DRAINAGE MEMORANDUM

For

Chick-fil-A

99 Stafford Street
City of Worcester, Massachusetts
Worcester County

Prepared by:

BOHLER
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900 TEL.

Joshua G. Swerling, P.E.
Massachusetts P.E. Lic. # 41697

BOHLER

October 1, 2024

#MAA240159.00

TABLE OF CONTENTS

APPENDICIES

I. SUMMARY

This report examines the changes in drainage that can be expected as the result of the redevelopment of the project site for the proposed Chick-fil-a quick-serve restaurant with drive-through at 99 Stafford Street in the City of Worcester, Massachusetts. The site, which contains approximately 2.4 acres of land, contains a former Walgreens building, paved parking lot, and associated landscaped areas.

The proposed project includes the construction of a new Chick-fil-a quick-serve restaurant with drive-through, parking areas, landscaping, utilities and stormwater management components. The project also includes construction of new landscaped areas. This report addresses a comparative analysis of the pre- and post-development site runoff conditions using the Rational Method. The project will also provide erosion and sedimentation controls during the demolition and construction periods, as well as long term stabilization of the site.

The entirety of the project area flows to existing catch basins within the site. The existing building roof area contains a gutter system that convey stormwater to a sub-surface infiltration basin located at the rear of the parcel. Stormwater generated from the parking area is collected via catch-basins that convey stormwater through a water-quality device (Stormceptor) and ultimately discharges into the municipal drainage system along Stafford Street. As a result of this redevelopment, a decrease in flow is expected to all discharge points as a result of the decrease of approximately 9,700 square feet of impervious area.

The proposed site conditions will improve water quality through the decrease in impervious area. The existing water quality device (Stormceptor) will also remain to add additional water quality improvements prior to conveying stormwater into the municipal drainage system. Implementation of stormwater Best Management Practices will comply with Massachusetts DEP standards. Stormwater management will meet all redevelopment requirements of the current Massachusetts Department of Environmental Protection Stormwater Policy Handbook and the City of Worcester's requirements for stormwater drainage. The proposed drainage condition will maintain the existing drainage patterns.

Per the soil borings performed in May of 2024, the site is comprised of mostly glacial till material. Refer to **Appendix C** for additional information.

II. RATIONAL DRAINAGE CALCULATIONS

EXISTING CONDITIONS

Coverage type	acres	pct.	"C"	frac.	
Impervious	1.65	0.68	0.95	0.64	
Landscape / Grass	0.79	0.32	0.30	0.1	
Total	2.44			0.74	(Composite "C")

PROPOSED CONDITIONS

Coverage type	acres	pct.	"C"	frac.	
Impervious	1.43	0.59	0.95	0.56	
Landscape / Grass	1.01	0.41	0.30	0.12	
Total	2.44			0.68	(Composite "C")

Time of Concentration 5 MIN

IDF Chart	"I"
2-yr storm	4.3
10-yr storm	5.8
50-yr storm	7.2
100-yr storm	8.0

RUNOFF CALCULATIONS "Q" = C x I x A

Existing Conditions	C	I	A	Q	
2-yr storm	0.74	4.3	2.44	7.76	cfs
10-yr storm	0.74	5.8	2.44	10.47	cfs
50-yr storm	0.74	7.2	2.44	12.99	cfs
100-yr storm	0.74	8.0	2.44	14.44	cfs

Proposed Conditions	C	I	A	Q	
2-yr storm	0.68	4.3	2.44	7.14	cfs
10-yr storm	0.68	5.8	2.44	9.64	cfs
50-yr storm	0.68	7.2	2.44	11.96	cfs
100-yr storm	0.68	8.0	2.44	13.29	cfs

Difference (Existing vs. Proposed)			
2-yr storm	-0.61	cfs	-8%
10-yr storm	-0.83	cfs	-8%
50-yr storm	-1.03	cfs	-8%
100-yr storm	-1.14	cfs	-8%

III. STORMWATER MANAGEMENT STANDARDS

Standard #1: No New Untreated Discharges

The project has been designed to maintain the existing drainage patterns and will decrease peak flows as a result of a decrease in impervious area.

Standard #2: Peak Rate Attenuation

As outlined in **Section II**, the development of the site has been designed so that post-development peak rates of runoff as well as volume are below pre-development conditions for the 2-, 10-, 50-, and 100-year storm events.

Standard #3: Recharge

The project is a redevelopment and results in a significant decrease of impervious area. Thus, no recharge is required. However, on-site recharge will be increased due to the increase in pervious landscaped area.

Standard #4: Water Quality

The project is a redevelopment and results in a decrease of impervious area. Thus, no water quality is required. However, water quality will be increased due to the increase in pervious landscaped areas as well as including the existing water quality device (Stormceptor) into the proposed drainage design.

Standard #5: Land Use with Higher Potential Pollutant Loads

Not Applicable for this project.

Standard #6: Critical Areas

Not Applicable for this project.

Standard #7: Redevelopment

The site is considered a redevelopment and results in a decrease of approximately 2,750 SF of impervious area.

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

The proposed project will provide construction period erosion and sedimentation controls as indicated within the site plan set provided for this project. This includes a proposed construction exit, protection for stormwater inlets, protection around temporary material stock piles and various other techniques as outlined on the erosion and sediment control sheets.

Standard #9: Operation and Maintenance Plan (O&M Plan)

An Operation and Maintenance (O&M) Plan for this site has been prepared and is included in **Appendix E** of this report. The O&M Plan outlines procedures and time tables for the long term operation and maintenance of the proposed site stormwater management system, including initial inspections upon completion of construction and periodic monitoring of the system components, in accordance with established practices and the manufacturer's recommendations. The O&M Plan includes a list of responsible parties.

Standard #10: Prohibition of Illicit Discharges

The proposed stormwater system will only convey allowable non-stormwater discharges (firefighting waters, irrigation, air conditioning condensation, etc.) and will not contain any illicit discharges from prohibited sources.

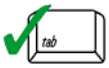
III. STORMWATER MANAGEMENT STANDARDS

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.

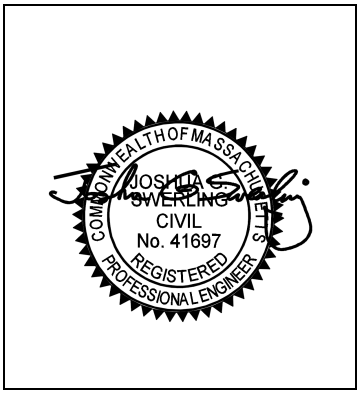
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



10/01/2024

Signature and Date

Checklist

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

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist 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 B: PROJECT LOCATION MAPS

