH	1.7	35	S7	24/10	20.0-22.0	20 18 17 20	Dense, brown, medium to coarse grain, GRAVELLY SAND, trace silt. (Glacial Outwash)
22	147		22.0 / 146.7								
23	146			Bottom of borehole 22 feet below ground surface.							
24	145										
25	144										
26	143										
27	142										
28	141										
29	140										
30	139										
31	138										
32	137										
33	136										
34	135										
35	134										
36	133										
37	132										
38	131										
39	130										
	129										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
A 20 foot observation well installed with 10 feet of screen and 10 feet of solid.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-27-18
Date Finished: 8-27-18

DRAFT

Boring No. B-7

Contractor: Carr-Dee
Driller/Helper: Jay/Neil
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 168.9

Casing Type/Depth (ft): 2.25" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample: TVOC (ppm)	Sample: N-Value / RQD	Sample: No.	Sample: Pen./Rec. (in)	Sample: Depth (ft)	Sample: Blows/6" / Min/ft	Sample Description and Boring Notes
			0.5 / 168.4	ASPHALT							
1	168			FILL	0.0	21	S1	18/10	0.5-2.0	10 11 10	Compact, brown, SAND, some gravel, trace silt. (Fill)
2	167										
3	166				0.3	38	S2	24/18	2.0-4.0	10 16 22 19	Dense, brown, GRAVELLY SAND, trace silt. (Fill)
4	165		4.0 / 164.9								
5	164			GLACIAL OUTWASH	0.7	33	S3	24/12	4.0-6.0	13 21 12 18	Dense, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
6	163										
7	162				0.3	50	S4	24/12	6.0-8.0	21 28 22 26	Dense to very dense, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
8	161		8.0 / 160.9								
9	160			Bottom of borehole 8 feet below ground surface.							
10	159										
11	158										
12	157										
13	156										
14	155										
15	154										
16	153										
17	152										
18	151										
19	150										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
No observed groundwater.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-27-18
Date Finished: 8-27-18

Boring No. **B-8**

Contractor: Carr-Dee
Driller/Helper: Jay/Neil
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 168.4

Casing Type/Depth (ft): 2.25" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
	168		0.3 / 168.1	ASPHALT							
1	167			FILL	0.3	18	S1	18/4	0.5-2.0	4 9 9	Compact, brown, SAND, some silt and gravel, w/ brick and ash & cinders. (Fill)
2	166										
3	165				0.3	47	S2	24/14	2.0-4.0	15 20 27 22	Dense, brown, SAND and GRAVEL, trace silt. (Fill)
4	164										
5	163		6.0 / 162.4		0.2	64	S3	24/10	4.0-6.0	22 20 44 44	Very dense, brown, SAND and GRAVEL, trace silt. (Fill)
6	162			GLACIAL OUTWASH	0.1	43	S4	24/14	6.0-8.0	26 28 15 20	Very dense, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Fill)
7	161		8.0 / 160.4								
8	160			Bottom of borehole 8 feet below ground surface.							
9	159										
10	158										
11	157										
12	156										
13	155										
14	154										
15	153										
16	152										
17	151										
18	150										
19	149										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
No observed groundwater.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-27-18
Date Finished: 8-27-18

Boring No. B-9

Contractor: Carr-Dee
Driller/Helper: Jay/Neil
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 170.0

Casing Type/Depth (ft): 2.25" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
			0.5 / 169.5	ASPHALT							
1	169			FILL	0.0	77	S1	18/12	0.5-2.0	21 34 43	Very dense, brown, GRAVELLY SAND, some silt. (Fill)
2	168										
3	167				0.4	66	S2	24/18	2.0-4.0	22 21 45 56	Very dense, brown, GRAVELLY SAND, some silt. (Fill)
4	166		4.0 / 166.0								
5	165			GLACIAL OUTWASH	0.3	87	S3	18/12	4.0-5.5	20 35 56 100/0"	Very dense, brown, medium to coarse grain, GRAVELLY SAND, trace silt. (Glacial Outwash) Split spoon and auger refusal 6.5 feet below ground surface.
6	164		6.5 / 163.5								
7	163			Bottom of borehole 6.5 feet below ground surface.							
8	162										
9	161										
10	160										
11	159										
12	158										
13	157										
14	156										
15	155										
16	154										
17	153										
18	152										
19	151										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
No observed groundwater.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-27-18
Date Finished: 8-27-18

Boring No. B-10

Contractor: Carr-Dee
Driller/Helper: Jay/Neil
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 170.6

Casing Type/Depth (ft): 2.25" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample: TVOC (ppm)	Sample: N-Value / RQD	Sample: No.	Sample: Pen./Rec. (in)	Sample: Depth (ft)	Sample: Blows/6" / Min/ft	Sample Description and Boring Notes
	170		0.5 / 170.1	ASPHALT							
1					0.1	54	S1	18/4	0.5-2.0	11 27 28	Very dense, brown, GRAVELLY SAND, some silt, w/ ash & cinders. (Fill)
2	169			FILL							
3	168				0.3	83	S2	24/8	2.0-4.0	29 45 38 36	Very dense, brown, SAND and GRAVEL, some silt. (Fill)
4	167		4.0 / 166.6								
5	166				0.2	43	S3	24/8	4.0-6.0	10 19 24 30	Dense, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
6	165			GLACIAL OUTWASH							
7	164				0.2	73	S4	24/10	6.0-8.0	16 28 45 39	Very dense, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
8	163		8.0 / 162.6								
9	162			Bottom of borehole 8 feet below ground surface.							
10	161										
11	160										
12	159										
13	158										
14	157										
15	156										
16	155										
17	154										
18	153										
19	152										
	151										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
No observed groundwater.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-27-18
Date Finished: 8-27-18

DRAFT

Boring No. B-11

Contractor: Carr-Dee
Driller/Helper: Jay/Neil
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 170.4

Casing Type/Depth (ft): 2.25" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
1	170				0.2	30	S1	24/20	0.0-2.0	3 12 18 24	Compact to dense, brown, SAND and GRAVEL, some silt. (Fill)
2	169										
3	168			FILL	0.6	97	S2	24/18	2.0-4.0	22 41 56 51	Very dense, brown, GRAVELLY SAND, trace silt. (Fill)
4	167										
5	166		5.0 / 165.4								
6	165				0.2	47	S3	24/16	5.0-7.0	29 31 16 18	Dense, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash) Auger refusal 9 feet below ground surface.
7	164			GLACIAL OUTWASH							
8	163										
9	162		9.0 / 161.4								
10	161			Bottom of borehole 9 feet below ground surface.							
11	160										
12	159										
13	158										
14	157										
15	156										
16	155										
17	154										
18	153										
19	152										
	151										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
No observed groundwater.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-24-18
Date Finished: 8-24-18

DRAFT

Boring No. B-12 (OW)

Contractor: Carr-Dee
Driller/Helper: Joe/Jay
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 175.8

Casing Type/Depth (ft): 3"
Casing Hammer (lbs)/Drop (in): 300lb/24"
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations

Date	Depth	Elev.	Notes
8-24-18	20	155.8	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
			0.5 / 175.3	ASPHALT							
1	175				0.7	40	S1	18/8	0.5-2.0	20 16 24	Dense, brown, SAND and GRAVEL, some silt, w/ brick and ash & cinders. (Fill)
2	174										
3	173				0.1	22	S2	24/8	2.0-4.0	11 7 15 17	Compact, brown, SAND and GRAVEL, trace silt, w/ brick and ash & cinders. (Fill)
4	172										
5	171				0.1	28	S3	24/6	4.0-6.0	9 15 13 15	Compact, brown, SAND and GRAVEL, trace silt, w/ brick and ash & cinders. (Fill)
6	170			FILL							
7	169				0.2	28	S4	24/10	6.0-8.0	18 16 12 20	Compact, brown, SAND and GRAVEL, trace silt, w/ brick and ash & cinders. (Fill)
8	168										
9	167				0.1	40	S5	24/8	8.0-10.0	28 24 16 17	Dense, brown, SAND and GRAVEL, trace silt. (Fill)
10	166		10.0 / 165.8								
11	165				0.0	20	S6	24/5	10.0-12.0	7 9 11 9	Compact, brown, medium to coarse grain, GRAVELLY SAND, trace silt. (Glacial Outwash)
12	164										
13	163				0.2	16	S7	24/3	12.0-14.0	11 8 8 7	Compact, brown, medium to coarse grain, GRAVELLY SAND, trace silt. (Glacial Outwash)
14	162										
15	161			GLACIAL OUTWASH	0.2	5	S8	24/6	14.0-16.0	7 3 2 13	Loose, brown, medium to coarse grain, SAND, some gravel, trace silt. (Glacial Outwash)
16	160										
17	159										
18	158										
19	157										
	156										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
A 25 foot observation well installed with 10 feet of screen and 15 feet of solid.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-24-18
Date Finished: 8-24-18