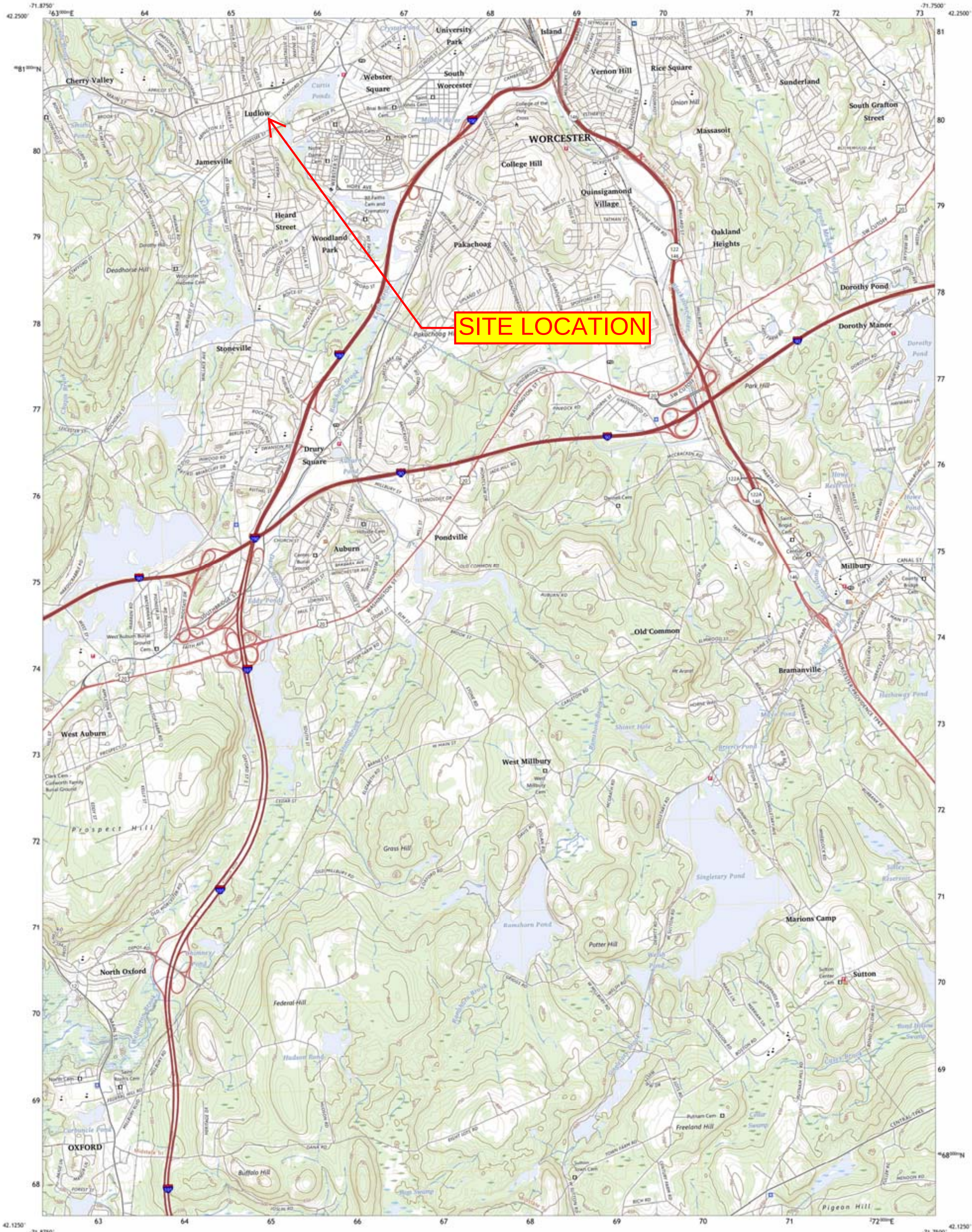
- *USGS MAP*
- *FEMA FIRMETTE*

USGS
science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map
US Topo

WORCESTER SOUTH QUADRANGLE
MASSACHUSETTS - WORCESTER COUNTY
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid:Universal Transverse Mercator, Zone 19T
This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery....NAIP, September 2018 - November 2018
Roads....U.S. Census Bureau, 2018
Names....GNIS, 1974 - 2023
Hydrography....National Hydrography Dataset, 2004 - 2023
Contours....National Elevation Dataset, 2023
Boundaries....Multiple sources; see metadata file 2021 - 2022
Wetlands....FWS National Wetlands Inventory 2008

UTM GRID AND 2023 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard.

QUADRANGLE LOCATION

1 Paxton
2 Worcester North
3 Shrewsbury
4 Leicester
5 Grafton
6 Webster
7 Oxford
8 Uxbridge

ADJOINING QUADRANGLES

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

WORCESTER SOUTH, MA
2024

National Flood Hazard Layer FIRMette

71°50'52"W 42°14'35"N

71°50'15"W 42°14'8"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/30/2024 at 8:57 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

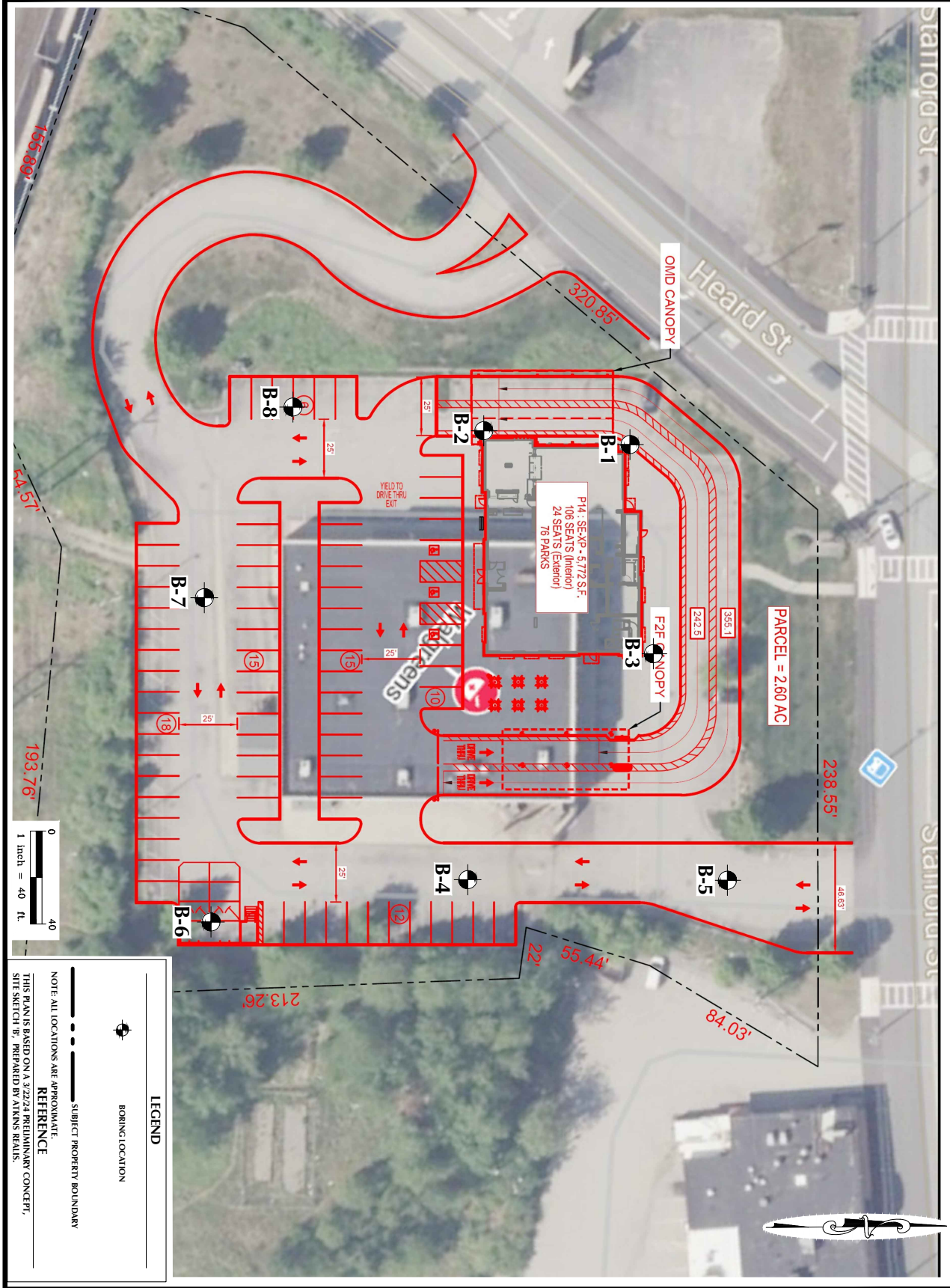
APPENDIX C: SOIL INFORMATION

- *SOIL TESTING RESULTS*

WHITESTONE

FIGURE 1
Boring Location Plan

N:\Job Folders\2024\2421819GM\Drawings and Plans\CAD\GM2421819.000.dwg



PROJECT #:	GM2421819.000
DESIGNED BY:	MR
DRAWN BY:	RR
SCALE:	1" = 40'
DATE:	5/20/24
FIGURE:	1

DRAWING TITLE:
BORING LOCATION PLAN

CLIENT:
CHICK-FIL-A, INC.

PROJECT:
PROPOSED CHICK-FIL-A RESTAURANT
99 STAFFORD STREET
CITY AND COUNTY OF WORCESTER, MASSACHUSETTS

WHITESTONE
An Employee-Owned Company
352 TURNPIKE ROAD, SUITE 105, SOUTHBOROUGH, MA 01772
508.485.0755 WHITESTONEASSOC.COM

WHITESTONE

APPENDIX A
Records of Subsurface Exploration

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-1

Page 1 of 1

Project:	Proposed Chick-fil-A Restaurant #05916	**WAI Project No.:**	GM2421819.000
Location:	99 Strafford Street, Worcester, Worcester County, Massachusetts	**Client:**	Chick-fil-A, Inc.

				Water Depth | Elevation (feet bgs) | (ft NAVD88)	Cave-In Depth | Elevation (feet bgs) | (ft NAVD88)
Surface Elevation:	± NS feet Above NAVD88	**Date Started:**	5/13/2024		
Termination Depth:	20.1 feet bgs	**Date Completed:**	5/13/2024		
Proposed Location:	Building / Canopy	**Logged By:**	ZH	**During:** -- | --	
Drill / Test Method:	HSA / SPT (Autohammer)	**Contractor:**	DE	**At Completion:** -- | --	**At Completion:** -- | --
		Equipment:	Mobile B-57	**24 Hours:** -- | --	**24 Hours:** -- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							PAVEMENT		4.5" Asphalt	
							GRAVEL		7" Granular Subbase	
0.5 - 2.5	S-1	X	9 - 13 - 14 - 14	19	27				Brown, Medium Dense, Poorly Graded Sand with Gravel (SP)	PID = 0.0 ppm
2.5 - 4.5	S-2	X	13 - 14 - 15 - 11	15	29				As Above (SP)	PID = 0.0 ppm
						5.0	GLACIO-FLUVIAL DEPOSIT			
5 - 7	S-3	X	18 - 9 - 13 - 6	9	22				As Above (SP)	PID = 0.0 ppm
7 - 9	S-4	X	15 - 13 - 11 - 13	17	24				As Above, Gray-Brown (SP)	PID = 0.0 ppm
						10.0				
10 - 12	S-5	X	7 - 21 - 20 - 19	15	41				Brown, Dense, Silty Sand with Gravel (SM)	PID = 0.0 ppm
						15.0	GLACIAL TILL			
15 - 17	S-6	X	8 - 23 - 28 - 33	14	51				As Above, Very Dense (SM)	PID = 0.0 ppm
20 - 20.1	S-7	X	50/1"	0	-	20.0			No Recovery	
									Boring Log B-1 Terminated at Depth of 20.1 feet below ground surface.	
						25.0				

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-2

Page 1 of 1

Project:	Proposed Chick-fil-A Restaurant #05916	**WAI Project No.:**	GM2421819.000
Location:	99 Strafford Street, Worcester, Worcester County, Massachusetts	**Client:**	Chick-fil-A, Inc.

				Water Depth | Elevation (feet bgs) | (ft NAVD88)	Cave-In Depth | Elevation (feet bgs) | (ft NAVD88)
Surface Elevation:	± NS feet Above NAVD88	**Date Started:**	5/13/2024		
Termination Depth:	21.8 feet bgs	**Date Completed:**	5/13/2024		
Proposed Location:	Building / Canopy	**Logged By:**	ZH	**During:** 17.0 | --	
Drill / Test Method:	HSA / SPT (Autohammer)	**Contractor:**	DE	**At Completion:** -- | --	**At Completion:** -- | --
		Equipment:	Mobile B-57	**24 Hours:** -- | --	**24 Hours:** -- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							PAVEMENT		4" Asphalt	
							GRAVEL		6" Granular Subbase	
0.5 - 2.5	S-1	X	9 - 11 - 12 - 9	17	23				Brown, Medium Dense, Poorly Graded Sand with Gravel (SP)	PID = 0.0 ppm
2.5 - 4.5	S-2	X	5 - 5 - 6 - 7	20	11		GLACIO-FLUVIAL DEPOSIT		As Above (SP)	PID = 0.0 ppm
						5.0				
5 - 7	S-3	X	13 - 9 - 5 - 9	13	14				As Above (SP)	PID = 0.0 ppm
						7.0				
7 - 9	S-4	X	17 - 21 - 26 - 25	19	47				Gray-Brown, Dense, Silty Sand with Gravel (SM)	PID = 0.0 ppm
						10.0				
10 - 11.4	S-5	X	23 - 37 - 50/5"	15	74				As Above, Very Dense (SM)	PID = 0.0 ppm Cobbles
							GLACIAL TILL			
						15.0				
15 - 17	S-6	X	29 - 34 - 37 - 24	12	71				As Above (SM)	PID = 0.0 ppm
						20.0				
20 - 21.8	S-7	X	16 - 47 - 42 - 50/4"	23	89				As Above, Brown, (SM)	PID = 0.0 ppm Cobbles
									Boring Log B-2 Terminated at Depth of 21.8 feet below ground surface.	
						25.0				

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-3

Page 1 of 1

Project:	Proposed Chick-fil-A Restaurant #05916	**WAI Project No.:**	GM2421819.000
Location:	99 Strafford Street, Worcester, Worcester County, Massachusetts	**Client:**	Chick-fil-A, Inc.