DRAFT

Boring No. B-12 (OW)

Contractor: Carr-Dee
Driller/Helper: Joe/Jay
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 175.8

Casing Type/Depth (ft): 3"
Casing Hammer (lbs)/Drop (in): 300lb/24"
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations

Date	Depth	Elev.	Notes
8-24-18	20	155.8	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
21	155			GLACIAL OUTWASH	0.1	19	S9	24/12	20.0-22.0	4 7 12 9	Compact, brown, medium to coarse grain, SAND and GRAVEL, some silt. (Glacial Outwash)
22	154										
23	153										
24	152										
25	151										
26	150				0.0	53	S10	24/14	25.0-27.0	16 18 35 104	Very dense, brown, SAND and GRAVEL, trace to some silt. (Glacial Outwash)
27	149		27.0 / 148.8								
28	148			Bottom of borehole 27 feet below ground surface.							
29	147										
30	146										
31	145										
32	144										
33	143										
34	142										
35	141										
36	140										
37	139										
38	138										
39	137										
	136										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
A 25 foot observation well installed with 10 feet of screen and 15 feet of solid.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
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Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-22-18
Date Finished: 8-22-18

DRAFT

Boring No. B-13

Contractor: Carr-Dee
Driller/Helper: Joe/Jay
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 162.9

Casing Type/Depth (ft): 3.25" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations			
Date	Depth	Elev.	Notes
8-22-18	10	152.9	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
1	162				0.2	14	S1	24/8	0.0-2.0	2 8 6 4	Compact, brown, SAND and GRAVEL, some silt. (Fill)
2	161										
3	160				0.1	4	S2	24/6	2.0-4.0	3 3 1 1	Very loose to loose, brown, SAND and GRAVEL, some silt, w/ ash & cinders. (Fill)
4	159										
5	158			FILL	0.5	4	S3	24/4	4.0-6.0	2 2 2 3	Very loose to loose, brown, SAND and GRAVEL, some silt, w/ brick and ash & cinders. (Fill)
6	157										
7	156				0.1	12	S4	24/4	6.0-8.0	4 6 6 8	Compact, brown, SAND, some silt and gravel, w/ brick and ash & cinders. (Fill)
8	155										
9	154				1.0	32	S5	24/8	8.0-10.0	19 22 10 7	Dense, brown, SAND, some silt and gravel, w/ brick. (Fill)
10	153		10.0 / 152.9								
11	152		11.0 / 151.9	ORGANIC DEPOSIT	0.2	33	S6	12/6	10.0-11.0	12 14	Very stiff to hard, black, ORGANIC SILT, some peat, w/ wood. (Organic Deposit)
12	151			GLACIAL OUTWASH	0.2	33	S6A	12/10	11.0-12.0	19 17	Dense, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
13	150					38	S7	24/10	12.0-14.0	11 18 20 20	Dense, brown, medium to coarse grain, SAND and GRAVEL, trace silt. (Glacial Outwash)
14	149		14.0 / 148.9								
15	148			Bottom of borehole 14 feet below ground surface.							
16	147										
17	146										
18	145										
19	144										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Rain
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Trotter Road Development
Location: 1500 Main Street
City/State: Weymouth, MA

Job #: 6649
Date Started: 8-27-18
Date Finished: 8-27-18

DRAFT

Boring No. B-14

Contractor: Carr-Dee
Driller/Helper: Jay/Neil
Logged By/Reviewed By: J. Cronin
Surface Elevation (ft): 169.1

Casing Type/Depth (ft): 2.25" HSA
Casing Hammer (lbs)/Drop (in): N/A
Sampler Size/Type: 24" SplitSpoon
Sampler Hammer (lbs)/Drop (in): 140lb/30"

Groundwater Observations			
Date	Depth	Elev.	Notes
8-27-18	16	153.1	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
1	168				0.1	2	S1	24/6	0.0-2.0	1 1 1 1	Very loose, brown, SAND, some gravel. (Fill)
2	167										
3	166										
4	165										
5	164				0.3	3	S2	24/8	5.0-7.0	2 1 2 9	Very loose, brown, SAND, some gravel. (Fill)
6	163										
7	162			FILL							
8	161										
9	160										
10	159				0.3	11	S3	24/8	10.0-12.0	2 2 9 2	Compact, brown, SAND, some gravel. (Fill)
11	158										
12	157										
13	156										
14	155										
15	154		15.0 / 154.1								
16	153			GLACIAL OUTWASH	1.2	7	S4	24/6	15.0-17.0	5 3 4 7	Loose, brown, SAND and GRAVEL, trace silt. (Fill)
17	152		17.0 / 152.1								
18	151			Bottom of borehole 17 feet below ground surface.							
19	150										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

DRAFT

APPENDIX C:

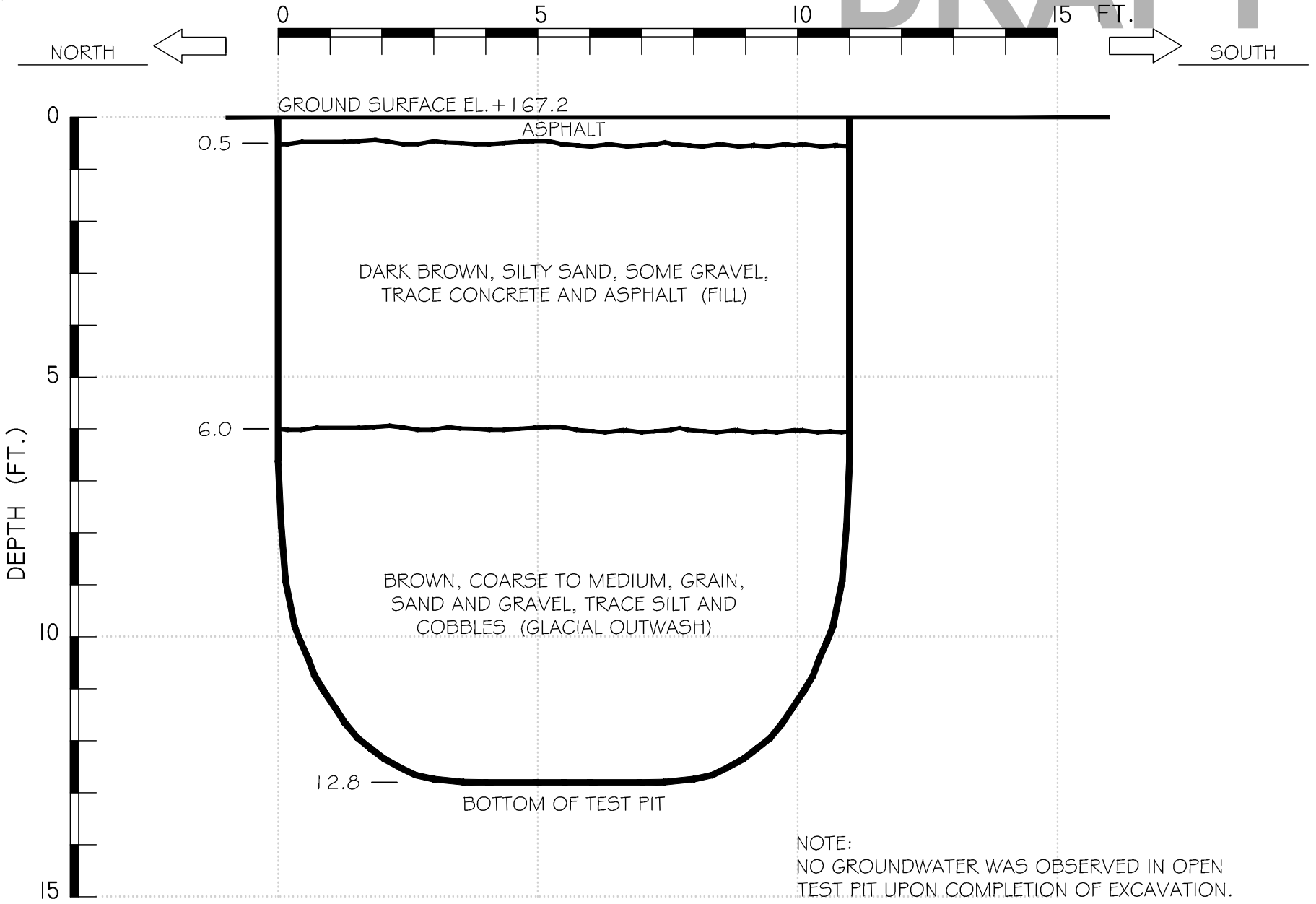
TEST PIT LOGS TP-1 THROUGH TP-12
PREPARED BY MCPHAIL

JOB NO. 6649

DATE AUGUST 21, 2018

TEST PIT LOG

TEST PIT NO. 1



NOTE:
NO GROUNDWATER WAS OBSERVED IN OPEN TEST PIT UPON COMPLETION OF EXCAVATION.