Surface Elevation:	± NS feet Above NAVD88	**Date Started:**	5/13/2024	**Water Depth | Elevation (feet bgs) | (ft NAVD88)**	**Cave-In Depth | Elevation (feet bgs) | (ft NAVD88)**
Termination Depth:	22.0 feet bgs	**Date Completed:**	5/13/2024		
Proposed Location:	Building	**Logged By:**	ZH	**During:** -- | --	
Drill / Test Method:	HSA / SPT (Autohammer)	**Contractor:**	DE	**At Completion:** -- | --	**At Completion:** -- | --
		Equipment:	Mobile B-57	**24 Hours:** -- | --	**24 Hours:** -- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							PAVEMENT		4" Asphalt	
							GRAVEL		5" Granular Subbase	
0.5 - 2.5	S-1	X	4 - 7 - 12 - 10	10	19				Brown, Medium Dense, Poorly Graded Sand with Gravel (SP)	PID = 0.0 ppm
2.5 - 4.5	S-2	X	7 - 12 - 10 - 12	16	22				As Above (SP)	PID = 0.0 ppm
						5.0				
5 - 7	S-3	X	12 - 6 - 5 - 5	13	11				As Above (SP)	PID = 0.0 ppm
7 - 9	S-4	X	4 - 7 - 6 - 7	10	13				As Above (SP)	PID = 0.0 ppm
						10.0				
10 - 12	S-5	X	10 - 7 - 11 - 10	14	18		GLACIO-FLUVIAL DEPOSIT		Brown, Medium Dense, Poorly Graded Sand with Silt and Gravel (SP-SM)	PID = 0.0 ppm Cobbles
						15.0				
15 - 17	S-6	X	12 - 10 - 8 - 11	3	18				As Above (SP-SM)	PID = 0.0 ppm
						20.0				
20 - 22	S-7	X	8 - 18 - 13 - 10	16	31		GLACIAL TILL		Brown, Dense, Silty Sand with Gravel (SM)	PID = 0.0 ppm
						25.0			Boring Log B-3 Terminated at Depth of 22.0 feet below ground surface.	

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-4

Page 1 of 1

Project:	Proposed Chick-fil-A Restaurant #05916	**WAI Project No.:**	GM2421819.000
Location:	99 Strafford Street, Worcester, Worcester County, Massachusetts	**Client:**	Chick-fil-A, Inc.

Surface Elevation:	± NS feet Above NAVD88	**Date Started:**	5/13/2024	**Water Depth | Elevation** (feet bgs) | (ft NAVD88)		**Cave-In Depth | Elevation** (feet bgs) | (ft NAVD88)	
Termination Depth:	22.0 feet bgs	**Date Completed:**	5/13/2024				
Proposed Location:	Building	**Logged By:**	ZH	**During:**	-- | --		
Drill / Test Method:	HSA / SPT (Autohammer)	**Contractor:**	DE	**At Completion:**	-- | --	**At Completion:**	-- | --
		Equipment:	Mobile B-57	**24 Hours:**	-- | --	**24 Hours:**	-- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							PAVEMENT		3" Asphalt	
							GRAVEL		8" Granular Subbase	
0.5 - 2.5	S-1	X	7 - 13 - 14 - 12	17	27		EXISTING FILL		Brown, Medium Dense, Silty Sand with Gravel (FILL)	PID = 0.0 ppm
2.5 - 4.5	S-2	X	15 - 17 - 12 - 12	18	29				As Above (FILL)	PID = 0.0 ppm
						5.0				
						5.5			As Above, Gray to Black (FILL)	
5 - 7	S-3	X	9 - 15 - 9 - 4	19	24				Brown, Medium Dense, Poorly Graded Sand with Silt and Gravel (SP-SM)	PID = 0.0 ppm
7 - 9	S-4	X	4 - 5 - 5 - 4	13	10				As Above, Loose to Medium Dense (SP-SM)	PID = 0.0 ppm
						10.0				
10 - 12	S-5	X	14 - 13 - 9 - 7	0	22		GLACIO-FLUVIAL DEPOSIT		No Recovery. Medium Dense	Cobbles
						15.0				
15 - 17	S-6	X	10 - 10 - 9 - 9	12	19				Gray-Brown, Medium Dense, Poorly Graded Sand with Silt and Gravel (SP-SM)	PID = 0.0 ppm
						20.0				
20 - 22	S-7	X	6 - 8 - 8 - 7	0	16				No Recovery. Medium Dense	
						25.0			Boring Log B-4 Terminated at Depth of 22.0 feet below ground surface.	

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-5

Project:	Proposed Chick-fil-A Restaurant #05916	**WAI Project No.:**	GM2421819.000
Location:	99 Strafford Street, Worcester, Worcester County, Massachusetts	**Client:**	Chick-fil-A, Inc.

				Water Depth | Elevation (feet bgs) | (ft NAVD88)	Cave-In Depth | Elevation (feet bgs) | (ft NAVD88)
Surface Elevation:	± NS feet Above NAVD88	**Date Started:**	5/13/2024		
Termination Depth:	7.0 feet bgs	**Date Completed:**	5/13/2024		
Proposed Location:	Access	**Logged By:**	ZH	**During:** -- | --	
Drill / Test Method:	HSA / SPT (Autohammer)	**Contractor:**	DE	**At Completion:** -- | --	**At Completion:** -- | --
		Equipment:	Mobile B-57	**24 Hours:** -- | --	**24 Hours:** -- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							PAVEMENT		3" Asphalt	
							GRAVEL		6" Granular Subbase	
1 - 3	S-1	X	7 - 14 - 47 - 22	12	61	3.0	EXISTING FILL		Brown, Very Dense, Silty Sand with Gravel (FILL)	PID = 0.0 ppm Cobbles
3 - 5	S-2	X	11 - 10 - 12 - 9	9	22	5.0	GLACIO-FLUVIAL DEPOSIT		Gray-Brown, Medium Dense, Poorly Graded Sand with Silt and Gravel (SP-SM)	PID = 0.0 ppm
5 - 7	S-3	X	3 - 6 - 5 - 7	5	11				As Above (SP-SM)	PID = 0.0 ppm
									Boring Log B-5 Terminated at Depth of 7.0 feet below ground surface.	
						10.0				
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-6

Page 1 of 1

Project:	Proposed Chick-fil-A Restaurant #05916	**WAI Project No.:**	GM2421819.000
Location:	99 Strafford Street, Worcester, Worcester County, Massachusetts	**Client:**	Chick-fil-A, Inc.

Surface Elevation:	± NS feet Above NAVD88	**Date Started:**	5/13/2024		**Water Depth | Elevation** (feet bgs) | (ft NAVD88)		**Cave-In Depth | Elevation** (feet bgs) | (ft NAVD88)
Termination Depth:	7.0 feet bgs	**Date Completed:**	5/13/2024				
Proposed Location:	Dumpster Pad	**Logged By:**	ZH	**During:**	-- | --		
Drill / Test Method:	HSA / SPT (Autohammer)	**Contractor:**	DE	**At Completion:**	-- | --	**At Completion:**	-- | --
		Equipment:	Mobile B-57	**24 Hours:**	-- | --	**24 Hours:**	-- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							PAVEMENT		4" Asphalt	
							GRAVEL		7" Granular Subbase	
1 - 3	S-1	X	6 - 10 - 13 - 14	19	23		EXISTING FILL		Brown, Medium Dense, Silty Sand with Gravel (FILL)	PID = 0.0 ppm
3 - 5	S-2	X	8 - 9 - 7 - 11	16	16	5.0			As Above (FILL)	PID = 0.0 ppm
5 - 7	S-3	X	12 - 7 - 5 - 4	10	12				As Above, Black, Cobbles (FILL)	PID = 0.0 ppm
						10.0			*Boring Log B-6 Terminated at Depth of 7.0 feet below ground surface.*	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-7

Page 1 of 1

Project:	Proposed Chick-fil-A Restaurant #05916	**WAI Project No.:**	GM2421819.000
Location:	99 Strafford Street, Worcester, Worcester County, Massachusetts	**Client:**	Chick-fil-A, Inc.