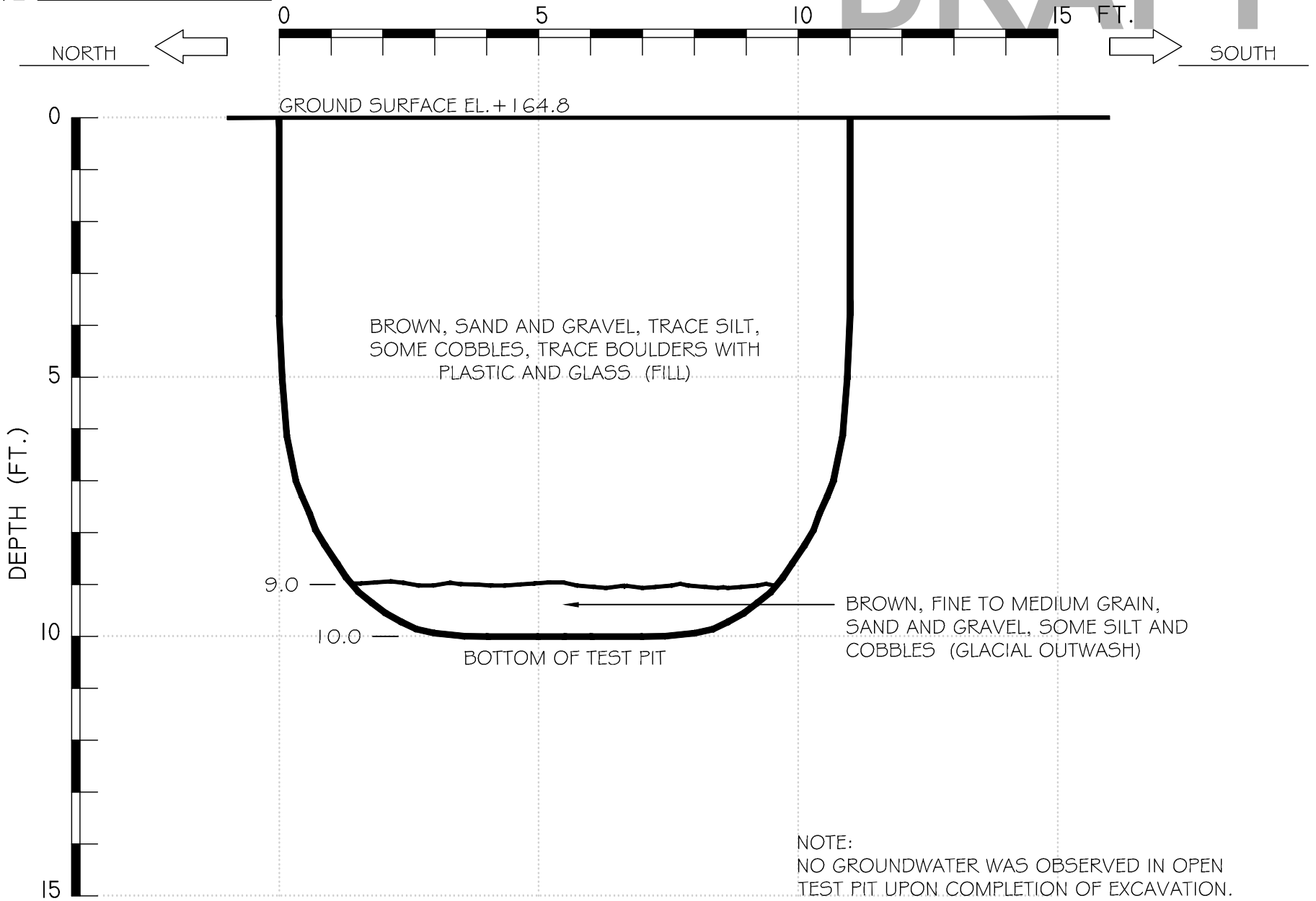
McPHAIL ASSOCIATES, LLC

JOB NO. 6649

DATE AUGUST 21, 2018

TEST PIT LOG

TEST PIT NO. 2



NOTE:
NO GROUNDWATER WAS OBSERVED IN OPEN TEST PIT UPON COMPLETION OF EXCAVATION.

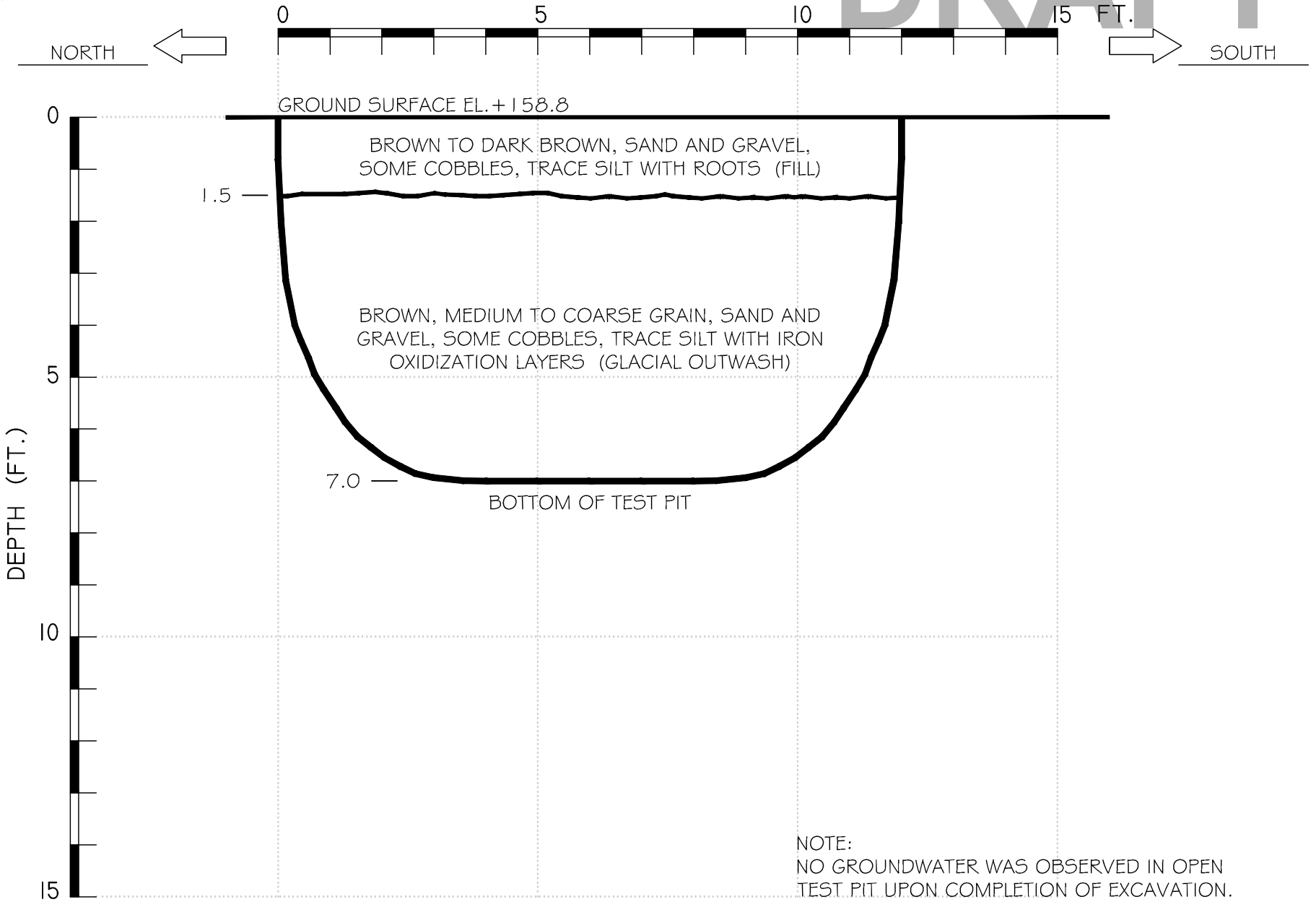
McPHAIL ASSOCIATES, LLC

JOB NO. 6649

DATE AUGUST 21, 2018

TEST PIT LOG

TEST PIT NO. 3



McPHAIL ASSOCIATES, LLC

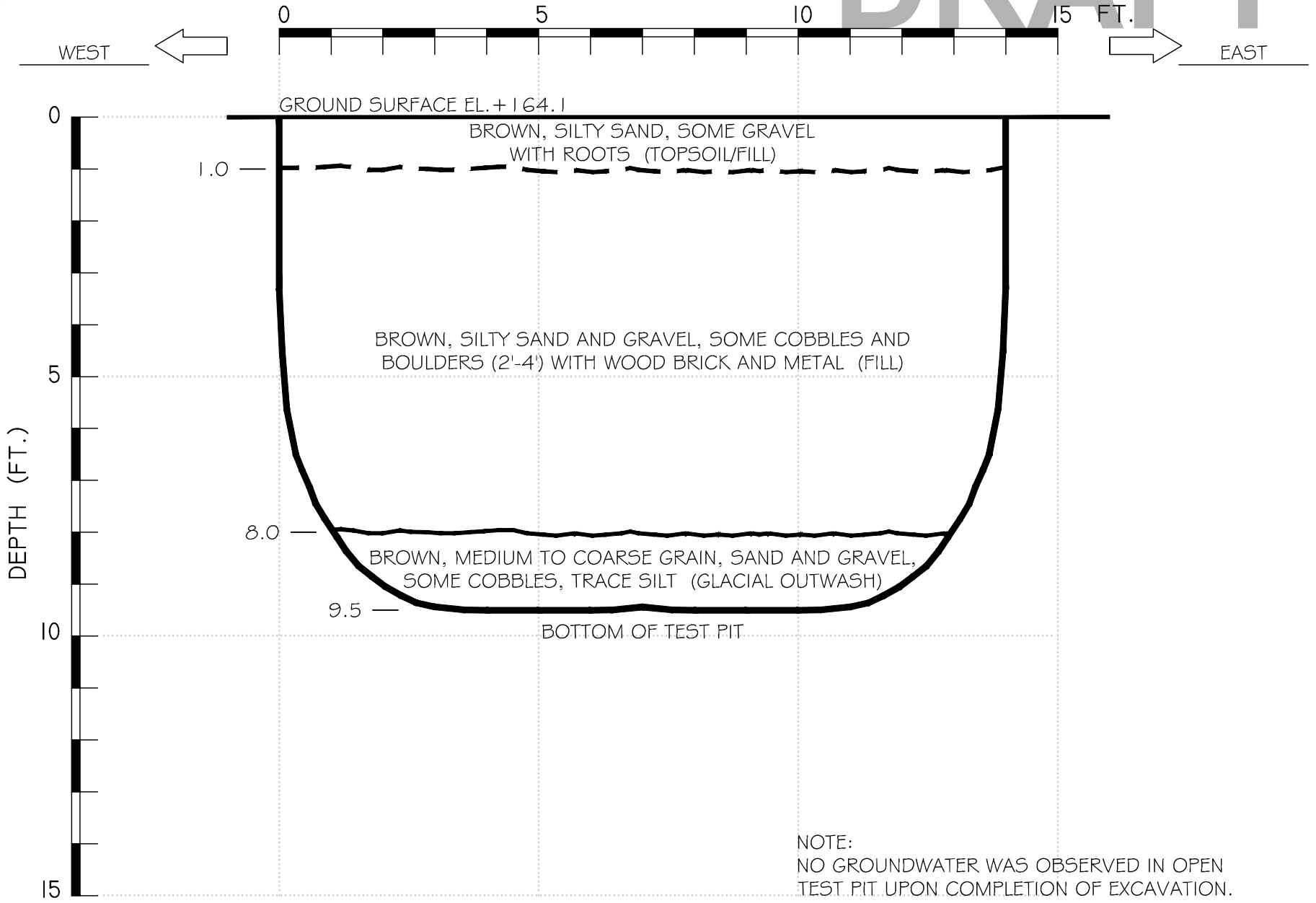
NOTE:
NO GROUNDWATER WAS OBSERVED IN OPEN TEST PIT UPON COMPLETION OF EXCAVATION.

JOB NO. 6649

DATE AUGUST 21, 2018

TEST PIT LOG

TEST PIT NO. 4



NOTE:
NO GROUNDWATER WAS OBSERVED IN OPEN TEST PIT UPON COMPLETION OF EXCAVATION.