Surface Elevation:	± NS feet Above NAVD88	**Date Started:**	5/13/2024		**Water Depth | Elevation** (feet bgs) | (ft NAVD88)		**Cave-In Depth | Elevation** (feet bgs) | (ft NAVD88)
Termination Depth:	7.0 feet bgs	**Date Completed:**	5/13/2024				
Proposed Location:	Parking	**Logged By:**	ZH	**During:**	-- | --		
Drill / Test Method:	HSA / SPT (Autohammer)	**Contractor:**	DE	**At Completion:**	-- | --	**At Completion:**	-- | --
		Equipment:	Mobile B-57	**24 Hours:**	-- | --	**24 Hours:**	-- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							PAVEMENT		3" Asphalt	
							GRAVEL		6" Granular Subbase	
1 - 3	S-1	X	4 - 9 - 13 - 14	19	22		EXISTING FILL		Brown, Medium Dense, Silty Sand with Gravel (FILL)	PID = 0.0 ppm
3 - 5	S-2	X	9 - 9 - 17 - 12	19	26	4.0			As Above, Brown to Black (FILL)	PID = 0.0 ppm
						5.0	GLACIO-FLUVIAL DEPOSIT		Brown, Medium Dense, Poorly Graded Sand with Silt and Gravel (SP-SM)	
5 - 7	S-3	X	9 - 16 - 8 - 9	5	24				As Above (SP-SM)	PID = 0.0 ppm
									Boring Log B-7 Terminated at Depth of 7.0 feet below ground surface.	
						10.0				
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-8

Project:	Proposed Chick-fil-A Restaurant #05916	**WAI Project No.:**	GM2421819.000
Location:	99 Strafford Street, Worcester, Worcester County, Massachusetts	**Client:**	Chick-fil-A, Inc.
Surface Elevation:	± NS feet Above NAVD88	**Date Started:**	5/13/2024
Termination Depth:	7.0 feet bgs	**Date Completed:**	5/13/2024
Proposed Location:	Parking	**Logged By:**	ZH
Drill / Test Method:	HSA / SPT (Autohammer)	**Contractor:**	DE
		Equipment:	Mobile B-57

Water Depth | Elevation (feet bgs) | (ft NAVD88)		Cave-In Depth | Elevation (feet bgs) | (ft NAVD88)	
During:	-- | --		
At Completion:	-- | --	**At Completion:**	-- | --
24 Hours:	-- | --	**24 Hours:**	-- | --

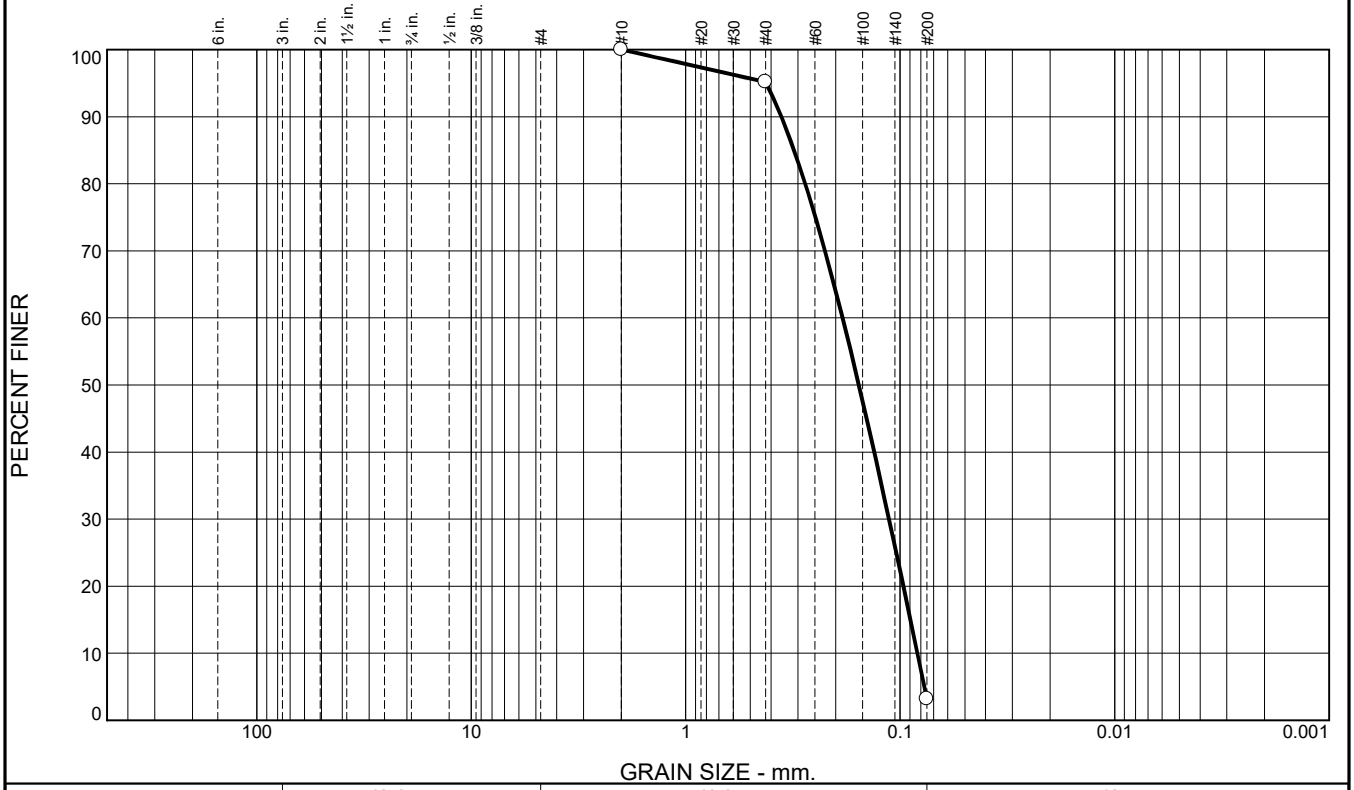
SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							PAVEMENT		4" Asphalt	
							GRAVEL		6" Granular Subbase	
						1.5	FILL		Brown, Silty Sand with Gravel (FILL)	
1 - 3	S-1	X	4 - 9 - 10 - 13	23	19		GLACIO-FLUVIAL DEPOSIT		Brown, Medium Dense, Poorly Graded Sand with Silt and Gravel (SP-SM)	PID = 0.0 ppm
3 - 5	S-2	X	5 - 9 - 8 - 9	22	17	5.0			As Above (SP-SM)	PID = 0.0 ppm
5 - 7	S-3	X	4 - 6 - 6 - 7	24	12				As Above (SP-SM)	PID = 0.0 ppm
									Boring Log B-8 Terminated at Depth of 7.0 feet below ground surface.	
						10.0				
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