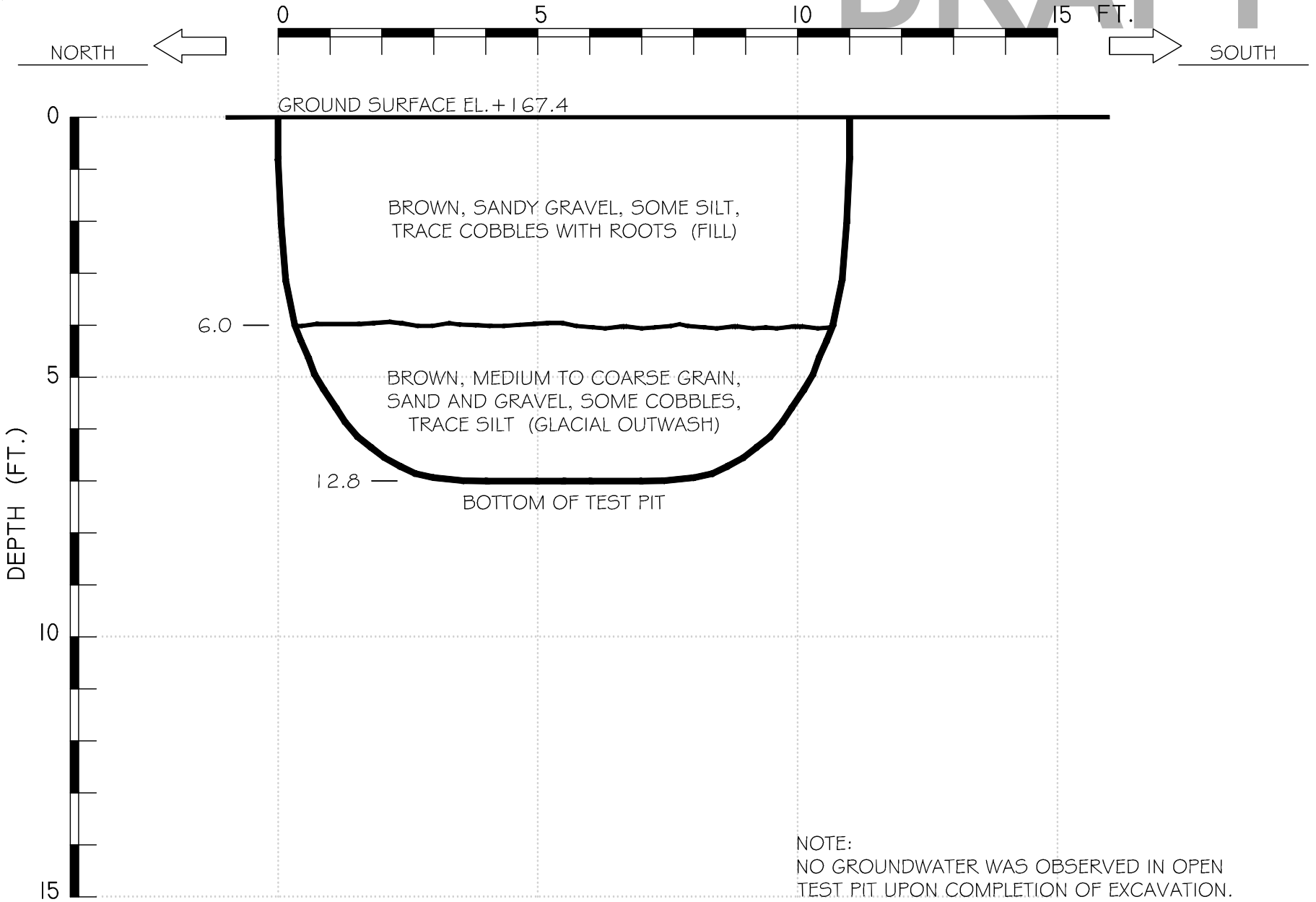
McPHAIL ASSOCIATES, LLC

JOB NO. 6649

DATE AUGUST 21, 2018

TEST PIT LOG

TEST PIT NO. 5



McPHAIL ASSOCIATES, LLC

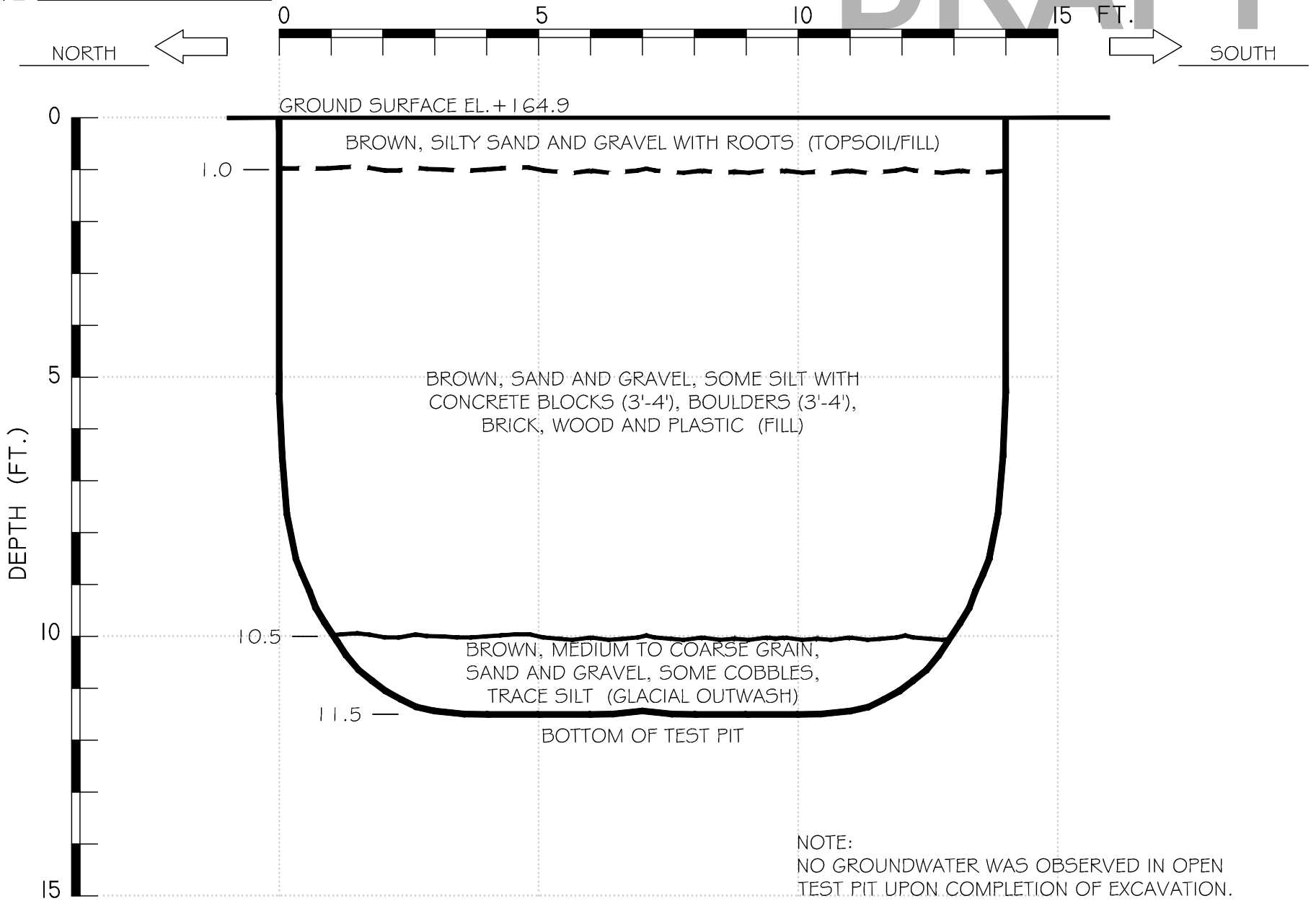
NOTE:
NO GROUNDWATER WAS OBSERVED IN OPEN TEST PIT UPON COMPLETION OF EXCAVATION.

JOB NO. 6649

DATE AUGUST 21, 2018

TEST PIT LOG

TEST PIT NO. 6



McPHAIL ASSOCIATES, LLC

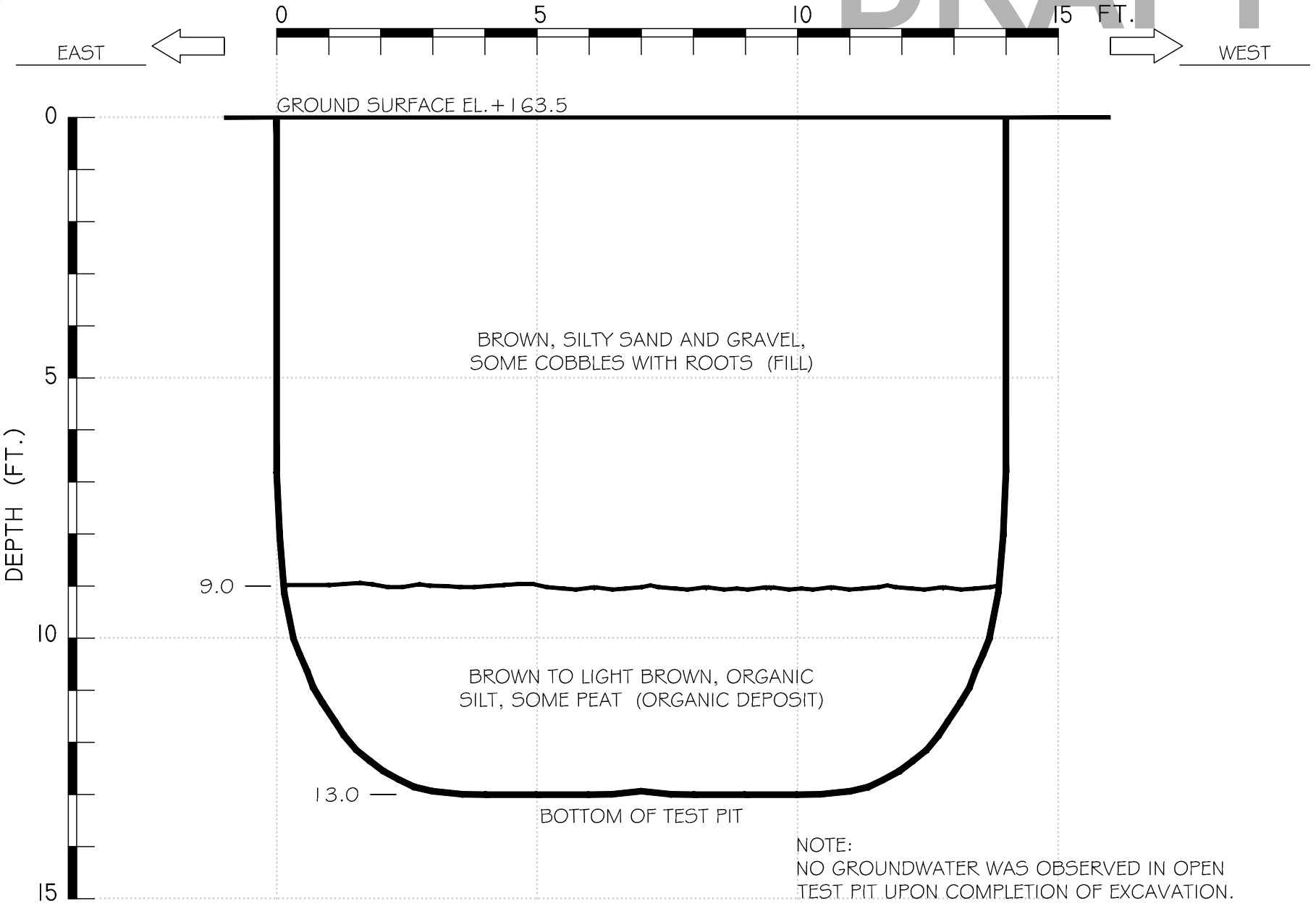
NOTE:
NO GROUNDWATER WAS OBSERVED IN OPEN TEST PIT UPON COMPLETION OF EXCAVATION.

JOB NO. 6649

DATE AUGUST 21, 2018

TEST PIT LOG

TEST PIT NO. 7



NOTE:
NO GROUNDWATER WAS OBSERVED IN OPEN TEST PIT UPON COMPLETION OF EXCAVATION.

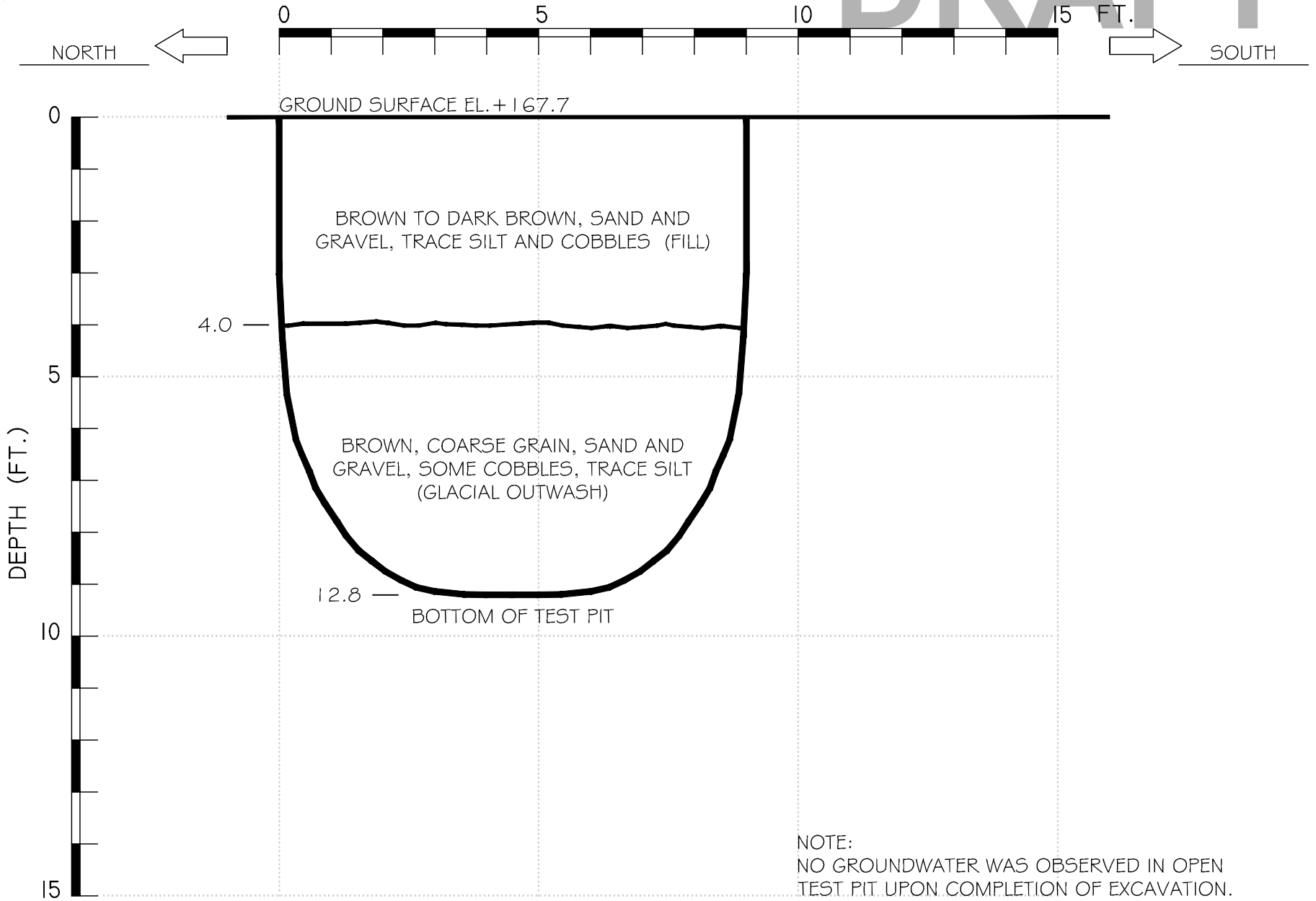
McPHAIL ASSOCIATES, LLC

JOB NO. 6649

DATE AUGUST 21, 2018

TEST PIT LOG

TEST PIT NO. 8



NOTE:
NO GROUNDWATER WAS OBSERVED IN OPEN TEST PIT UPON COMPLETION OF EXCAVATION.