APPENDIX B
Laboratory Test Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	4.8	92.0	3.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	95.2		
#200	3.2		

* (no specification provided)

Material Description

Poorly Graded Sand

Atterberg Limits

PL= NP LL= NV PI= NV

Coefficients

D_{90}= 0.3583 D_{85}= 0.3128 D_{60}= 0.1858
D_{50}= 0.1561 D_{30}= 0.1129 D_{15}= 0.0897
D_{10}= 0.0831 C_u= 2.24 C_c= 0.83

Classification

USCS= SP AASHTO= A-3

Remarks

Moisture Content: 11.2%

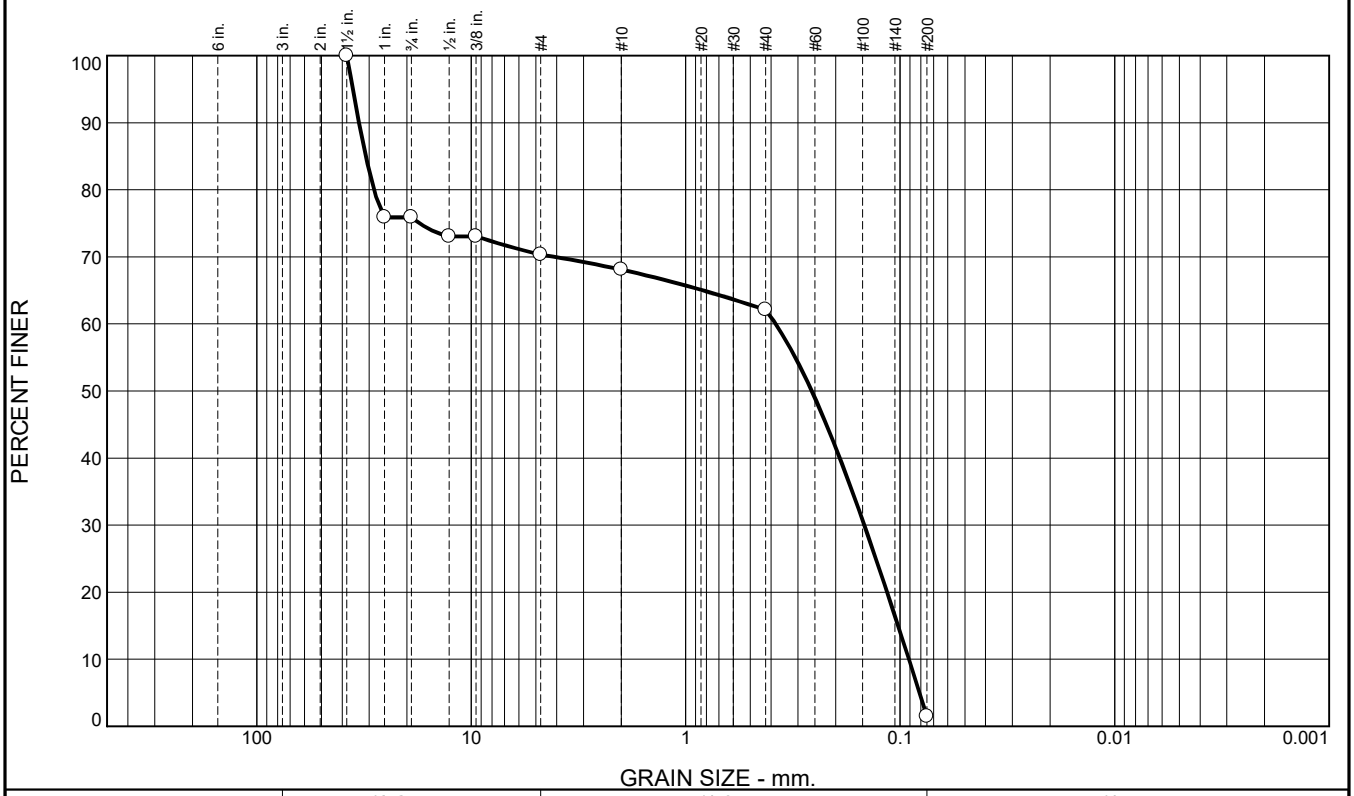
Location: B-2
Sample Number: S-2 **Depth:** 2.5' - 4.5' **Date:** 5/22/24

WHITESTONE

Client: Chick-fil-A, Inc.
Project: Proposed Chick-fil-A Restaurant #05916
99 Strafford Street, Worcester, Worcester County, MA
Project No: GM2421819.000 **Figure** S-1

Tested By: MM **Checked By:** RWM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	24.1	5.6	2.2	6.0	60.6	1.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	75.9		
3/4"	75.9		
1/2"	73.1		
3/8"	73.1		
#4	70.3		
#10	68.1		
#40	62.1		
#200	1.5		

* (no specification provided)

Material Description

Poorly Graded Sand with Gravel

Atterberg Limits

PL= NP LL= NV PI= NV

Coefficients

D_{90}= 33.4271 D_{85}= 31.0769 D_{60}= 0.3812
D_{50}= 0.2586 D_{30}= 0.1472 D_{15}= 0.1024
D_{10}= 0.0912 C_u= 4.18 C_c= 0.62

Classification

USCS= SP AASHTO= A-3

Remarks

Moisture Content: 5.4%

Location: B-3
Sample Number: S-3 **Depth:** 5' - 7' **Date:** 5/22/24

WHITESTONE

Client: Chick-fil-A, Inc.
Project: Proposed Chick-fil-A Restaurant #05916
99 Strafford Street, Worcester, Worcester County, MA
Project No: GM2421819.000 **Figure** S-2

Tested By: MM **Checked By:** RWM

WHITESTONE

APPENDIX C
Supplemental Information (USCS, Terms & Symbols)

WHITESTONE
An Employee-Owned Company

352 TURNPIKE ROAD
SUITE 105
SOUTHBOROUGH, MA 01772
508.485.0755
whitestoneassoc.com

UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMITS LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMITS GREATER THAN 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS FOR SAMPLES WITH 5% TO 12% FINES

GRADATION*

% FINER BY WEIGHT

TRACE..... 1% TO 10%
LITTLE..... 10% TO 20%
SOME..... 20% TO 35%
AND..... 35% TO 50%

COMPACTNESS*
Sand and/or Gravel

RELATIVE DENSITY

LOOSE. ..... 0% TO 40%
MEDIUM DENSE.... 40% TO 70%
DENSE..... 70% TO 90%
VERY DENSE..... 90% TO 100%

CONSISTENCY*
Clay and/or Silt

RANGE OF SHEARING STRENGTH IN POUNDS PER SQUARE FOOT

VERY SOFT..... LESS THAN 250
SOFT..... ..... 250 TO 500
MEDIUM..... 500 TO 1000
STIFF..... 1000 TO 2000
VERY STIFF..... 2000 TO 4000
HARD..... GREATER THAN 4000

** VALUES ARE FROM LABORATORY OR FIELD TEST DATA, WHERE APPLICABLE. WHEN NO TESTING WAS PERFORMED, VALUES ARE ESTIMATED.*

L:\Geotechnical Forms and References\Reports\USCSTRMSSYM MA.docx

WHITESTONE
An Employee-Owned Company

352 TURNPIKE ROAD
SUITE 105
SOUTHBOROUGH, MA 01772
508.485.0755
whitestoneassoc.com

GEOTECHNICAL TERMS AND SYMBOLS

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

N: Standard Penetration Value: Blows per ft. of a 140 lb. hammer falling 30" on a 2" O.D. split-spoon.
Qu: Unconfined compressive strength, TSF.
Qp: Penetrometer value, unconfined compressive strength, TSF.
Mc: Moisture content, %.
LL: Liquid limit, %.
PI: Plasticity index, %.
δd: Natural dry density, PCF.
▼: Apparent groundwater level at time noted after completion of boring.

DRILLING AND SAMPLING SYMBOLS

NE: Not Encountered (Groundwater was not encountered).
SS: Split-Spoon - 1 ⅜" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
AU: Auger Sample.
OB: Diamond Bit.
CB: Carbide Bit
WS: Washed Sample.

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

Term (Non-Cohesive Soils)	Standard Penetration Resistance
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

Term (Cohesive Soils)	Qu (TSF)
Very Soft	0 - 0.25
Soft	0.25 - 0.50
Firm (Medium)	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	4.00+

PARTICLE SIZE

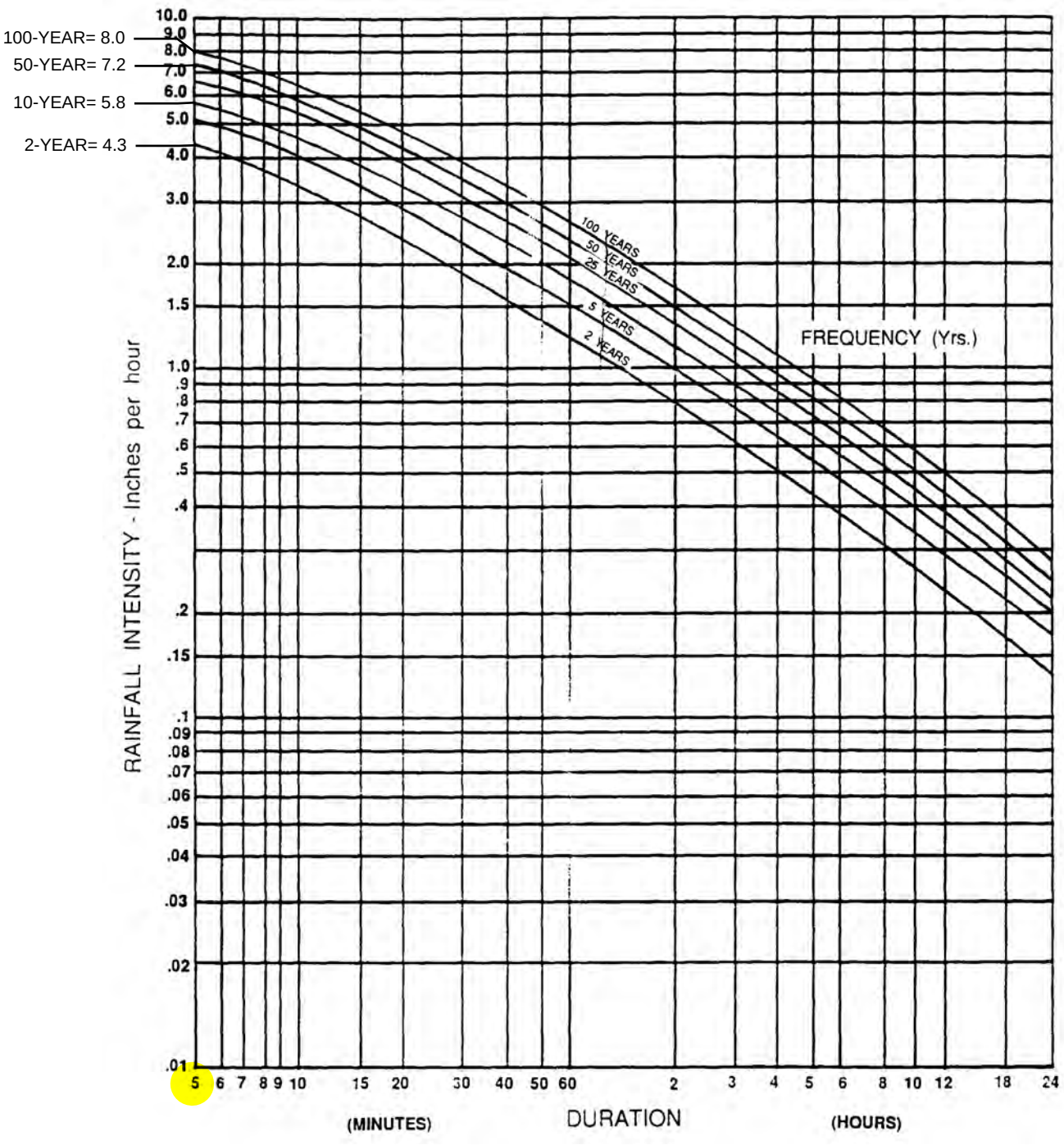
Boulders	8 in.+	Coarse Sand	5mm-0.6mm	Silt	0.074mm-0.005mm
Cobbles	8 in.-3 in.	Medium Sand	0.6mm-0.2mm	Clay	-0.005mm
Gravel	3 in.-5mm	Fine Sand	0.2mm-0.074mm		

APPENDIX D: RAINFALL DATA

- *INTENSITY-DURATION-FREQUENCY CURVE*

Exhibit 8-14

Intensity - Duration - Frequency Curve for Worcester, MA



Source: TR55 - Urban Hydrology for Small Wetlands, NRCS

APPENDIX E: OPERATION AND MAINTENANCE

- *STORMWATER OPERATION AND MAINTENANCE PLAN*
- *INSPECTION REPORT*
- *INSPECTION AND MAINTENANCE LOG FORM*
- *LONG-TERM POLLUTION PREVENTION PLAN*
- *ILLICIT DISCHARGE STATEMENT*
- *SPILL PREVENTION*

STORMWATER OPERATION AND MAINTENANCE PLAN

Chick-fil-A
99 Stafford Street
Worcester, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

Chick-fil-A
99 Stafford Street
Worcester, MA

RESPONSIBLE PARTY POST CONSTRUCTION:

Chick-fil-A
99 Stafford Street
Worcester, MA

Construction Phase

During the construction phase, all erosion control devices and measures shall be maintained in accordance with the final record plans, local/state approvals and conditions, the EPA Construction General Permit and the Stormwater Pollution Prevention Plan (SWPPP). Additionally, the maintenance of all erosion / siltation control measures during construction shall be the responsibility of the general contractor. Upon proper notice to the property owner, the Town/City or its authorized designee shall be allowed to enter the property at a reasonable time and in a reasonable manner for the purposes of inspection.

Post Development Controls

Once construction is completed, the post development stormwater controls are to be operated and maintained in compliance with the following permanent procedures (note that the continued implementation of these procedures shall be the responsibility of the Owner or its assignee):

1. Parking lots and on-site driveways: Sweep at least four (4) times per year and on a more frequent basis depending on sanding operations. All resulting sweepings shall be collected and properly disposed of offsite in accordance with MADEP and other applicable requirements.

2. Catch basins, manholes and piping: Inspect four (4) times per year and at the end of foliage and snow-removal seasons. These features shall be cleaned four (4) times per year. or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the catch basin or underground system. Accumulated sediment and hydrocarbons present must be removed and properly disposed of off-site in accordance with MADEP and other applicable requirements.

STORMWATER MANAGEMENT SYSTEM

POST-CONSTRUCTION INSPECTION REPORT

LOCATION:

Chick-fil-A
99 Stafford Street
Worcester, MA

RESPONSIBLE PARTY:

Chick-fil-A
99 Stafford Street
Worcester, MA

NAME OF INSPECTOR:	INSPECTION DATE:
Note Condition of the Following (sediment depth, debris, standing water, damage, etc.):	
Other:	
Note Recommended Actions to be taken on the Following (sediment and/or debris removal, repairs, etc.):	
Other:	
Other:	
Comments:	

STORMWATER INSPECTION AND MAINTENANCE LOG FORM

Chick-fil-A
99 Stafford Street – Worcester, MA

Stormwater Management Practice	Responsible Party	Date	Maintenance Activity Performed

LONG-TERM POLLUTION PREVENTION PLAN

Chick-fil-A
99 Stafford Street
Worcester, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

Chick-fil-A
99 Stafford Street
Worcester, MA

RESPONSIBLE PARTY POST CONSTRUCTION:

Chick-fil-A
99 Stafford Street
Worcester, MA

For this site, the Long-Term Pollution Prevention Plan will consist of the following:

- No outdoor maintenance or washing of vehicles allowed.
- The property owner shall be responsible for "good housekeeping" including proper periodic maintenance of building and pavement areas, curbing, landscaping, etc.
- Proper storage and removal of solid waste (dumpsters).
- Sweeping of driveways a minimum of twice per year with a commercial cleaning unit. Any sediment removed shall be disposed of in accordance with applicable local and state requirements.
- Regular inspections and maintenance of Stormwater Management System as noted in the "O&M Plan".
- Snow removal shall be the responsibility of the property owner. Snow shall not be plowed, dumped and/or placed in forebays, infiltration basins or similar stormwater controls. Salting and/or sanding of pavement / walkway areas during winter conditions shall only be done in accordance with all state/local requirements and approvals.

OPERATON AND MAINTENANCE TRAINING PROGRAM

The Owner will coordinate an annual in-house training session to discuss the Operations and Maintenance Plan, the Long-Term Pollution Prevention Plan, and the Spill Prevention Plan and response procedures. Annual training will include the following:

Discuss the Operations and Maintenance Plan

- Explain the general operations of the stormwater management system and its BMPs
- Identify potential sources of stormwater pollution and measures / methods of reducing or eliminating that pollution
- Emphasize good housekeeping measures

Discuss the Spill Prevention and Response Procedures

- Explain the process in the event of a spill
- Identify potential sources of spills and procedures for cleanup and /or reporting and notification
- Complete a yearly inventory or Materials Safety Data sheets of all tenants and confirm that no potentially harmful chemicals are in use.
- Trash and other debris shall be removed from all areas of the site at least twice yearly.
- In no case shall snow be disposed of or stored in resource areas (wetlands, floodplain, streams or other water bodies).
- If necessary, stockpiled snow will be removed from the Site and disposed of at an off-site location in accordance with all local, state and federal regulations.

ILLICIT DISCHARGE STATEMENT

Certain types of non-stormwater discharges are allowed under the U.S. Environmental Protection Agency Construction General Permit. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Any existing illicit discharges, if discovered during the course of the work, will be reported to MassDEP and the local DPW, as applicable, to be addressed in accordance with their respective policies. No illicit discharges will be allowed in conjunction with the proposed improvements.

Duly Acknowledged:

_____

Name & Title

SPILL PREVENTION AND RESPONSE PROCEDURES (POST CONSTRUCTION)

In order to prevent or minimize the potential for a spill of Hazardous Substances or Oil or come into contact with stormwater, the following steps will be implemented:

1. All Hazardous Substances or Oil (such as pesticides, petroleum products, fertilizers, detergents, acids, paints, paint solvents, cleaning solvents, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.

2. The minimum practical quantity of all such materials will be kept on site.

3. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided on site.

4. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.

5. It is the OWNER's responsibility to ensure that all Hazardous Waste on site is disposed of properly by a licensed hazardous material disposal company. The OWNER is responsible for not exceeding Hazardous Waste storage requirements mandated by the EPA or state and local authorities.

In the event of a spill of Hazardous Substances or Oil, the following procedures should be followed:

1. All measures should be taken to contain and abate the spill and to prevent the discharge of the Hazardous Substance or Oil to stormwater or off-site. (The spill area should be kept well ventilated and personnel should wear appropriate protective clothing to prevent injury from contact with the Hazardous Substances.)

2. For spills of less than five (5) gallons of material, proceed with source control and containment, clean-up with absorbent materials or other applicable means unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.

3. For spills greater than five (5) gallons of material immediately contact the MADEP at the toll-free 24-hour statewide emergency number: **1-888-304-1133**, the local fire department (**9-1-1**) and an approved emergency response contractor. Provide information on the type of material spilled, the location of the spill, the quantity spilled, and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so desired. (Use the form provided, or similar).

4. If there is a Reportable Quantity (RQ) release, then the National Response Center should be notified immediately at (800) 424-8802; within 14 days a report should be submitted to the EPA regional office describing the release, the date and circumstances of the release and the steps taken to prevent another release. This Pollution Prevention Plan should be updated to reflect any such steps or actions taken and measures to prevent the same from reoccurring.

SPILL PREVENTION CONTROL AND COUNTERMEASURE FORM

Chick-fil-A
99 Stafford Street
Worcester, MA

Where a release containing a hazardous substance occurs, the following steps shall be taken by the facility manager and/or supervisor:

1. Immediately notify The Worcester Fire Department (at **9-1-1**)

2. All measures must be taken to contain and abate the spill and to prevent the discharge of the pollutant(s) to off-site locations, receiving waters, wetlands and/or resource areas.

3. Notify the Worcester Board of Health at (508) 799-8531 and the Conservation Commission at (508) 799-1400.

4. Provide documentation from licensed contractor showing disposal and cleanup procedures were completed as well as details on chemicals that were spilled to the Town of Belmont Board of Health and Conservation Commission.

Date of spill:_____ Time:_____ Reported By:_____

Weather Conditions:_____

Material Spilled	**Location of Spill**	**Approximate Quantity of Spill (in gallons)**	**Agency(s) Notified**	**Date of Notification**

Cause of Spill:_____

_____

Measures Taken to Clean up Spill:_____

_____

Type of equipment: _____ Make: _____ Size:_____

License or S/N: _____

Location and Method of Disposal_____

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring:_____

_____

Additional Contact Numbers:

- DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP) EMERGENCY PHONE: 1-888-304-1133
- NATIONAL RESPONSE CENTER PHONE: (800) 424-8802
- U.S. ENVIRONMENTAL PROTECTION AGENCYPHONE: (888) 372-7341