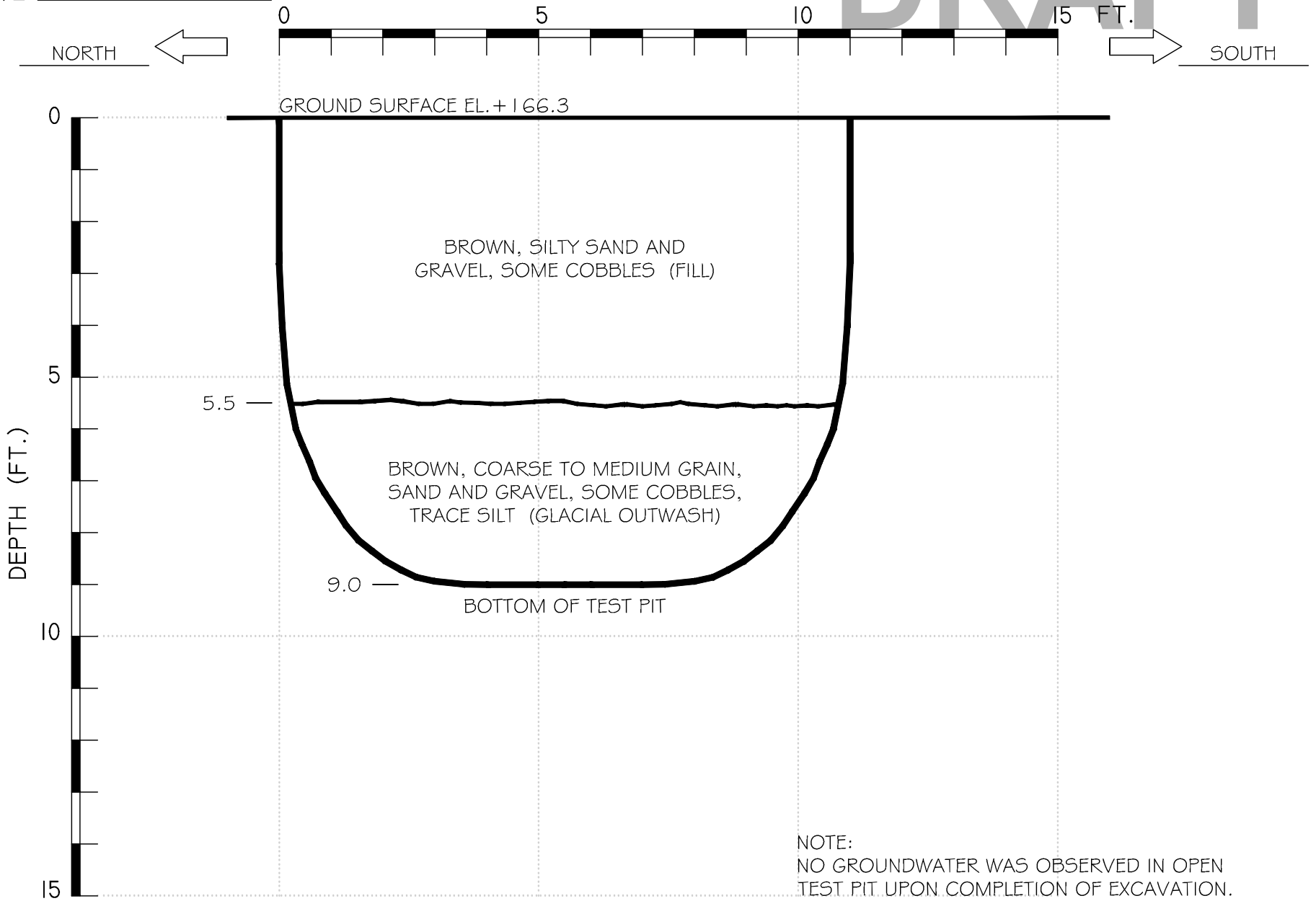
McPHAIL ASSOCIATES, LLC

JOB NO. 6649

DATE AUGUST 21, 2018

TEST PIT LOG

TEST PIT NO. 9



McPHAIL ASSOCIATES, LLC

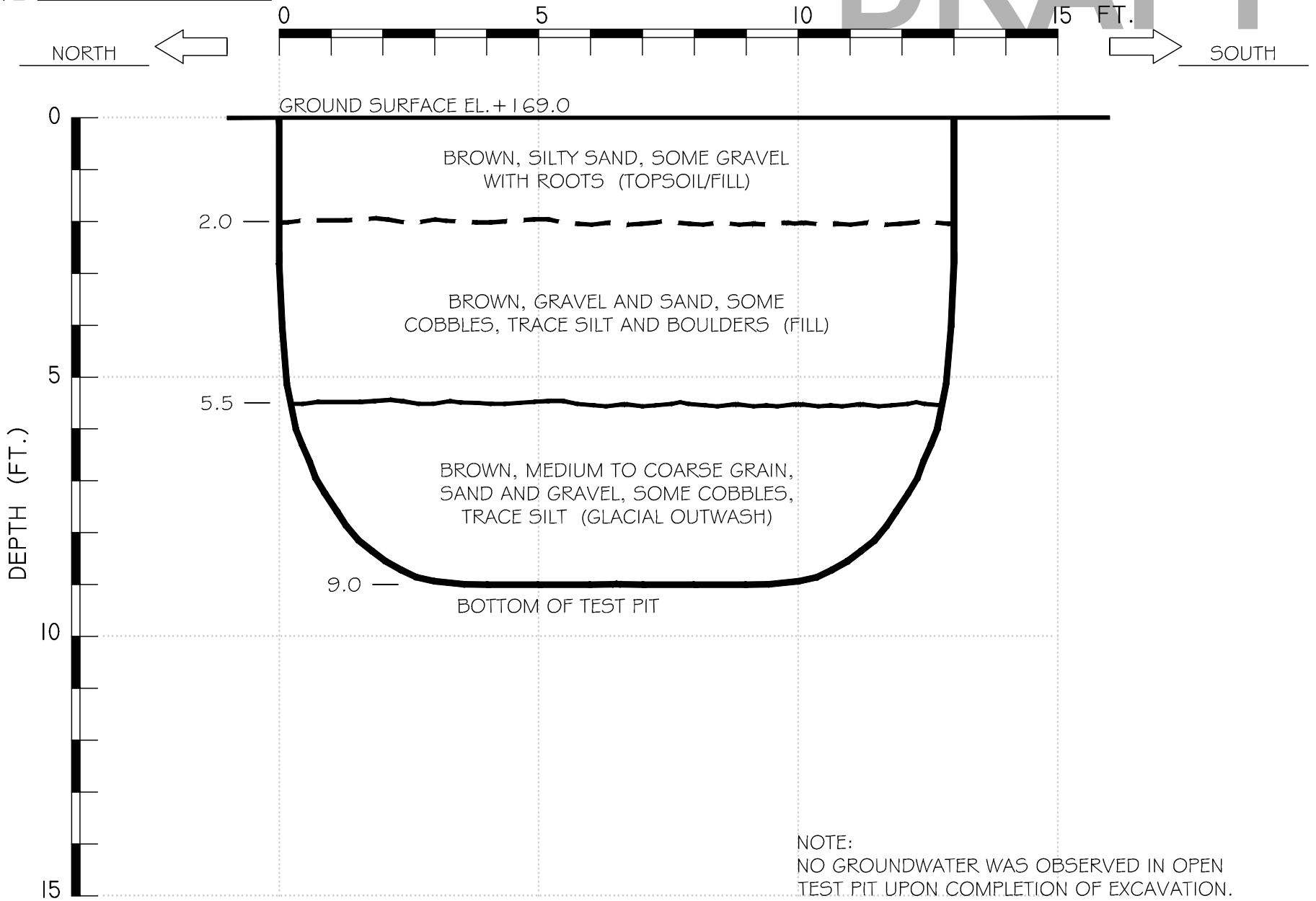
NOTE:
NO GROUNDWATER WAS OBSERVED IN OPEN TEST PIT UPON COMPLETION OF EXCAVATION.

JOB NO. 6649

DATE AUGUST 21, 2018

TEST PIT LOG

TEST PIT NO. 10



McPHAIL ASSOCIATES, LLC

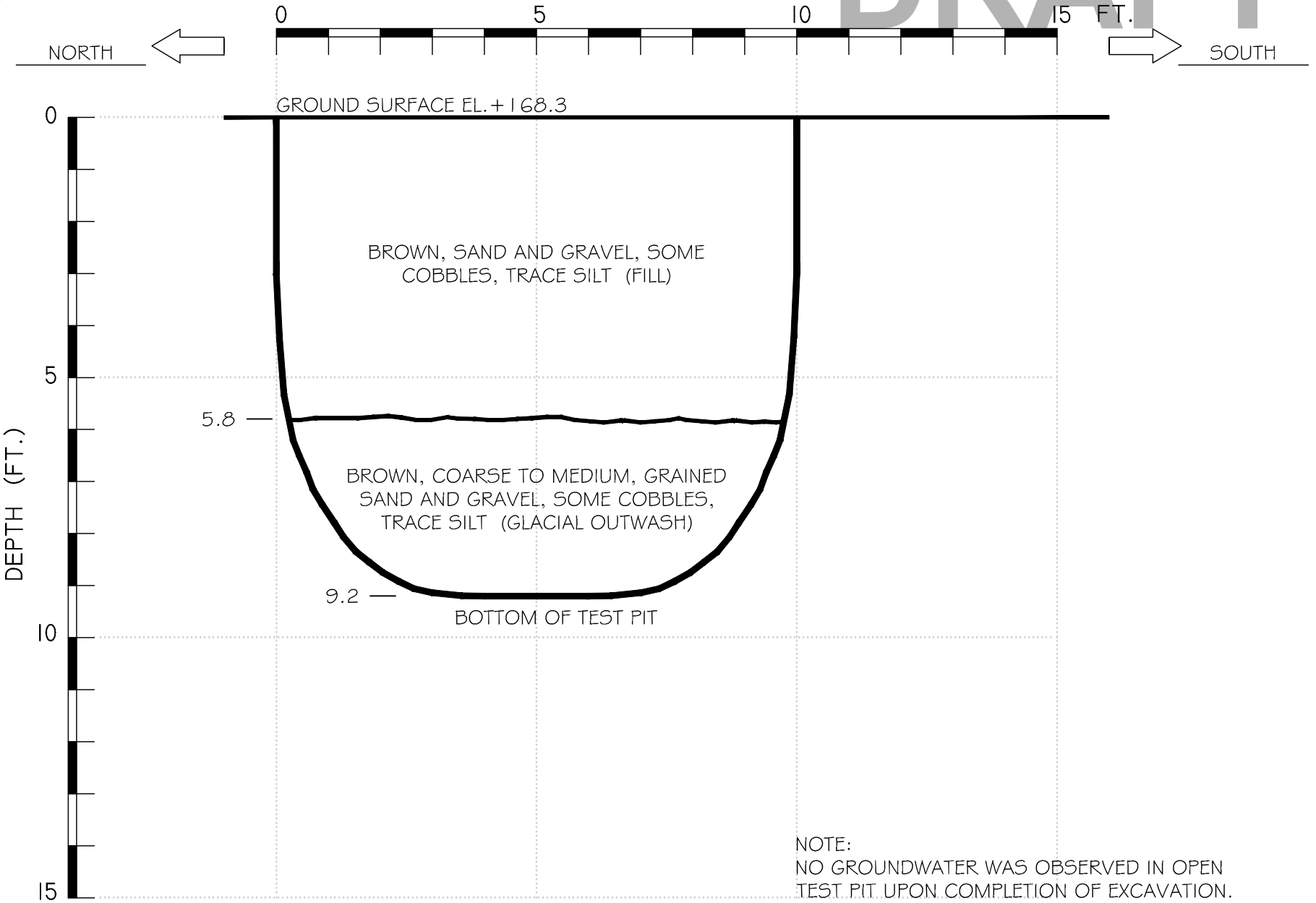
NOTE:
NO GROUNDWATER WAS OBSERVED IN OPEN TEST PIT UPON COMPLETION OF EXCAVATION.

JOB NO. 6649

DATE AUGUST 21, 2018

TEST PIT LOG

TEST PIT NO. 11



NOTE:
NO GROUNDWATER WAS OBSERVED IN OPEN TEST PIT UPON COMPLETION OF EXCAVATION.

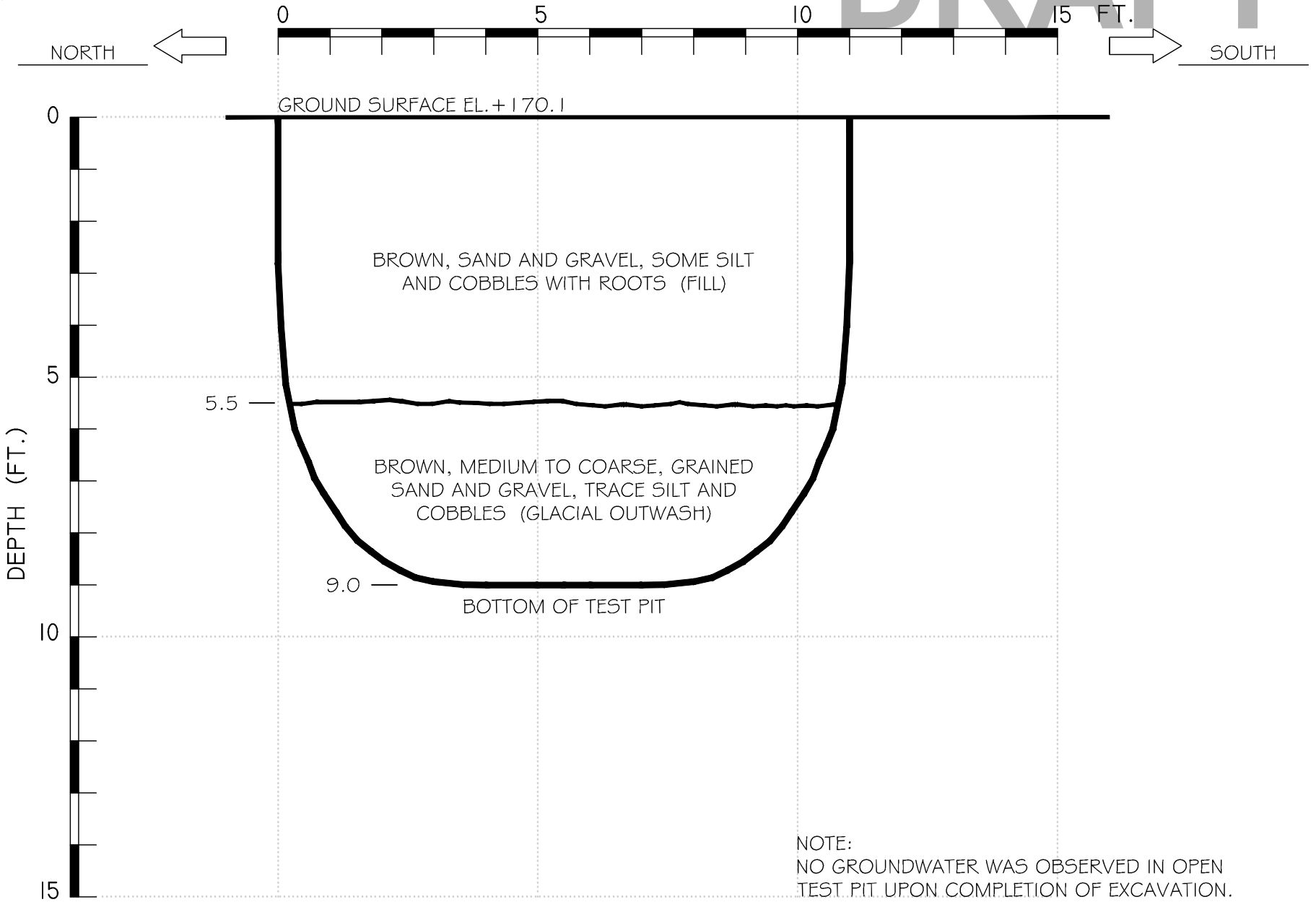
McPHAIL ASSOCIATES, LLC

JOB NO. 6649

DATE AUGUST 21, 2018

TEST PIT LOG

TEST PIT NO. 12



NOTE:
NO GROUNDWATER WAS OBSERVED IN OPEN TEST PIT UPON COMPLETION OF EXCAVATION.

McPHAIL ASSOCIATES, LLC

DRAFT

APPENDIX D:

GROUNDWATER MONITORING REPORTS PREPARED BY MCPHAIL

GROUNDWATER MONITORING REPORT						
Well I.D.	B-1(OW)	**Elevation of Road Box**	+152.2	**Job. No.** **Job Name**	6649.9.00 1500 Main Street	
Date	**Time**	**Elapsed Time**	**Depth of Water from Road Box**	**Elevation of Water**	**Remarks**	**Read By**
		Days	**Feet**	**Feet**		
8/23/2018	9:30	INITIAL	16.0	+136.3	BEFORE DEVELOPED	JC
8/29/2018	10:30	6	15.9	+136.3	AFTER DEVELOPED	JC

GROUNDWATER MONITORING REPORT						
Well I.D.	B-2(OW)	**Elevation of Road Box**	+152.1	**Job. No.** **Job Name**	6649.9.00 1500 Main Street	
Date	**Time**	**Elapsed Time**	**Depth of Water from Road Box**	**Elevation of Water**	**Remarks**	**Read By**
		Days	**Feet**	**Feet**		
8/22/2018	9:30	INITIAL	7.2	+7.2	BEFORE DEVELOPED	JC
8/29/2018	10:30	6	7.0	+7.4	AFTER DEVELOPED	JC

GROUNDWATER MONITORING REPORT						
Well I.D.	B-4(OW)	**Elevation of Road Box**	+153.3	**Job. No.** **Job Name**	6649.9.00 1500 Main Street	
Date	**Time**	**Elapsed Time**	**Depth of Water from Road Box**	**Elevation of Water**	**Remarks**	**Read By**
		Days	**Feet**	**Feet**		
8/23/2018	9:30	INITIAL	16.4	+135.8	BEFORE DEVELOPED	JC
8/29/2018	10:30	6	16.4	+135.8	AFTER DEVELOPED	JC

GROUNDWATER MONITORING REPORT						
Well I.D.	B-6(OW)	**Elevation of Road Box**	+152.2	**Job. No.** **Job Name**	6649.9.00 1500 Main Street	
Date	**Time**	**Elapsed Time**	**Depth of Water from Road Box**	**Elevation of Water**	**Remarks**	**Read By**
		Days	**Feet**	**Feet**		
8/24/2018	9:30	INITIAL	16.4	+135.8	BEFORE DEVELOPED	JC
8/29/2018	15:30	6	9.3	+142.9	AFTER DEVELOPED	JC

GROUNDWATER MONITORING REPORT						
Well I.D.	B-12(OW)	**Elevation of Road Box**	+155.8	**Job. No.** **Job Name**	6649.9.00 1500 Main Street	
Date	**Time**	**Elapsed Time**	**Depth of Water from Road Box**	**Elevation of Water**	**Remarks**	**Read By**
		Days	**Feet**	**Feet**		
8/24/2018	9:30	INITIAL	19.4	+132.8	BEFORE DEVELOPED	JC
8/29/2018	10:30	6	19.3	+132.9	AFTER DEVELOPED	JC

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 Norfolk and Suffolk Counties, Massachusetts

1500 Main St, Weymouth, MA

October 24, 2018

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 (https://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: 1:1,550 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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:
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: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 14, Sep 12, 2018

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

Date(s) aerial images were photographed: Aug 26, 2014—Sep 4, 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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	1.6	25.9%
602	Urban land, 0 to 15 percent slopes	4.7	74.1%
Totals for Area of Interest		**6.4**	**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.

Norfolk and Suffolk Counties, Massachusetts

260B—Sudbury fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: vky4
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sudbury and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sudbury

Setting

Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable coarse-loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 11 inches: sandy loam
H2 - 11 to 22 inches: sandy loam
H3 - 22 to 60 inches: gravelly coarse sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 5 percent

Hydric soil rating: No

Walpole

Percent of map unit: 5 percent
Landform: Terraces
Hydric soil rating: Yes

Deerfield

Percent of map unit: 5 percent
Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

602—Urban land, 0 to 15 percent slopes

Map Unit Setting

National map unit symbol: vkyj
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 120 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 99 percent
Minor components: 1 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Excavated and filled land

Minor Components

Rock outcrops

Percent of map unit: 1 percent
Hydric soil rating: Unranked

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Drainage Class

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized-excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Map Scale: 1:1,550 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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 Rating Polygons

- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Subaqueous
- Not rated or not available

Soil Rating Lines

- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Subaqueous
- Not rated or not available

Soil Rating Points

- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Subaqueous
- Not rated or not available

Water Features

Streams and Canals

Transportation

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

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 14, Sep 12, 2018

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

Date(s) aerial images were photographed: Aug 26, 2014—Sep 4, 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.

Table—Drainage Class

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	Moderately well drained	1.6	25.9%
602	Urban land, 0 to 15 percent slopes		4.7	74.1%
Totals for Area of Interest			**6.4**	**100.0%**

Rating Options—Drainage Class

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Water Features

This folder contains tabular reports that present soil hydrology information. The reports (tables) include all selected map units and components for each map unit. Water Features include ponding frequency, flooding frequency, and depth to water table.

Hydrologic Soil Group and Surface Runoff

This table gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

Report—Hydrologic Soil Group and Surface Runoff

Absence of an entry indicates that the data were not estimated. The dash indicates no documented presence.

Hydrologic Soil Group and Surface Runoff–Norfolk and Suffolk Counties, Massachusetts			
Map symbol and soil name	**Pct. of map unit**	**Surface Runoff**	**Hydrologic Soil Group**
260B—Sudbury fine sandy loam, 2 to 8 percent slopes			
Sudbury	85	Low	B
602—Urban land, 0 to 15 percent slopes			
Urban land	99	—	—

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf