DRAINAGE CALCULATIONS
AND
STORMWATER MANAGEMENT PLAN

For The

Wendy's Restaurant

located at

1699 & 1701 Worcester Road
(Tax Map 463 Block 9 Lots 28A&28B)
Framingham, Massachusetts

Submitted to:

Town of Framingham
Planning Board
150 Concord Street
Framingham, MA

Prepared for:

The Wendy's Company
40 General Warren Blvd.
Malvern, PA 19335

Prepared by

Engineering Alliance, Inc.
Civil Engineering & Land Planning Consultants

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February 9, 2015

Table of Contents

Proposed Restaurant Development
Wendy's
1699 & 1701 Worcester Road
Framingham, MA

Project Description

The project consists of the re-development of a site comprised of approximately 1.3± acre (57,744 SF) of land located at 1699 & 1701 Worcester Road, in Framingham MA. The property consists of parcels of land known as Tax Map 463, Block 9, Lot 28A & Lot 28B. The property was formally occupied by Tin Alley Grill and currently includes a one-story building, cement concrete pavement and various landscaped areas around the fringe of the existing parking lot.

The site preparation includes the demolition of the existing 5,900 SF building, removal of all infrastructure, and pulverizing the existing pavement. The proposed project consists of the construction of a 3,496 SF building and a 297 SF cooler, which will house the operations of the proposed Wendy's Restaurant with drive through service window. In addition to the proposed building, the project will also include the construction of a bituminous concrete parking lot, dumpster enclosure, landscaped areas, utility connections, storm water management facilities and incidental site grading.

The site abuts Worcester Road (Route 9) to the south, California Avenue to the east and developed commercial properties to the north and west. Frontage and access is provided on both Worcester Road and California Avenue.

Site Description

The 1.3± acre (57,744 SF) project site is located at the northwest corner of the intersection of Worcester Road (Route 9) and California Avenue. There is an existing restaurant on the site. Runoff generally flows from south to north, across the parking lot, where it is collected by two adjacent catch basins, and which discharge the untreated stormwater to the municipal drainage system. In the pre development condition, the majority of the site is paved with slopes ranging from 1% to 6%. Approximately 90% of the site is comprised of paved parking lot and building. The edges of the property consist of landscaped areas which are sparse due to the lack of maintenance that has occurred over the years.

Proposed Development

The proposed project includes the demolition of the existing 5,900 s.f. building and the construction of a proposed 3,793 s.f. Wendy's Restaurant with drive through service window. The proposed building will be sited in a similar location as the existing building. The site grading will remain substantially the same as the pre-development condition thus retaining the existing drainage patterns. A significant amount of landscaping has been proposed in the post development condition reducing the impervious surfaces from 90% in the pre-development condition to 68% in the post development condition. The proposed landscaping will not only serve to reduce the rate at which storm water runs off of the subject property but will also promote ground water recharge. In addition to the proposed landscaping, storm water quality will be improved with the addition of five (5) deep sump catch basins with hooded outlets and two CDS water quality units by Contech. The CDS units have been proposed upstream of each connection to the municipal storm water system and will serve to remove TSS prior to discharge to the off-site drainage system.

Drainage Clculations

The Rational Method *Q=CiA (where Q = the peak discharge in cfs, C = the runoff coefficient, i = rainfall intensity in inches/hour and A = the drainage area in acres)* was employed to develop pre and post-development peak flows generated by the subject property. The decrease in the rater of runoff generated by the site is a direct result of the reduction in impervious surfaces and increase in landscaped (pervious) surfaces. Refer to Appendix A for Rational Method Drainage Calculations and corresponding pre-development and post-development watershed plans. The calculations assumed a time of concentration of 5 minutes in both the pre and post development condition. The runoff coefficients utilized were as follows: impervious buildings and parking lots C=0.90 and pervious landscaped areas C=0.30. In both the pre and post development condition, a watershed area consisting of a total of 58,235 s.f. was analyzed.

A summary of the **pre development** peak rates of runoff is as follows

Total Watershed Area: 1.34 Ac
Total Impervious surfaces: 1.20 Ac
Total Pervious surfaces: 0.14 Ac

Weighted Runoff Coefficient: 0.84

Pre-Development Condition Peak Discharge Summary:

	2-Year Storm (i=4.1 in/hr)	10-Year Storm (i=5.3 in/hr)	25-Year Storm (i-6.0 in/hr)	100-Year Storm (i=7.4 in/hr)
Rate of Runoff	4.60 CFS	5.95 CFS	6.73 CFS	8.30 CFS

A summary of the **Post development** peak rates of runoff is as follows

Total Watershed Area: 1.34 Ac
Total Impervious surfaces: 0.91 Ac
Total Pervious surfaces: 0.43 Ac

Weighted Runoff Coefficient: 0.71

Pre-Development Condition Peak Discharge Summary:

	2-Year Storm (i=4.1 in/hr)	10-Year Storm (i=5.3 in/hr)	25-Year Storm (i-6.0 in/hr)	100-Year Storm (i=7.4 in/hr)
Rate of Runoff	3.89 CFS	5.02 CFS	5.69 CFS	7.02 CFS
% Decrease	15.4%	15.6%	15.4%	15.4%

As noted above, the post development condition will result in a net decrease in storm water runoff generated by the site for all storms up to and including the 100-year storm event. The addition of landscaped areas have been utilized to increase ground water re-charge. The design does not include structural infiltration systems for either the roof or the parking lot due to the high ledge profile encountered on-site. Refer to the Geotechnical Report in Appendix D for soil boring logs and a summary of the soil testing results.

On-site Drainage Facility

The on-site drainage system consists of a series of deep sump, hooded catch basins which discharge to Contech CDS water quality units prior to discharge to the municipal drainage system. The closed drainage system has been sized to convey storm water runoff generated by the 25-year storm event. Storm water is conveyed from the proposed catch basins to the down gradient water quality units via a series of 12-inch P.E. ADS N-12 (corrugated outside and

smooth inside) pipe laid at a minimum slope of 0.5%. Refer to Appendix B for rational method calculations.

Compliance with Stormwater Requirements

The proposed site has been designed so as to comply with the storm water management requirements of the Town of Framingham which references the Framingham Zoning By-Law, Framingham Subdivision Rules and Regulations and the Massachusetts Department of Environmental Protection (DEP) Stormwater management standards. The following is a summary of the DEP standards and compliance with the same:

Low Impact Development (LID) Measures

The amount of impervious area has been significantly reduced in the post development condition. The significant increase in landscaping will reduce the rate of storm water runoff while providing treatment and ground water recharge.

Standard #1- Untreated Storm Water

All runoff generated by the proposed parking lot will be treated via a series of deep sump hooded catch basins and CDS water quality inlets prior to discharge into the municipal system. The pre-development condition did not include any water quality treatment devices.

Standard #2: Post Development Peak Discharge Rates

The significant reduction in impervious surfaces will serve to reduce the peak rates of runoff exiting the property and closed drainage system.

Standard #3: Recharge to Groundwater

Structural BMP's have not been incorporated into this project due to the high ledge profile. However, groundwater recharge will be promoted via the significant increase in landscaped areas.

Standard #4: 80% TSS Removal

The proposed Best Management Practices for this site provide for at least 80% TSS removal and consist of a "treatment stream" which includes both nonstructural and structural elements. Deep sump catch basins and a water quality treatment units will be used to reduce pollutant loading.

The 80% TSS removal rate is based on information available for the Contech CDS water quality unit, as approved by MassDEP, combined with the removal rates for deep sump catch basins listed in the Massachusetts DEP Stormwater Handbook.

Standard #5: Land Use with Higher Potential Pollutant Loads

The proposed use is a land use with higher potential pollutant loads and has been designed appropriately.

Standard #6: Protection of Critical Areas

The site does not contain, nor directly discharge to any critical areas, as defined by the Department of Environmental Protection.

Standard #7: Redevelopment Projects

This is a redevelopment project. All stormwater management standards applying to redevelopment have been met.

Standard #8: Erosion/Sediment Control During Construction

An erosion and sediment control plan has been developed for this project implementing at a minimum: silt fence, a crushed stone construction entrance, catch basin inlet protection, and

provisions for stabilizing disturbed areas. The project will disturb more than one acre and will require a NPDES Construction General Permit, which will be filed prior to construction.

Standard #9: Operation/Maintenance Plan

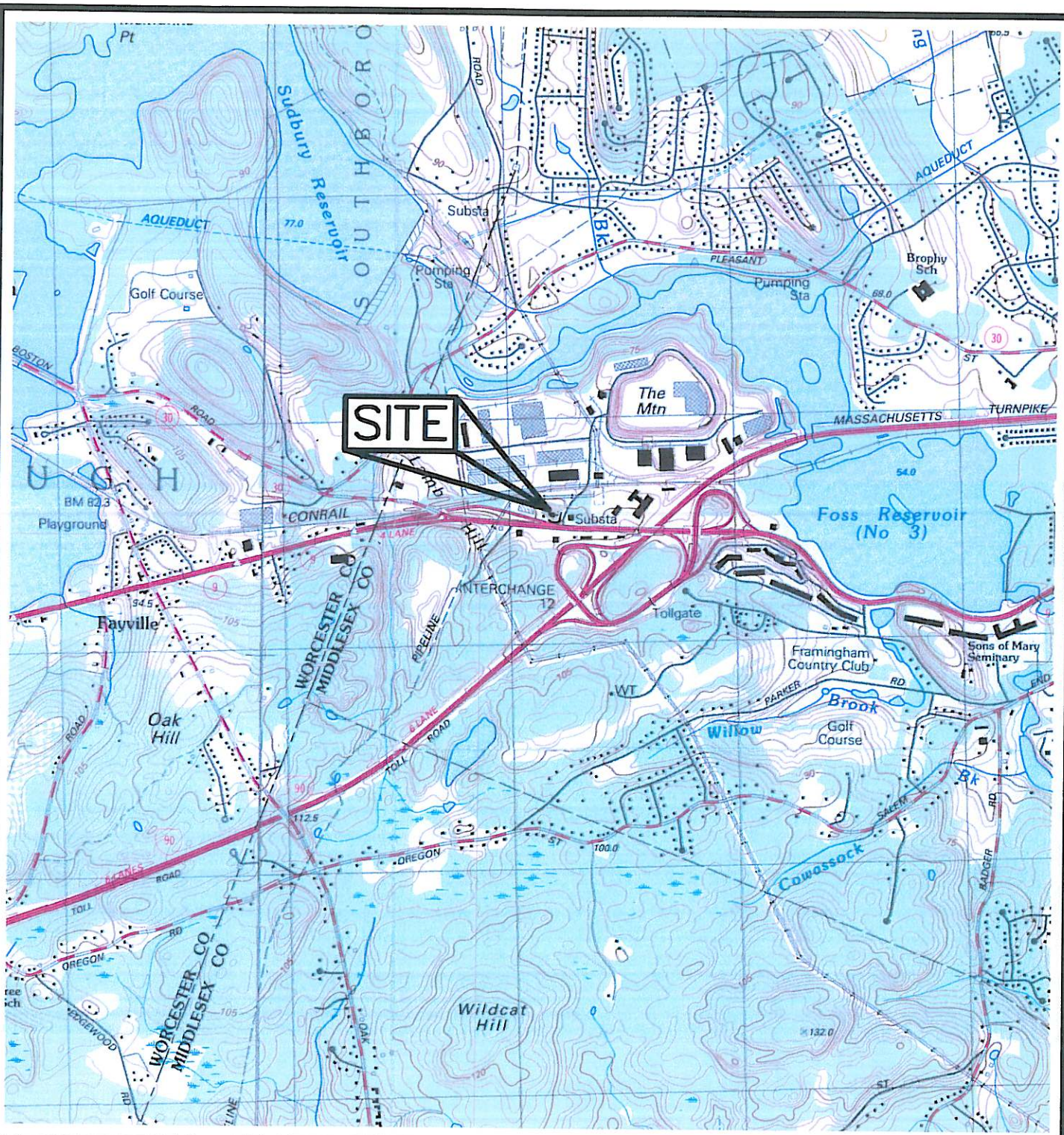
An Operation and Maintenance Plan developed in accordance with the Stormwater Management Standards is provided in Appendix C of this report.

Standard #10: Illlicit Discharges

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

Erosion and Siltation Control

Straw wattles and silt fence will be placed at the downhill limit of work prior to the commencement of any construction activity. The integrity of the erosion control devices will be maintained by periodic inspection and replacement as necessary. The straw wattles and silt fence will remain in place until the first course of pavement has been placed and all side slopes have been loamed and seeded and vegetation has been established.



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Plan of Land

1699 Worcester Road
Tax Map 463, Block 9, Lot 28A and Lot 28B
Framingham, Massachusetts

PROJECT: 14-49001	DATE: July, 21 2014
SCALE: 1:25,000	DWG FILE NAME: Figures.dwg
DESIGNED BY: Hourmat Abdul Rauf	CHECKED BY: Richard A. Salvo, P.E.

DRAWING TITLE:
FIGURE 1 - USGS LOCUS MAP

DRAWING #: 1of5

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PROJECT: 14-49001	DATE: July, 21 2014
SCALE: 1"=250'	DWG FILE NAME: Figures.dwg
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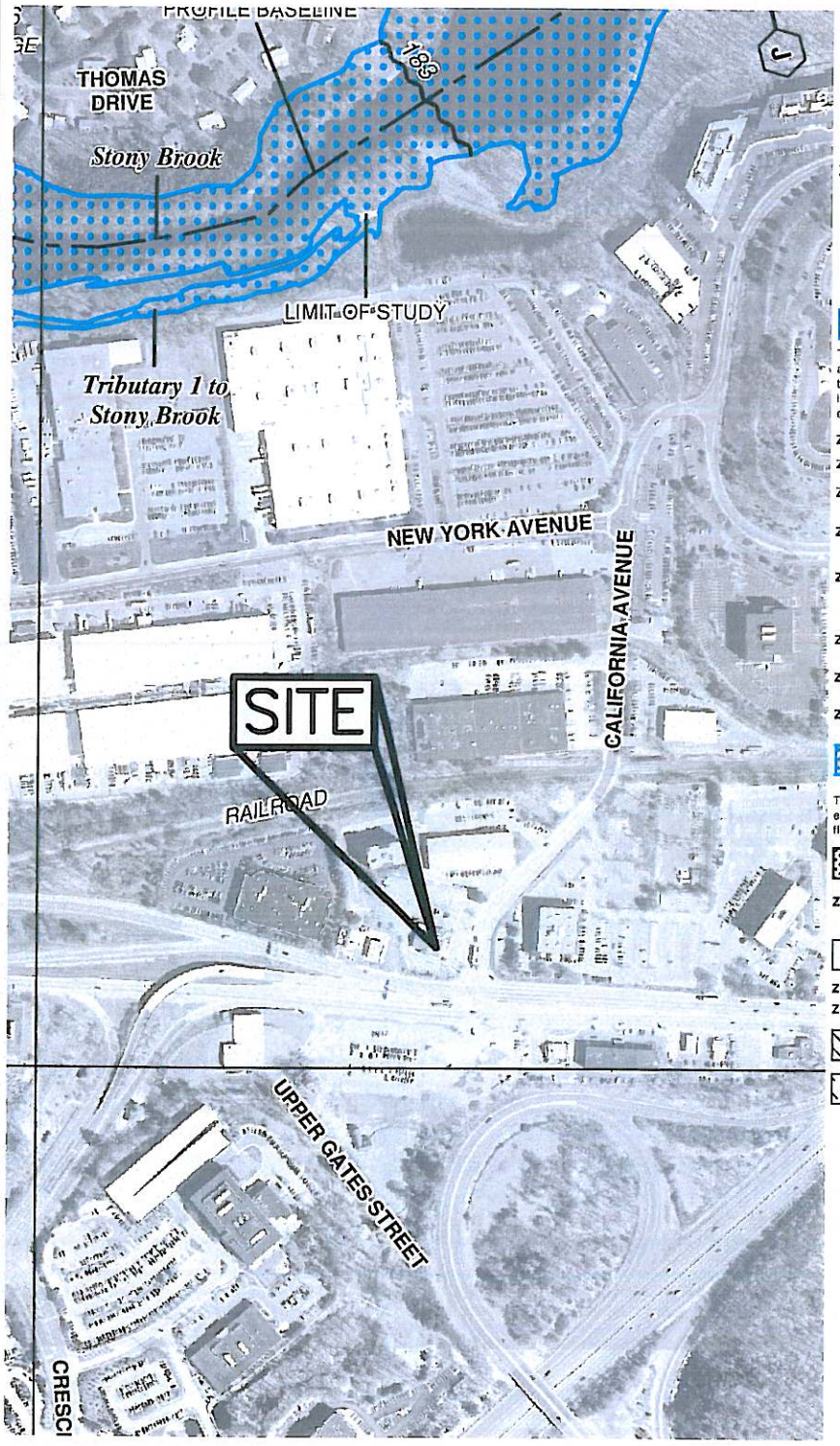
DRAWING TITLE:
FIGURE 2 - ORTHO PHOTO

DRAWING #: 2of5



MAP SCALE 1" = 500'

250 0 500 1000 FEET

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that ha a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determine
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevatic determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free encroachment so that the 1% annual chance flood can be carried without substantial increases ir flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

NATIONAL FLOOD INSURANCE PROGRAM
ESSEX COUNTY

COMMUNITY PANEL NO: 25009C0418F

EFFECTIVE DATE: JULY 3, 2012

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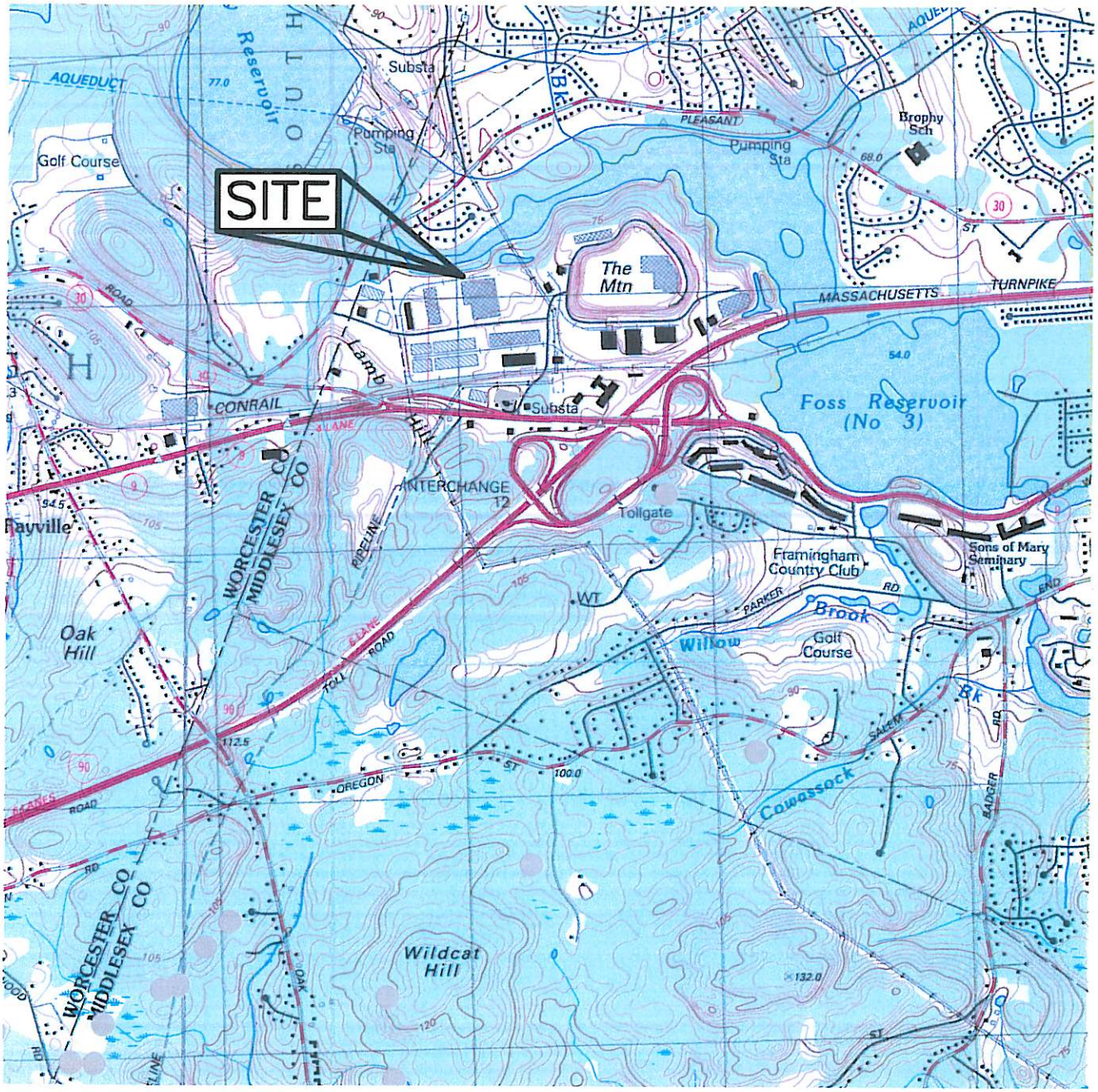
SCALE: 1"=500'	DWG FILE NAME: Figures.dwg
DESIGNED BY: Hourmat Abdul Rauf	CHECKED BY: Richard A. Salvo, P.E.

DRAWING TITLE:
FIGURE 3 - FEMA FLOOD MAP

DRAWING #: 3of5



LEGEND:

- = NHESP CERTIFIED VERNAL POOLS

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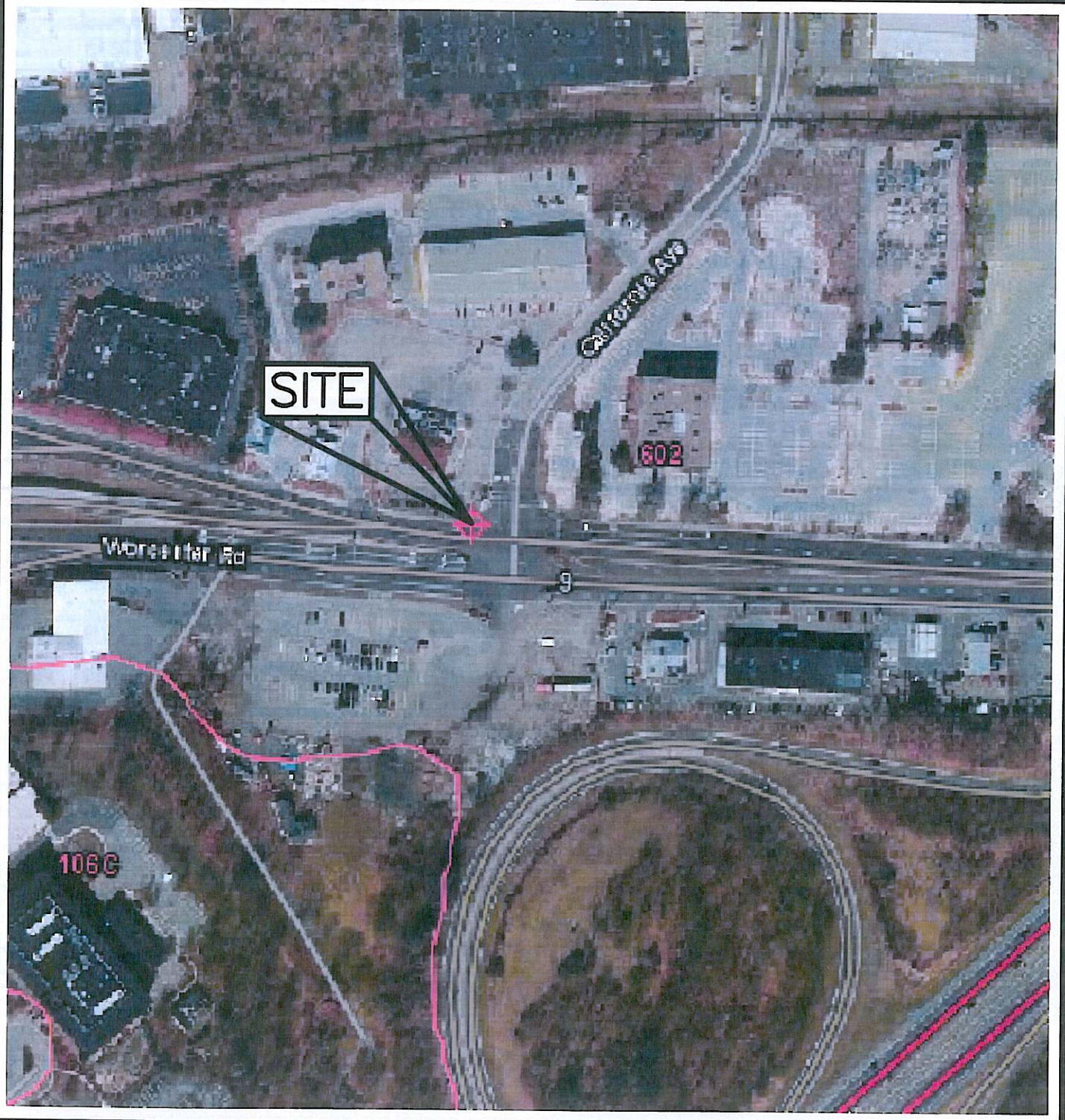
SCALE: 1:25,000	DWG FILE NAME: Figures.dwg
DESIGNED BY: Hourmat Abdul Rauf	CHECKED BY: Richard A. Salvo, P.E.

DRAWING TITLE:
FIGURE 4 - NATURAL HERITAGE MAP

DRAWING #: 4 of 5



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Plan of Land

1699 Worcester Road
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PROJECT: 14-49001	DATE: July, 21 2014
SCALE: 1"=200'	DWG FILE NAME: Figures.dwg
DESIGNED BY: Hourmat Abdul Rauf	CHECKED BY: Richard A. Salvo, P.E.

DRAWING TITLE:
FIGURE 5 - SOILS MAP

DRAWING #: 5 of 5

Scituate

Percent of map unit: 5 percent
Landform: Hillslopes, depressions
Landform position (two-dimensional): Toeslope, summit
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Linear
Across-slope shape: Concave

602—Urban land

Map Unit Setting

Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Udorthents, loamy

Percent of map unit: 5 percent

Rock outcrop

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

Udorthents, wet substratum

Percent of map unit: 5 percent

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 13, Dec 17, 2013

APPENDIX A

Rational Method Calculations
Existing Watershed Plan
Proposed Watershed Plan

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Rational Method Drainage Calculations

Name:	**Wendy's Restaurant**	Project No.:	**14-49001**
	1699 Worcester Road	Date:	**2/9/2015**
		Computed By:	**R. Salvo, P.E.**
Client:	**Wendy's**	Checked By:	**E. Heyland, P.E.**

Rational Method Drainage Calculations (Q=CiA)

Where:

Q=Peak Flow (Cubic Feet Per Second)
C=Runoff Coefficient (Unitless)
i=Rainfall Intensity (in/hr)
A=Area (acres)

"C" Values

Impervious:

Building	0.90
Parking Lot	0.90

Pervious:

Landscaped areas	0.30

Time of Concentration

Minimum time of concentration controls 5 Minutes

Intensity (i) for 2, 10, 25 & 100 Year Storm Event

See attached rainfall intensity data for T_c=5 Min.

I= 4.10 in/hr (2-yr) 5.30 in/hr (10-yr) 6.00 in/hr (25-yr) 7.40 in/hr (100-yr)

PRE-DEVELOPMENT CONDITION

Description of Area	Area (Acres)	Runoff Coefficient	AxC
Building	0.14	0.90	0.13
Parking Lot	1.06	0.90	0.95
Landscaping	0.14	0.30	0.04
Totals:	1.34		1.12

Weighted Runoff Coefficient=$\sum$(AxC)/$\sum$A= 0.84

2 Year Storm Event	Q(CFS)= 4.60
10 Year Storm Event	Q(CFS)= 5.95
25 Year Storm Event	Q(CFS)= 6.73
100 Year Storm Event	Q(CFS)= 8.30

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Rational Method Drainage Calculations

Name: **Wendy's Restaurant**
1699 Worcester Road

Client: **Wendy's**

Project No.: **14-49001**
Date: **2/9/2015**
Computed By: **R. Salvo, P.E.**
Checked By: **E. Heyland, P.E.**

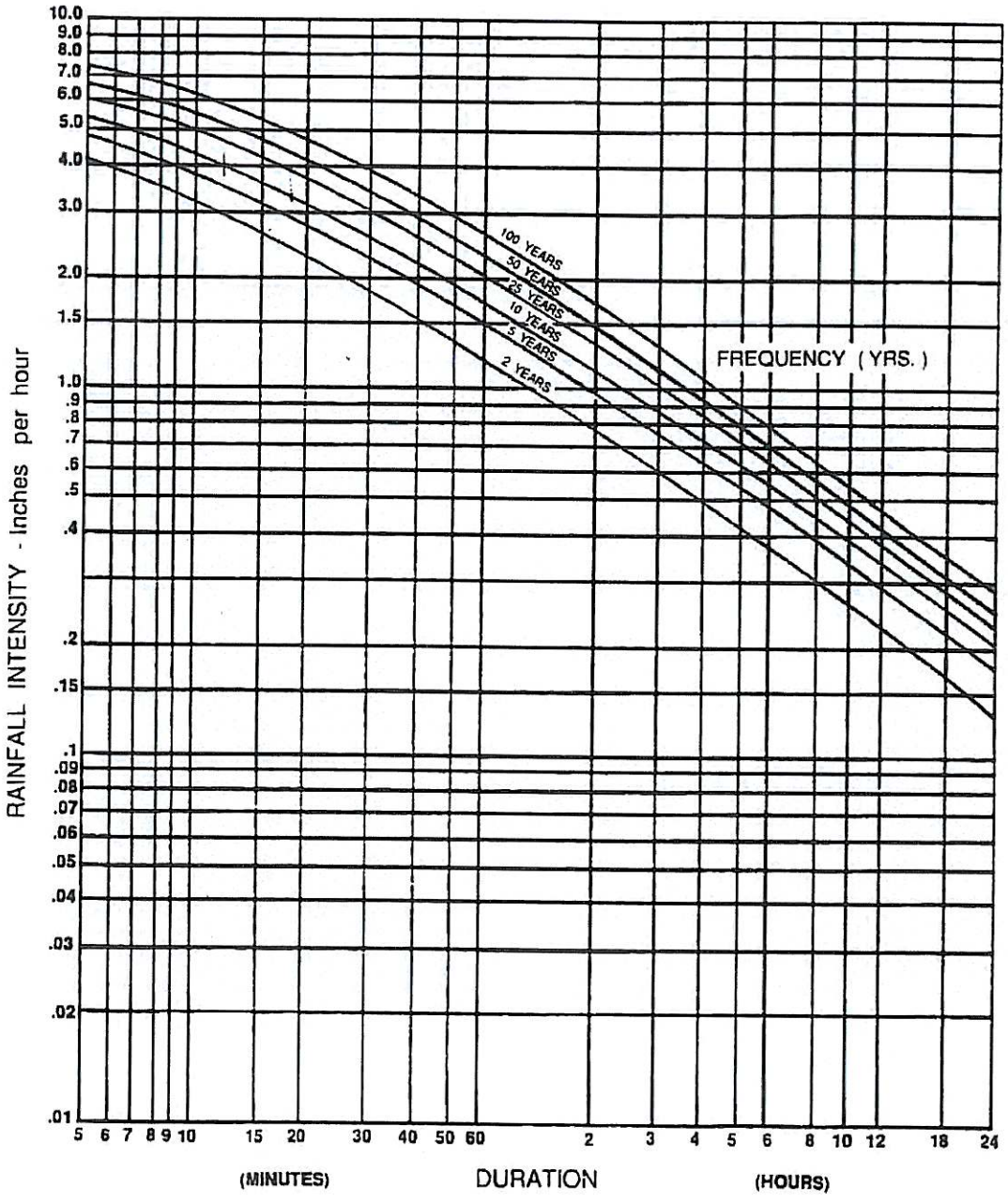
POST-DEVELOPMENT CONDITION (TRIBUTARY TO FELLSWAY)

Description of Area	Area (Acres)	Runoff Coefficient	AxC
Building	0.09	0.90	0.08
Parking Lot	0.82	0.90	0.74
Landscaping	0.43	0.30	0.13
Totals:	1.34		0.95

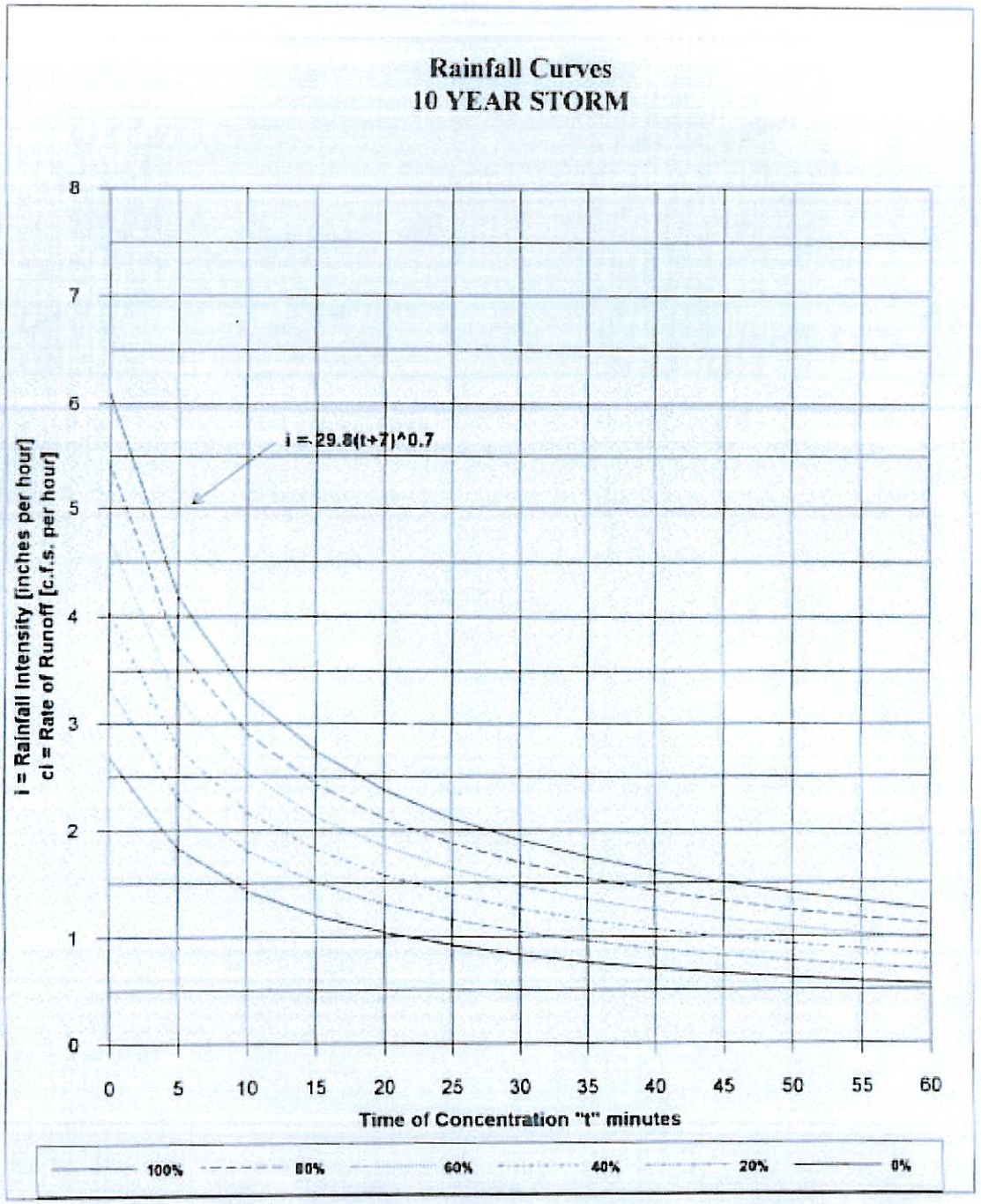
Weighted Runoff Coefficient = $\sum(AxC)/\sum A$ = 0.71

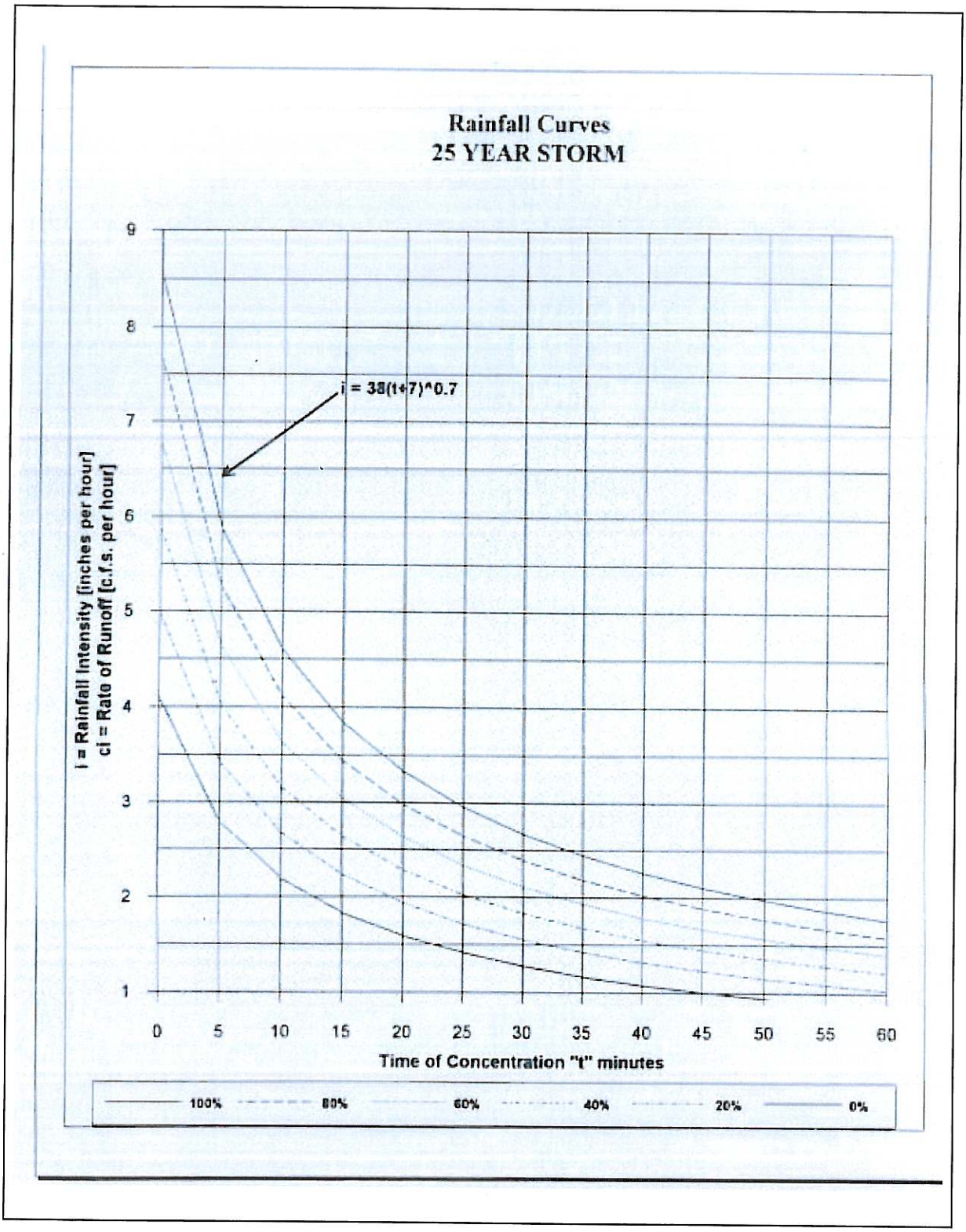
2 Year Storm Event	Q(CFS)= 3.89
10 Year Storm Event	Q(CFS)= 5.02
25 Year Storm Event	Q(CFS)= 5.69
100 Year Storm Event	Q(CFS)= 7.02

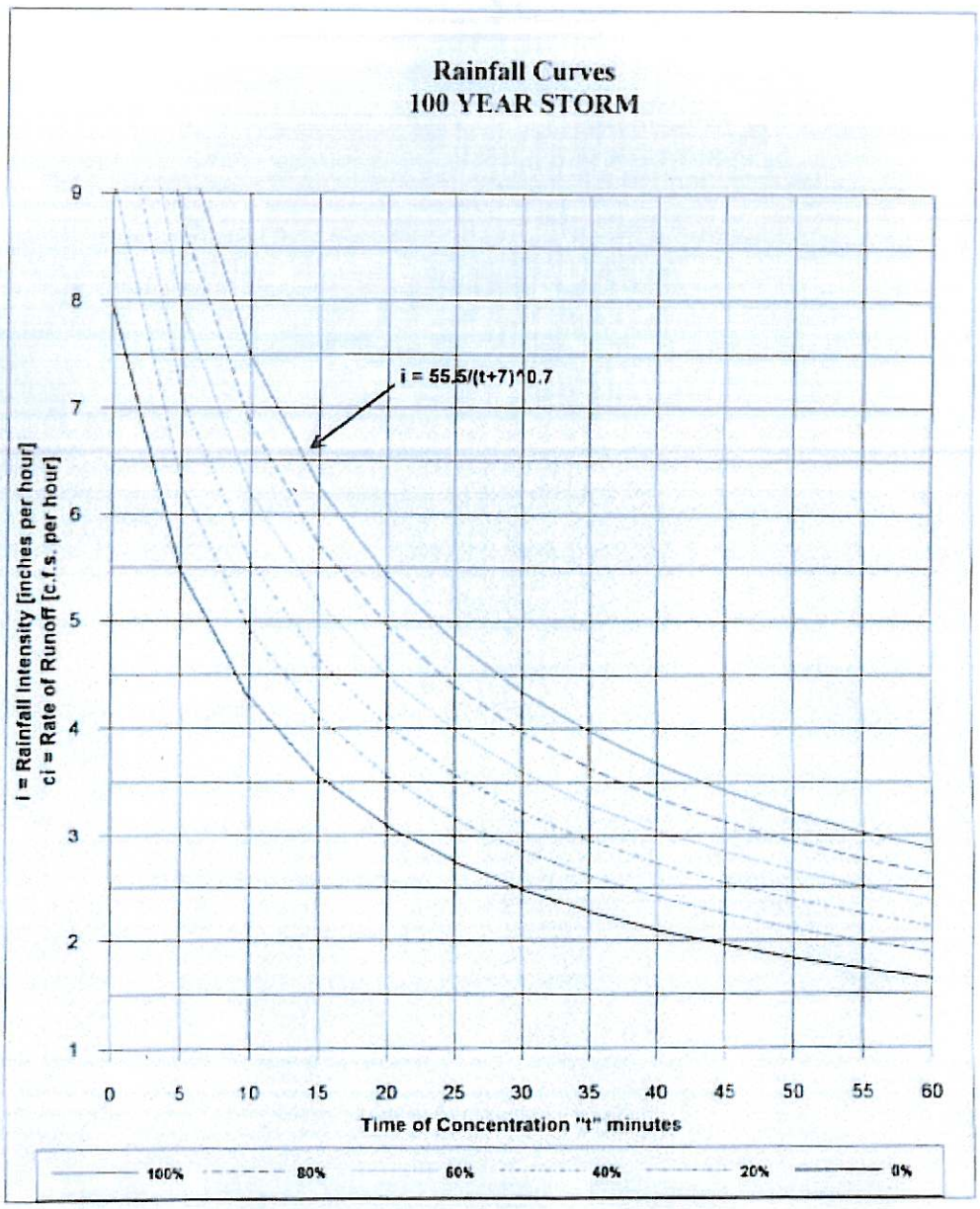
Exhibit 8-12
Intensity - Duration - Frequency Curve for Boston, MA

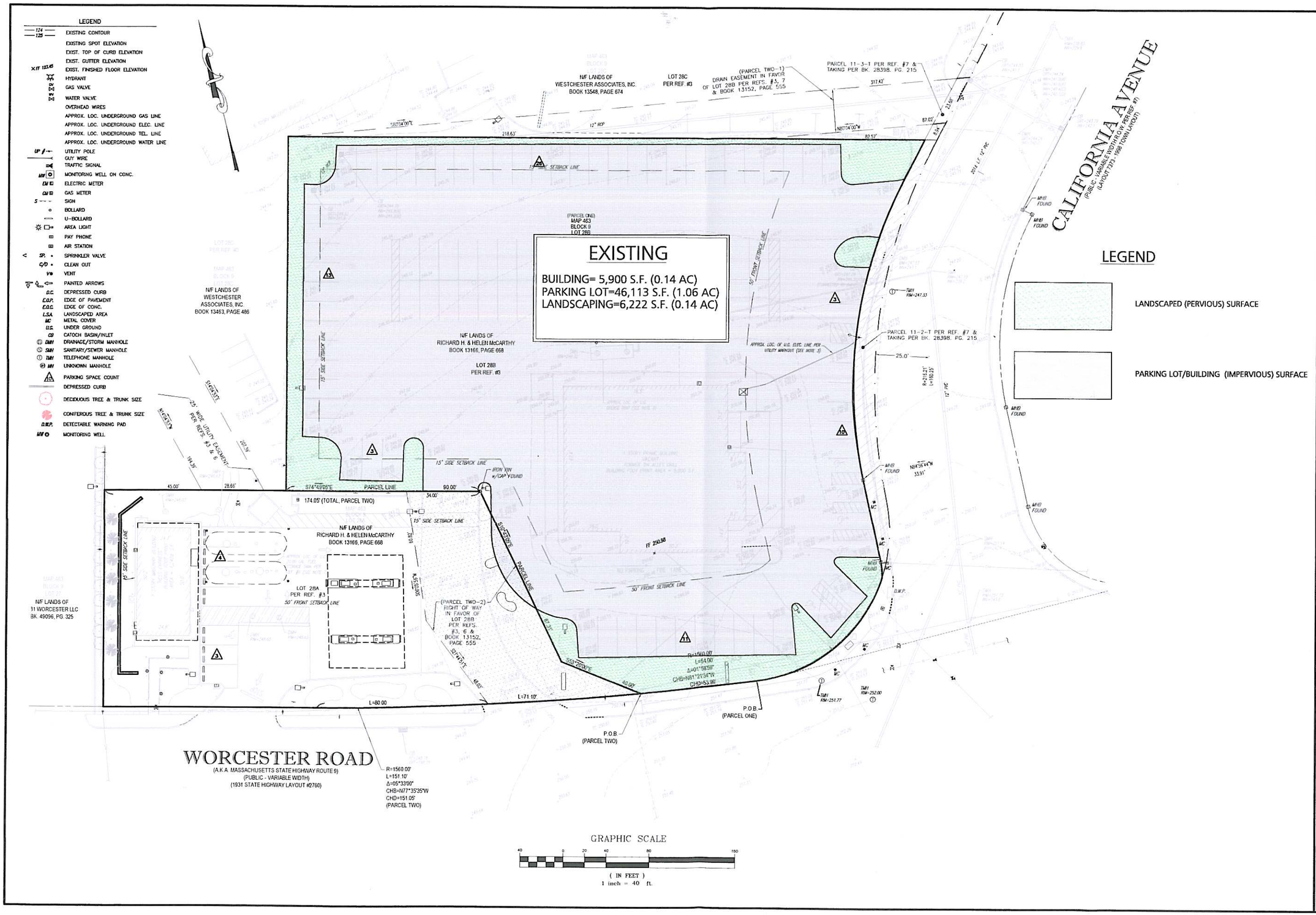


Source: TR55 - Urban Hydrology for Small Wetlands, NRCS


Rainfall Curves
10 YEAR STORM
i = 29.8(t+7)^0.7
i = Rainfall Intensity [inches per hour]
ci = Rate of Runoff [c.f.s. per hour]
Time of Concentration "t" minutes
0
1
2
3
4
5
6
7
8
0
5
10
15
20
25
30
35
40
45
50
55
60
100%
80%
60%
40%
20%
0%


Rainfall Curves
25 YEAR STORM
i = 38(t+7)^0.7
i = Rainfall Intensity [inches per hour]
ci = Rate of Runoff [c.f.s. per hour]
9
8
7
6
5
4
3
2
1
0
5
10
15
20
25
30
35
40
45
50
55
60
Time of Concentration "t" minutes
100%
80%
60%
40%
20%
0%


Rainfall Curves
100 YEAR STORM
i = 55.5/(t+7)^0.7
i = Rainfall Intensity [inches per hour]
ci = Rate of Runoff [c.f.s. per hour]
9
8
7
6
5
4
3
2
1
0
5
10
15
20
25
30
35
40
45
50
55
60
Time of Concentration "t" minutes
100%
80%
60%
40%
20%
0%



DESCRIPTION OF REVISION | DATE

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PROJECT:
Site Plan
1699 &1701 Worcester Road
(Tax Map 463 Block 9 Lots 28A&28B)
Framingham, Massachusetts

PROJECT #: 14-49001
SCALE: As Noted
DRAWING TITLE: Existing Watershed Plan
DWG. NO. EWS
DATE: February 9, 2015
DWG FILE NAME: 14-49001.dwg
DESIGN BY: Eric Brodsnese
CHECKED BY: Richard A. Salvo, P.E.

APPLICANT:
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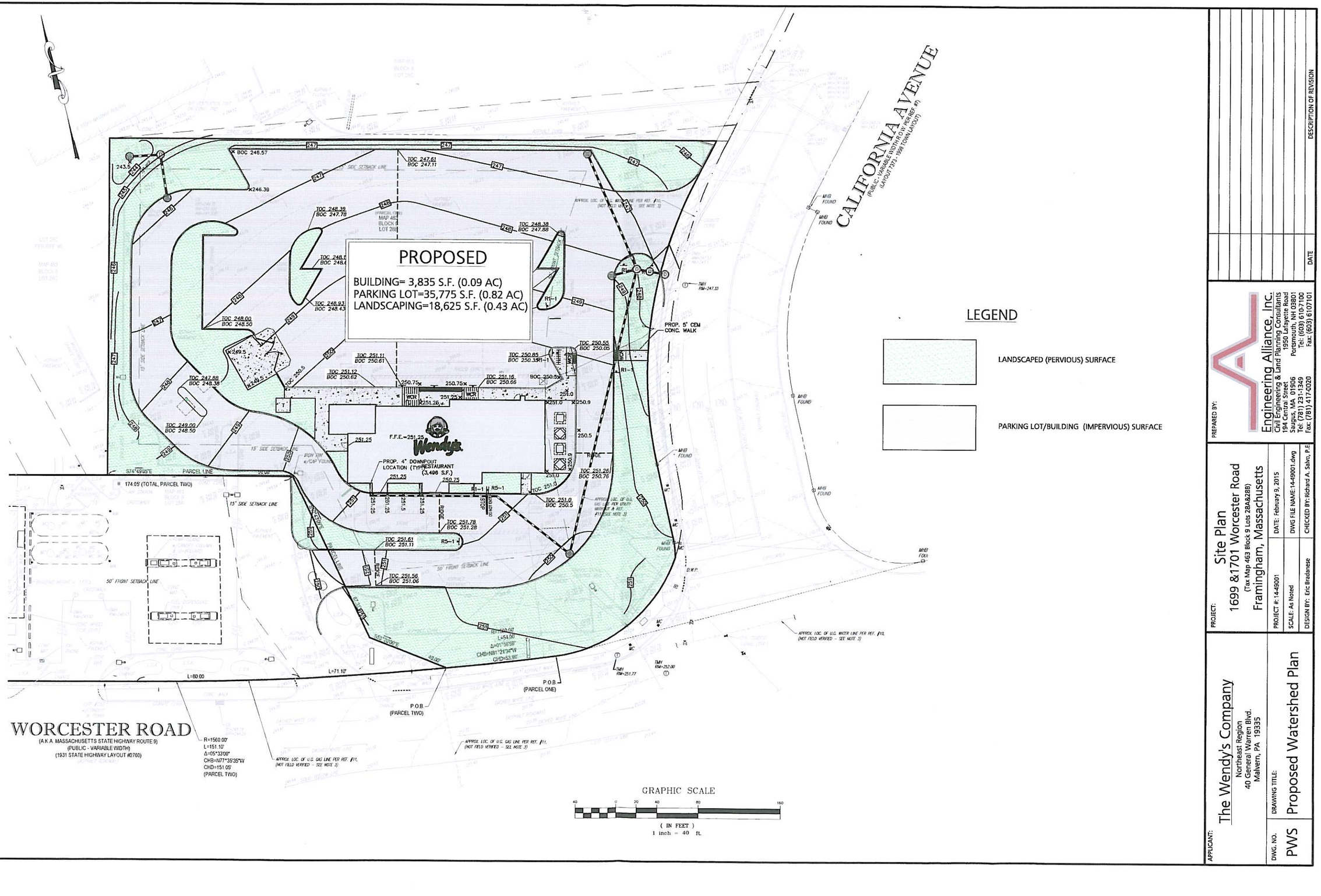

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(Tax Map 463 Block 9 Lots 28A&28B)
Framingham, Massachusetts

DWG. NO.: PWS

DRAWING TITLE: Proposed Watershed Plan

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DESIGN BY: Eric Brodanese
CHECKED BY: Richard A. Salvo, P.E.

APPENDIX B

Closed Drainage System Rational Method Calculations
Closed Drainage Watershed Map
CDS Water Quality Sizing Calculations

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Storm Drainage Computations

Name: Wendy's Restaurant
Framingham, MA

Client: Wendy's

Proj. No.: 14-49001
Date: Feb. 9, 2015
Computed by: E. Bradanese
Checked by: R. Salvo, P.E.

Design Parameters:
25 Year Storm Boston, MA IDF Curve

k_e= 0.5

LOCATION		AREA	C	C x A	SUM	FLOW TIME (MIN)		i*	DESIGN					CAPACITY		PROFILE							INLET CONTROL		OUTLET CONTROL			JUNCTION LOSSES		
FROM	TO	(AC.)			C x A	PIPE	CONC TIME		Q	V	n	PIPE	SLOPE	Q full	V full	LENGTH	FALL	RIM	INV	INV	W.S.E.	Freeboard	HW/D	HW	H	TW or h_o	HW	K_m	K_d	H loss
									cfs	fps		SIZE		ft^3/s	ft/s	ft	ft		UPPER	LOWER	ft	ft	ft	ft	ft	ft	junction	junction	junction
CB-1	DMH-1	0.31	0.89	0.27	0.27	0.29	5.0	6.0	1.6	3.3	0.011	12	0.0051	3.0	3.8	57	0.29	246.7	244.2	244.0	244.1	2.6	0.00	0.00	0.0	0.0	0.00	0.20	0.00	0.03
CB-2	DMH-1	0.05	0.90	0.05	0.05	0.08	5.0	6.0	0.3	1.9	0.011	12	0.0056	3.1	4.0	9	0.05	248.6	246.1	246.1	246.1	2.5	0.00	0.00	0.0	0.0	0.00	0.20	0.00	0.01
CB-3	DMH-1	0.37	0.61	0.23	0.23	0.75	5.0	6.0	1.4	3.1	0.011	12	0.0050	3.0	3.8	140	0.70	249.8	246.8	246.1	247.6	2.2	1.00	1.00	0.0	0.0	0.00	0.20	0.00	0.03
DMH-1	CDS	-	-	0.54	0.54	0.00	5.0	6.0	3.3	9.2	0.011	12	0.0500	9.4	12.0	2	0.10	248.0	243.9	243.8	243.8	4.2	1.00	1.00	0.0	0.0	0.00	0.20	0.00	0.26
CDS	EXDMH	-	-	0.54	0.54	0.01	5.0	6.0	3.3	7.2	0.011	12	0.0260	6.8	8.6	5	0.13	247.0	243.8	243.6	244.1	2.9	1.00	1.00	0.0	0.0	0.00	0.20	0.00	0.16
CB-4	CDS	0.40	0.81	0.32	0.32	0.07	5.0	6.0	1.9	4.4	0.011	12	0.0100	4.2	5.4	18	0.18	245.5	242.5	242.3	242.2	3.3	0.00	0.00	0.0	0.0	0.00	0.20	0.00	0.06
CB-5	CDS	0.03	0.30	0.01	0.01	0.14	5.0	6.0	0.1	1.2	0.011	12	0.0100	4.2	5.4	10	0.10	244.0	242.4	242.3	243.4	0.6	1.00	1.00	0.0	0.0	0.00	0.20	0.00	0.00
CDS	EXIST	-	-	0.33	0.33	1.82	5.0	6.0	2.0	2.7	0.011	12	0.0024	2.0	2.6	296	0.70	245.0	241.3	240.6	242.2	2.8	1.00	1.00	0.0	0.0	0.00	0.20	0.00	0.02

Engineering Alliance, Inc.
Civil Engineering & Land Planning Consultants
194 Central Street
Saugus, MA 01906

Weighted Runoff Coefficients

Name: Wendy's Framingham
Client: Wendy's
Proj. No.: **14-49001**
Date: **2/9/2015**
Computed by: **EB**
Checked by: **RAS**

Description of Area CB-1	Area (acres)	Runoff Coefficient	A x C
Pervious	0.01	0.30	0.00
Impervious	0.30	0.90	0.27
Totals =	0.31		0.27

Weighted Runoff Coefficient: **Σ(AxC) / ΣA = 0.89**

Description of Area CB-2	Area (acres)	Runoff Coefficient	A x C
Pervious	0.00	0.30	0.00
Impervious	0.05	0.90	0.05
Totals =	0.05		0.05

Weighted Runoff Coefficient: **Σ(AxC) / ΣA = 0.90**

Description of Area CB-3	Area (acres)	Runoff Coefficient	A x C
Pervious	0.18	0.30	0.05
Impervious	0.19	0.90	0.17
Totals =	0.37		0.23

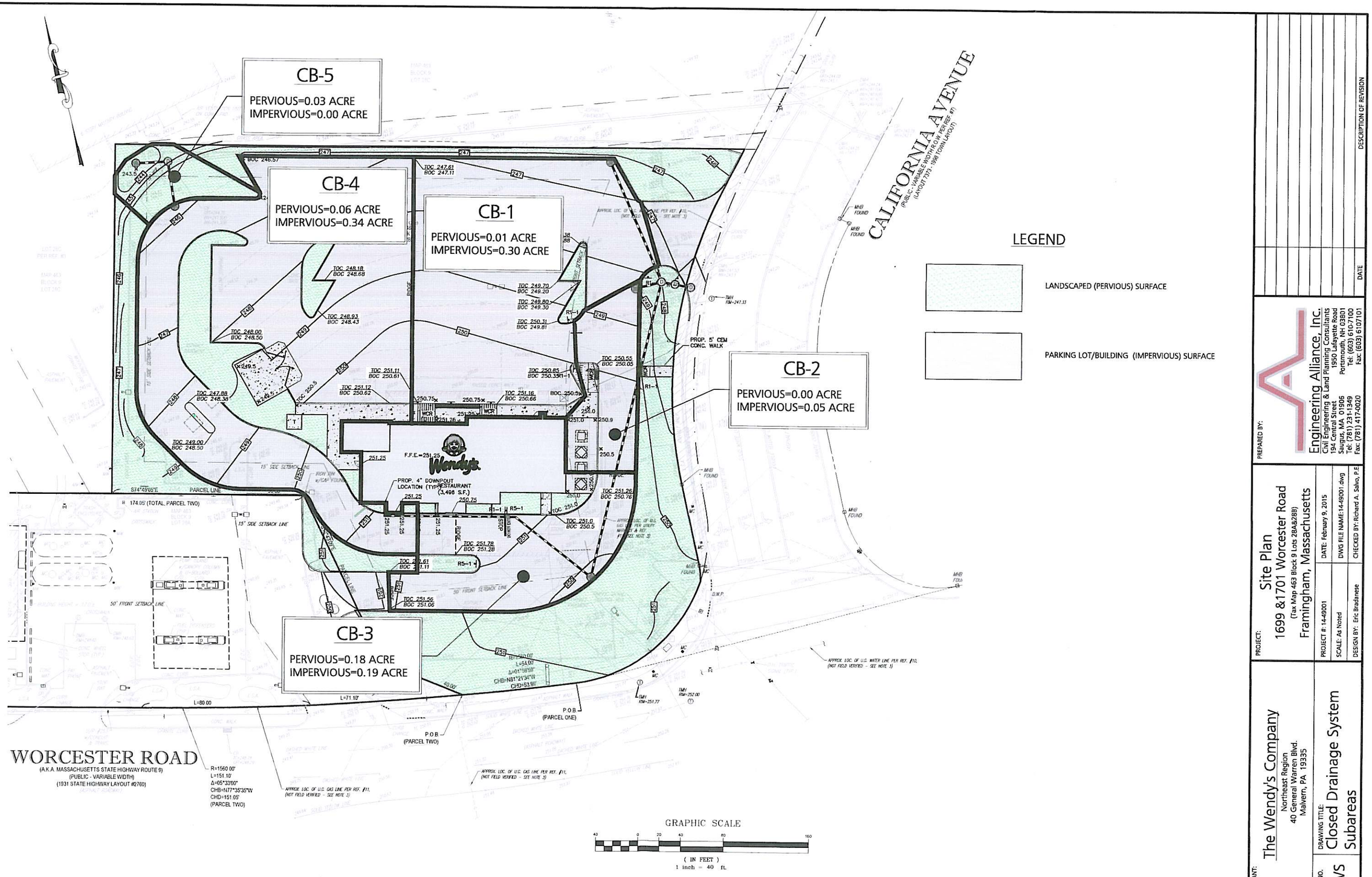
Weighted Runoff Coefficient: **Σ(AxC) / ΣA = 0.61**

Description of Area CB-4	Area (acres)	Runoff Coefficient	A x C
Pervious	0.06	0.30	0.02
Impervious	0.34	0.90	0.31
Totals =	0.40		0.32

Weighted Runoff Coefficient: **Σ(AxC) / ΣA = 0.81**

Description of Area CB-5	Area (acres)	Runoff Coefficient	A x C
Pervious	0.03	0.30	0.01
Impervious	0.00	0.90	0.00
Totals =	0.03		0.01

Weighted Runoff Coefficient: **Σ(AxC) / ΣA = 0.30**



DESCRIPTION OF REVISION | DATE

PREPARED BY:
Engineering Alliance, Inc.
Civil Engineering & Land Planning Consultants
194 Central Street, Saugus, MA 01906, Tel: (781) 231-3349, Fax: (781) 417-4020
1950 Lafayette Road, Portsmouth, NH 03801, Tel: (603) 610-7100, Fax: (603) 610-7101

PROJECT: 1699 &1701 Worcester Road (Tax Map 463 Block 9 Lots 28A&28B) Framingham, Massachusetts
Site Plan
PROJECT # 14-49001 | DATE: February 9, 2015
SCALE: As Noted | DWG FILE NAME: 14-49001.dwg
DESIGN BY: Eric Bradanese | CHECKED BY: Richard A. Salvo, P.E.

APPLICANT:
The Wendy's Company
Northeast Region
40 General Warren Blvd.
Malvern, PA 19335

DWG. NO. PWS
DRAWING TITLE: Closed Drainage System Subareas

Project: Wendy's - Framingham
Location: Framingham, MA
Prepared For: Rick Salvo - Engineering Alliance, Inc.

CONTECH ENGINEERED SOLUTIONS

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1.0" of runoff.

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

Given:

Structure Name	Impv. (acres)	A ($miles^2$)	t_c (min)	t_c (hr)	WQV (in)
CDS - E	0.54	0.0008438	6.0	0.100	1.00
CDS - W	0.34	0.0005313	6.0	0.100	1.00

Procedure:

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

Structure Name	qu (csm/in.)
CDS - E	774.00
CDS - W	774.00

1. Compute Q Rate using the following equation:

$$Q_1 = (qu)\ (A)\ (WQV)$$

where:

Q_1 = flow fate associated with first 1.0" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1.0" in this case)

Structure Name	Q_1 (cfs)
CDS - E	0.65
CDS - W	0.41

CDS ESTIMATED NET ANNUAL TSS REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

CONTECH ENGINEERED SOLUTIONS

WENDY'S - FRAMINGHAM
FRAMINGHAM, MA
for SYSTEM: CDS - EAST

Area	0.54	acres	CDS Model	
Weighted C	0.90		2015-4	
Tc	6	minutes	CDS Treatment Capacity	
			1.4	cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Removal Efficiency (%)	Incremental Removal (%)
0.02	10.2%	10.2%	0.01	0.01	96.7	9.8
0.04	9.6%	19.8%	0.02	0.02	96.3	9.3
0.06	9.4%	29.3%	0.03	0.03	95.8	9.1
0.08	7.7%	37.0%	0.04	0.04	95.3	7.4
0.10	8.6%	45.6%	0.05	0.05	94.9	8.1
0.12	6.3%	51.9%	0.06	0.06	94.4	5.9
0.14	4.7%	56.5%	0.07	0.07	93.9	4.4
0.16	4.6%	61.2%	0.08	0.08	93.4	4.3
0.18	3.5%	64.7%	0.09	0.09	93.0	3.3
0.20	4.3%	69.1%	0.10	0.10	92.5	4.0
0.25	8.0%	77.1%	0.12	0.12	91.3	7.3
0.30	5.6%	82.7%	0.15	0.15	90.1	5.0
0.35	4.4%	87.0%	0.17	0.17	88.9	3.9
0.40	2.5%	89.5%	0.19	0.19	87.8	2.2
0.45	2.5%	92.1%	0.22	0.22	86.6	2.2
0.50	1.4%	93.5%	0.24	0.24	85.4	1.2
0.75	5.0%	98.5%	0.36	0.36	79.5	4.0
1.00	1.0%	99.5%	0.49	0.49	73.6	0.7
1.50	0.0%	99.5%	0.73	0.73	61.7	0.0
2.00	0.0%	99.5%	0.97	0.97	49.9	0.0
3.00	0.5%	100.0%	1.46	1.40	27.9	0.1
						92.4
					Removal Efficiency Adjustment[2] =	6.5%
					Predicted % Annual Rainfall Treated =	93.5%
					Predicted Net Annual Load Removal Efficiency =	**85.9%**

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CDS ESTIMATED NET ANNUAL TSS REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

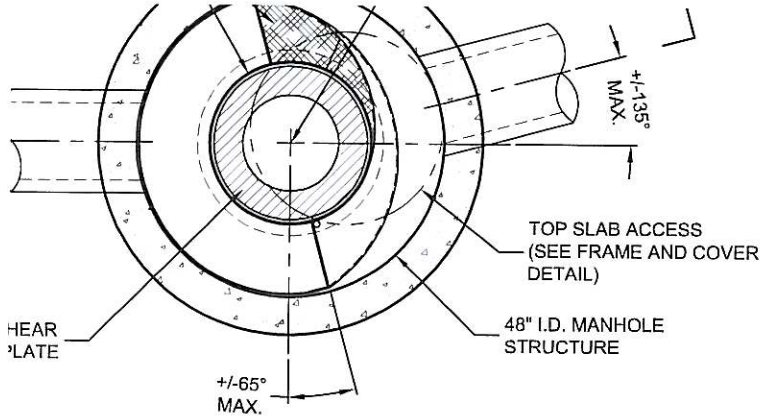
CONTECH ENGINEERED SOLUTIONS

WENDY'S - FRAMINGHAM
FRAMINGHAM, MA
for SYSTEM: CDS - WEST

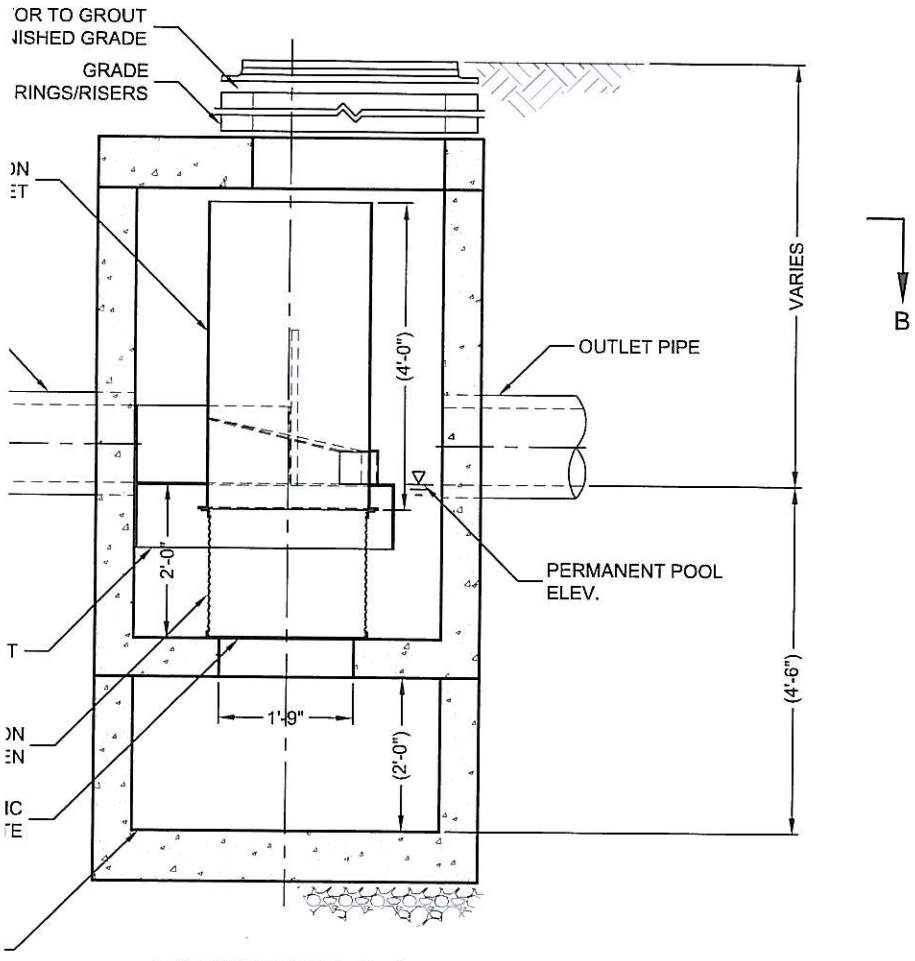
Area	0.34	acres	CDS Model	
Weighted C	0.90		2015-4	
Tc	6	minutes	CDS Treatment Capacity	
			1.4	cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Removal Efficiency (%)	Incremental Removal (%)
0.02	10.2%	10.2%	0.01	0.01	96.9	9.9
0.04	9.6%	19.8%	0.01	0.01	96.6	9.3
0.06	9.4%	29.3%	0.02	0.02	96.3	9.1
0.08	7.7%	37.0%	0.02	0.02	96.0	7.4
0.10	8.6%	45.6%	0.03	0.03	95.7	8.2
0.12	6.3%	51.9%	0.04	0.04	95.4	6.0
0.14	4.7%	56.5%	0.04	0.04	95.1	4.4
0.16	4.6%	61.2%	0.05	0.05	94.8	4.4
0.18	3.5%	64.7%	0.06	0.06	94.5	3.4
0.20	4.3%	69.1%	0.06	0.06	94.2	4.1
0.25	8.0%	77.1%	0.08	0.08	93.5	7.5
0.30	5.6%	82.7%	0.09	0.09	92.8	5.2
0.35	4.4%	87.0%	0.11	0.11	92.0	4.0
0.40	2.5%	89.5%	0.12	0.12	91.3	2.3
0.45	2.5%	92.1%	0.14	0.14	90.5	2.3
0.50	1.4%	93.5%	0.15	0.15	89.8	1.2
0.75	5.0%	98.5%	0.23	0.23	86.1	4.3
1.00	1.0%	99.5%	0.31	0.31	82.3	0.8
1.50	0.0%	99.5%	0.46	0.46	74.9	0.0
2.00	0.0%	99.5%	0.61	0.61	67.4	0.0
3.00	0.5%	100.0%	0.92	0.92	52.6	0.3
						94.2
					Removal Efficiency Adjustment[2] =	6.5%
					Predicted % Annual Rainfall Treated =	93.5%
					Predicted Net Annual Load Removal Efficiency =	**87.7%**

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.



PLAN VIEW B-B
N.T.S.



ELEVATION A-A

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES

FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY V
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PL PRODUCTS REPRESENTATIVE. www.contech-cpi.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET AASHTO M306 LOAD F BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUA
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. R MAINTENANCE CLEANING.

INSTALLATION NOTES
1. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC BY ENGINEER OF RECORD.
2. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY T (LIFTING CLUTCHES PROVIDED).
3. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEME
4. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEV

APPENDIX C

Best Management Practices Operations and Maintenance Plan

STORMWATER SYSTEM MAINTENANCE PLAN

For The

Wendy's Restaurant

located at

1699 & 1701 Worcester Road
(Tax Map 463 Block 9 Lots 28A&28B)
Framingham, Massachusetts

Submitted to:

Town of Framingham
Planning Board
150 Concord Street
Framingham, MA

Prepared for:

The Wendy's Company
40 General Warren Blvd.
Malvern, PA 19335

Prepared by

Engineering Alliance, Inc.
Civil Engineering & Land Planning Consultants

194 Central Street
Saugus, MA 01906
Tel: (781) 231-1349
Fax: (781) 417-0020

1950 Lafayette Road
Portsmouth, NH 03801
Tel: (603) 610-7100
Fax: (603) 610-7101

February 9, 2015

STORMWATER SYSTEM MAINTENANCE PLAN

A Stormwater System Maintenance Plan is summarized below and will be incorporated into the construction documents for this project.

Engineering Alliance, Inc. has prepared the following Stormwater System Maintenance Plan for the proposed development of the property located at 1699 & 1701 Worcester Road (Tax Map 463 Block 9 Lots 28A&28B) in Framingham, Massachusetts. This plan is broken into two major sections. The first section is construction-related erosion and sedimentation controls. The second section is devoted to a post-development operation and maintenance plan.

Basic Information

Owner: The Wendy's Company
40 General Warren Blvd.
Malven, PA 19335

Section 1 - Construction Activities

1. Contact the Framingham Planning Board at least three (3) days prior to start of construction.
2. A stabilized construction entrance shall be installed per the detail on the plan entitled "Erosion & Sediment Control Plan". Vehicle wash down shall occur on the gravel surface that is adjacent to or part of the stabilized construction entrance.
3. Install straw wattles and silt fence to prevent sediment from leaving the subject property, as shown on the "Erosion & Sediment Control Plan".
4. The contractor shall only disturb the minimum area necessary.
5. Proper erosion and sediment control must be employed around all material stockpile areas. Regular provisions for dust control must be used, via a water truck or other acceptable method.
6. The entire project area shall be swept upon completion of construction and prior to removal of the erosion control devices.

Section 2 – Post Development Operation & Maintenance

1. Paved Areas (Bituminous Concrete) - Paved areas shall be swept by street sweepers periodically during dry weather to remove excess sediments, reducing the amount of sediments that the drainage system will have to remove from the runoff. Salt for de-icing on the paved areas during the winter months should be limited as much as possible, as this will reduce the need for removal and treatment. Sand containing the minimum amount of calcium chloride (or approved equivalent) needed for handling may be applied as part of the routine winter maintenance activities. **At a minimum all paved areas must be swept two times annually, in the fall and in the spring.**

2. Catch Basins – Catch basins shall be inspected monthly for the initial twelve-month period following the completion of the construction of the paved areas. Debris shall be removed from the catch basin grates, sumps and outlet pipes and disposed of in compliance with local, state and federal guidelines.

   Upon a period beginning twelve months after the completion of the site, all catch basins shall be inspected and maintained twice annually, once in April and once in November. Debris shall be removed from the catch basin grates, sumps and outlet pipes and disposed of in compliance with local, state and federal guidelines.

3. Water Quality Manhole: Contech CDS unit with manhole cover should be maintained bi-annually, after a large rain event, and when sediment levels exceed maintenance volumes, as required by the manufacturer. At a minimum, water quality manholes shall be serviced every spring and fall.

4. Snow removal and storage - Plowed snow shall be placed in pervious areas adjacent to the parking lot where it can slowly infiltrate. Sediments shall be removed from this area every spring. When the amount of snow exceeds the capacity of the snow storage areas, it shall be removed from the site at the owner's expense.

5. Maintenance Responsibilities - All post construction maintenance activities shall be documented and kept on file and made available to the Town of Framingham annually, or upon request. All post construction maintenance activities shall run with the title of the property in perpetuity.

APPENDIX D

Geotechnical Report

14-49001

REPORT OF GEOTECHNICAL INVESTIGATION

PROPOSED WENDY'S (#11468) RESTAURANT

1699 Worcester Road
Block 9, Lot 28B
Town of Framingham, Middlesex County, Commonwealth of Massachusetts

Prepared for:

WENDY'S INTERNATIONAL, LLC
40 General Warren Boulevard, Suite 200
Malvern, Pennsylvania 19355

Prepared by:

245 Main Street; Suite 113
Chester, New Jersey 07930

Peter H. Howell
Project Manager

Jeffrey W. Schaumburg, P.E.
Principal
MA PE License No.46801

Project #0127-14-018EC
September 23, 2014

REPORT OF GEOTECHNICAL INVESTIGATION

Proposed Wendy's (#11468) Restaurant
1699 Worcester Road
Block 9, Lot 28B
Town of Framingham, Middlesex County, Commonwealth of Massachusetts

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REPORT OF GEOTECHNICAL INVESTIGATION
Proposed Wendy's (#11468) Restaurant
1699 Worcester Road
Block 9, Lot 28B
Town of Framingham, Middlesex County, Commonwealth of Massachusetts

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(Continued)

APPENDICES

SECTION 1.0

Summary of Findings

Dynamic Earth, LLC (Dynamic Earth) has completed an exploration and evaluation of the subsurface conditions at the site of the proposed Wendy's restaurant to be located at 1699 Worcester Road in the Town of Framingham, Middlesex County, Commonwealth of Massachusetts. The site is identified further as Block 9, Lot 28B. The site of the proposed construction is shown on the *Boring Location Plan*.

At the time of Dynamic Earth's investigation, the subject site was developed with an existing Tin Alley Grill restaurant building and pavement. The proposed site development will include the demolition of the existing restaurant building and construction of a new Wendy's restaurant with associated pavement and utilities. The majority of the proposed Wendy's building will be within the footprint area of the existing restaurant building. Conceptual grading plans were not available at the time of report preparation, but the site is expected to be redeveloped near existing surface grades.

The subsurface exploration included reconnaissance of the project site, drilling soil test borings and evaluating the geotechnical conditions relevant to the proposed construction details provided. A summary of Dynamic Earth's findings and recommendations is presented below:

- **Generalized Subsurface Conditions:** The surficial materials encountered consisted of asphaltic pavement at the surface. Below the surface cover, relatively shallow existing fill material was encountered within the northwest portion of the subject site. The existing fill material was encountered to a depth of approximately two feet below the ground surface. Beneath the surface cover or existing fill materials, natural glacial till deposits were encountered that generally consisted of medium to fine sand (USCS: SW, SP and SM), gravel (USCS: GW) and clay (USCS: CL). The natural glacial deposits were encountered to boring refusal depths ranging between two feet and 10.5 feet below the ground surface. The refusal encountered is expected to be the top of rock. Groundwater was not encountered at the time of the investigation.

- **Foundations:** The proposed structures may be supported on conventional shallow foundations bearing within approved natural glacial deposits and/or compacted structural backfill. Due to the existing site development, the contractor should include a unit rate cost for overexcavation and replacement of unsuitable material prior to construction. If encountered, existing fill material and/or unsuitable material will need to be overexcavated below proposed foundations. The properly prepared soils will be suitable for support of conventional shallow foundations. The foundations may be designed to exert a maximum allowable net bearing pressure of 3,000 pounds per square foot.

- **Floor Slabs and Pavements:** Properly prepared and approved on-site soils and/or compacted structural fill material are expected to be suitable for support of proposed floor slabs and pavements. Provided that these materials are properly prepared and evaluated as detailed herein. Due to the existing site development, at least partial overexcavation and replacement should be anticipated.

- **Use of Site Soils as Structural Fill:** The existing fill material encountered appeared to be suitable for reuse as structural fill material with limited handling to segregate objectionable debris, where encountered. Controlled fill testing and monitoring of construction sequencing by Dynamic Earth will be critical to limit differential settlement.

- **Difficult Excavation:** Relatively shallow refusal on apparent rock was encountered within the western and southern portions of the project site at depths ranging from two feet and 10.5 feet below ground surface. **Use of rock excavation equipment should be anticipated during construction and the associated cost should be included in the construction budget.**

- **Groundwater Control:** Groundwater was not encountered during the course of the subsurface investigation.

- **Supplemental Evaluation of Inaccessible Areas:** The majority of the proposed building footprint was occupied by an existing building. As such, the subsurface conditions at presently inaccessible areas should be evaluated during the early phase of construction and following demolition to confirm that conditions in these areas are consistent with those encountered during this investigation, as detailed herein.

Detailed design criteria and construction recommendations for proposed foundations, floor slabs, pavements and related earthwork are discussed in the following report. Dynamic Earth should remain involved to provide consultation and review during the construction phase.

SECTION 2.0

Introduction

2.1 AUTHORIZATION

Dynamic Earth, LLC (Dynamic Earth) was authorized to conduct a geotechnical investigation by Mr. Chad Adams, in accordance with our August 19, 2014 proposal to Wendy's International, LLC.

2.2 PURPOSE

The purpose of this subsurface exploration and analysis was to:

- ascertain the various soil profile components at test locations;
- estimate the engineering characteristics of the proposed foundation bearing and subgrade materials;
- provide geotechnical criteria for use by the design engineers in preparing the foundations, floor slab, and pavement designs;
- provide recommendations for required earthwork and subgrade preparation;
- record groundwater levels at the time of the investigation and discuss the potential impact on the proposed construction;
- identifying the Seismic Site Class per the 2009 International Building Code and the site's liquefaction potential; and
- recommend additional investigation, if warranted.

2.3 SCOPE

The scope of the exploration and analysis included site geologic research and evaluation, subsurface exploration, field testing and sampling, laboratory testing, and geotechnical engineering analysis and evaluation of the subsurface materials. This *Report of Geotechnical Investigation* is limited to addressing the site conditions as they relate to the physical support of the proposed construction. Environmental considerations were not evaluated by Dynamic Earth.

2.3.1 Field Exploration

Field exploration of the project site was conducted by means of eight soil test borings (identified as borings B-1 through B-8). The borings were drilled with a truck-mounted drill rig using hollow stem augers. Borings B-1 through B-4 were drilled within the vicinity of the proposed building footprint and extended to refusal depths ranging between approximately two feet and seven feet below ground surface. Borings B-5 through B-8 were drilled within proposed pavement areas and extended to refusal depths ranging from approximately 3.5 feet and 10.5 feet below ground surface. The approximate test locations are shown on the accompanying *Boring Location Plan.*

The soil borings were completed in the presence of a Dynamic Earth engineer who performed field tests, recorded visual classifications, and collected samples of the various strata encountered. The borings were located in the field using normal taping procedures and estimated right angles. These locations are presumed to be accurate within several feet.

Soil borings and standard penetration tests (SPTs) were conducted in general accordance with ASTM designation D 1586. The SPT resistance value (N) can be used as an indicator of the consistency of fine-grained soils and the relative density of coarse-grained soils. The N-value for various soil types can be correlated to determine engineering behavior of during earthworks and foundations evaluation.

Groundwater table was not encountered during the course of the subsurface investigation. Seasonal variations, temperature effects, man-made effects, and recent rainfall conditions may influence the local groundwater table. Groundwater elevations derived from sources other than seasonally observed groundwater monitoring wells may not be representative of true groundwater levels.

2.3.2 Laboratory Testing Program

Physical Tests: Each sample was subjected to supplemental visual manual classifications. The results were used to support classifications in accordance with ASTM D-2488.

In addition, representative samples of selected strata encountered were subjected to a laboratory testing program which included, moisture content determinations (ASTM D-2216), washed gradation analyses (ASTM D-422) and Atterberg limits determination (ASTM D-4318) in order to perform supplementary engineering soil classifications in general accordance with ASTM D-2487. The soil strata tested were classified by the Unified Soil Classification System (USCS) and results of the laboratory testing are summarized in the following table.

Laboratory Test Results							
Boring	**Sample No.**	**Sample Depth (ft)**	**Natural Moisture Content (%)**	**Liquid Limit (%)**	**Plastic Index (%)**	**Sieve Minus No. 200 (%)**	**USCS Classification**
B-6	S-4	6 - 8	6.0	Not Plastic		35.1	SM
B-8	S-4	6 - 8	9.9	25	10	50.7	CL

The engineering classifications are useful when considered in conjunction with the additional site data to estimate other properties of the soil types encountered and to predict the soil's behavior under construction and service loads.

SECTION 3.0

Site Description

3.1 LOCATION AND DESCRIPTION

The subject property is located at 1699 Worcester Road in the Town of Framingham, Middlesex County, Commonwealth of Massachusetts. The site is further identified as Block 9, Lot 28B. The site is generally bounded to the north by an office building, commercial building and associated parking lot area; to the south by Worcester Road (Route 9); to the east by California Avenue beyond which are office buildings with associated parking; and to the west by a Hess service station beyond which is an office building. The site of the proposed construction is shown on the *Boring Location Plan.*

3.2 EXISTING CONDITIONS

Surface Cover/Development: At the time of this investigation, the subject site was developed with an existing one-story restaurant building and associated parking areas. The surficial cover consisted of asphalt and concrete pavement and landscaped islands.

Topography: No topographic information was available at the time of this report. However, based on visual observations made during our field investigation, the site appears to slope downward in the northern direction.

Site Drainage: Surface runoff generally appears to follow existing site topography toward low lying areas and stormwater inlets within the northern portion of the project site.

3.3 PROPOSED CONSTRUCTION

The proposed site development will include demolition of the existing restaurant building and construction of a Wendy's restaurant with associated pavements and utilities. The majority of the proposed Wendy's building will be within the footprint of the existing building. The proposed Wendy's will occupy a footprint area of approximately 3,650 square feet. Conceptual grading plans were not available; however, we anticipate that the majority of the site will be developed near existing site grades.

The maximum anticipated loads are expected to be less than the following:

- wall loads – 1.5 kips per linear foot;

- column loads – 60 kips;
- floor slab loads – 125 pounds per square foot; and
- pavement loads – 60,000 18-kip Equivalent Single Axle Loads (ESAL).

The scope of Dynamic Earth's investigation and the professional advice contained in this report were generated based on the project details and loading noted herein. Any revisions or additions to the design details enumerated in this report should be brought to the attention of Dynamic Earth for additional evaluation as warranted.

SECTION 4.0

Subsurface Conditions

4.1 SITE GEOLOGY

The site is located within the New England Upland Section of the Appalachian Highlands Physiographic Province of Massachusetts. Specifically, the Westboro Formation is mapped beneath the subject site. The Westboro Formation generally consists of quartzite and argillite overlain by an unnamed assemblage of metamorphosed mafic and felsic volcanic rocks. Overburden soils generally consist of glacial till deposits and artificial fill material.

4.2 SUBSURFACE SOIL PROFILE

Details of the subsurface materials encountered are presented on the *Records of Subsurface Exploration* presented in the Appendix of this report. The subsurface soil conditions encountered in the soil test borings consisted of the following generalized strata in order of increasing depth.

Surface Cover Material: The borings were performed within existing pavement areas and encountered approximately three inches to 4.5 inches of asphaltic concrete at the surface with no apparent subbase.

Existing Fill Material: Beneath the surface cover material, existing fill material was encountered within the northwest portion of the site (at Boring B-7) that generally consisted of medium to fine sand with variable amounts of gravel, silt, clay, and trace amounts of debris. The debris encountered consisted of wood fragments. The fill material was encountered to a depth of approximately two feet below the ground surface. A Standard Penetration Test (SPT) N-value of 25 blows per foot (bpf) was encountered within this stratum.

Glacial Till Deposits: Beneath the surface cover and existing fill material, natural glacial deposits were encountered that consisted of coarse to fine sand (USCS: SW, SP and SM) gravel, (USCS: GW), and clay (USCS: CL). The natural glacial till deposits were encountered to boring refusal depths ranging between two feet and 10.5 feet below the ground surface. SPT N-values within this stratum ranged between approximately 15 bpf and 78 bpf and averaged approximately 35 bpf, generally indicating dense conditions.

Rock: The refusal encountered is expected to be top of rock.

4.3 GROUNDWATER

Groundwater was not encountered during the course of the subsurface investigation. Groundwater levels are expected to fluctuate seasonally and following periods of significant precipitation.

SECTION 5.0

Conclusions and Recommendations

5.1 GENERAL

The proposed structures may be supported on conventional shallow foundations bearing within approved natural soils and/or compacted structural fill material. Due to the existing site development, at least partial overexcavation and replacement of unsuitable material should be anticipated. Proposed floor slabs and pavements may be supported on approved soils and/or properly placed and compacted structural fill material. Due to the existing site development, at least partial overexcavation and replacement of unsuitable material should be anticipated.

Since the majority of the proposed building footprint was occupied with an existing building, we recommend performing a supplemental evaluation of the subsurface conditions following demolition of the existing building to confirm the conditions encountered during this investigation. The contractor should include a unit rate cost for removal and replacement of unsuitable soil, if encountered.

The recommendations presented herein are sufficient to support the initial design and planning phase. These recommendations are contingent on the assumption that Dynamic Earth will remain involved in the final design process and that Dynamic Earth will be engaged to conduct the necessary construction phase geotechnical testing and inspection to ensure these recommendations are properly implemented.

5.2 SITE PREPARATION AND EARTHWORK

Demolition Surface Cover Stripping: Prior to the start of construction, all utilities should be identified and secured. Existing remnant structural elements, such as concrete foundations, should be removed entirely from below proposed foundations and floor slabs and excavated to at least two feet below pavement subgrade elevations. Remnant structural elements may remain in-place below these depths at pavement and non-structural locations provided they do not interfere with future construction; however, it is strongly recommended that such structural elements should be removed in their entirety. Any slabs left in-place, although discouraged, should be thoroughly fractured to promote vertical drainage. The resulting excavations should be backfilled with structural fill in accordance with the recommendations of Section 5.3. Dynamic Earth recommends that a qualified geotechnical representative be present to witness slab fracturing and backfilling operations.

The surface cover materials should be removed from within and at least five feet beyond the limits of the proposed building and pavement areas as well as any other area which will require fill placement.

Difficult Excavation: Auger refusal and difficult drilling were encountered at depths as shallow as two feet below the ground surface. As such, difficult excavation to remove rock and/or cobbles/boulders should be anticipated during construction.

While small boulders and cobbles may typically be removed with conventional excavation equipment, heavy excavating equipment with rock ripping tools may be required for larger boulders and/or to remove only the uppermost weathered rock. The speed and ease of excavation will depend on the type of grading equipment, the skill of the equipment operators, and the geologic structure of the material itself, such as the direction of bedding, planes of weakness, and spacing between discontinuities. Planned excavation depths beyond refusal depths will likely require the use of pneumatic hammers to remove the material.

Surface Preparation/Proofrolling: Prior to placing any fill or subbase materials to raise or restore grades to the desired building pad or pavement subgrade elevations, the existing exposed soils should be compacted to a firm and unyielding surface with several passes in two perpendicular directions of minimum 20-ton vibratory, smooth drum roller during favorable moisture conditions. The surface then should be proofrolled with a loaded tandem axle truck in the presence of Dynamic Earth's geotechnical engineer to help identify soft or loose pockets. Dynamic Earth anticipates at least partial overexcavation of the subgrade may be required if it is wetted or subjected to repeated construction traffic. Any fill or backfill should be placed and compacted in accordance with Section 5.3.

Subgrade Protection and Inspection: Every effort should be made to minimize disturbance of the on-site soils by construction traffic and surface runoff. Sandy soils typically dry relatively quickly following wet weather, and may require wetting to attain proper compaction during hot, dry months. Poorly graded sands disturbed by traffic also require frequent re-wetting and recompaction during hot, dry periods. Dynamic Earth should be retained as the Geotechnical Engineer of Record to inspect soil conditions during construction and verify the suitability of prepared foundation, floor slab and pavement subgrades for support of design loads.

5.3 STRUCTURAL FILL AND BACKFILL

Import/On-site Structural Fill Material: Soils placed as structural fill material should consist of well graded sand or gravel with a maximum particle size of three inches in diameter and less than 15 percent of material passing the number 200 sieve. These materials should be free of objectionable debris (clay clumps, organic and/or deleterious material, etc.) and within moisture

contents suitable for compaction. Alternative soil types with higher percentages of silt and clay may be considered, provided that the contractor is able to achieve proper compaction and maintain suitable subgrade once the material is placed. Fine-grained soils and/or granular soils with higher percentages of silt and clay are extremely moisture sensitive and will only be suitable for reuse as structural fill material under ideal weather conditions. Materials wetted beyond the optimum moisture content; containing oversized rock or debris; or with increased amounts of objectionable debris will not be suitable for reuse as structural fill material without special handling. As such, the contractor should be responsible for importing structural fill material and/or processing on-site soils as required so that these materials are suitable for structural fill placement.

Oversized debris greater than three inches in diameter (e.g. boulders, cobbles, concrete, brick, etc.) will need to be separated from on-site soils to be placed as structural fill. Approved material between three to 12 inches in diameter may be crushed or individually placed in fill layers deeper than two feet below proposed subgrade levels. Care must be taken to individually seat any large particles and to compact soil around large particles with hand operated equipment to minimize the risk of void formation. The larger material should not be placed near areas of the proposed utility or planned excavations. Boulders larger than approximately 12 inches are not expected to be adequate for use as fill or backfill and should be removed from the site or crushed to an adequate size.

The on-site soils include existing fill material with trace amounts of debris and granular glacial deposits. These materials are preliminarily expected to be suitable for reuse as structural fill material, but special handling to remove objectionable debris and/or process or remove oversized particles should be anticipated. Reuse of these materials will be contingent upon further evaluation during construction.

Compaction and Placement Requirements: Structural fill and backfill should be placed in maximum nine-inch loose lifts and compacted to 95 percent of the maximum dry density within a targeted two percent of the optimum moisture content as determined by ASTM D 1557 (Modified Proctor). Variations in moisture content may be acceptable subject to Dynamic Earth's on-site geotechnical engineer's approval if the contractor is able to achieve the necessary compaction. Dynamic Earth recommends using a minimum 20-ton smooth drum roller to compact subgrade soils beneath pavements or slabs and hand operated vibratory jumping jacks and plate compactors within confined excavations for foundations or utilities. Fill material compacted with hand operated equipment may need to be placed in thinner loose lifts and an increased number of passes may be required to achieve proper compaction.

Structural Fill Testing: Before filling operations begin, representative samples of each proposed fill material (on-site and imported) should be collected. The samples should be tested to

determine the maximum dry density, optimum moisture content, natural moisture content, gradation, and plasticity of the soil. These tests are needed for quality control during compaction and also to determine if the fill material is acceptable. The placement of all structural fill and backfill should be monitored by Dynamic Earth's geotechnical engineer or technician to ensure that the specified material and lift thicknesses are properly installed. A sufficient number of in-place density tests should be performed during fill placement to ensure that the specified compaction is achieved throughout the height of the fill or backfill.

5.4 GROUNDWATER CONTROL

Groundwater was not encountered during this subsurface investigation and the need for extensive permanent groundwater control is not anticipated.

Surface water runoff must be controlled and diverted away from construction areas by grading and limiting the exposure of excavations to rainfall. Temporary dewatering of trapped water or runoff may be required following periods of precipitation.

5.5 FOUNDATIONS

Anticipated Bearing Strata: The anticipated bearing stratum will be within the approved compacted structural fill material and/or natural glacial deposits. **An isolated pocket of existing fill was noted within the northern portion of the project site and may need to be overexcavated and recompacted if encountered below the proposed foundations. In addition, apparent shallow rock was encountered within the southern and western portion of the project site that may require rock excavation as detailed below.**

Shallow Foundation Design Criteria: Dynamic Earth recommends supporting the proposed structures on conventional shallow foundations bearing in the materials noted above. Foundations may be designed to impart a maximum allowable net bearing pressure of 3,000 pounds per square foot (psf). Regardless of loading conditions, proposed foundations should be sized no less than minimum dimensions of 24 inches for continuous wall footings and 36 inches for isolated column footings.

Any sign footings should be designed so that the maximum toe pressure due to the combined effect of vertical loads and overturning moment does not exceed the recommended maximum allowable net bearing pressure recommended above. In addition, positive contact pressure should be maintained throughout the base of the footings such that no uplift or tension exists between the base of the footings and the supporting soil. Uplift loads should be resisted by the weight of the concrete. Side friction should be neglected when proportioning the footings so that

lateral resistance should be provided by friction resistance at the base of the footings. A coefficient of friction against sliding of 0.35 is recommended.

Partial Rock Support: Footings should not bear partially on rock and partially on soil due to the risk of brittle fracture at hinging points. Any foundation subgrades that would result in partially supported rock conditions should be overexcavated an additional six inches and replaced with well graded, compacted structural fill, per Section 5.3, to provide a cushion against brittle fracture. Alternatively, footings may be extended to bear entirely on rock.

Menu Board Foundation: Proposed menu board functions that are drilled and cast in-place against undisturbed natural soil may be designed using lateral resistance from the passive earth pressure. **Menu board foundations installed by excavating (as opposed to drilling in-place) will not achieve the design lateral resistance unless the soils are properly backfilled and compacted.** The lateral resistance within the upper four feet should be neglected. While the design of the menu board foundation is not included in our current scope of work, the following soil parameters (for undisturbed glacial deposits) may be used for preliminary menu board foundation design:

- Unit Weight of Natural Soil – 125 pounds per cubic foot
- Internal Friction Angle – 30 degrees
- Active Earth Pressure Coefficient (K_a) – 0.33
- Passive Earth Pressure Coefficient (K_p) – 3.0

Careful inspection of the menu board foundation will be critical to confirm these preliminary design parameters.

Inspection/Overexcavation Criteria: The suitability of the bearing soils along and below the footing bottoms should be verified by Dynamic Earth's geotechnical engineer prior to placing concrete. **Due to the existing site development, a level of inspection higher than a routine footing bottom inspection by a testing laboratory will be required.** If encountered, we recommend performing the overexcavation of unsuitable foundation subgrade soils prior to placing new fill material and subsequent to laying out the proposed building foundations. Any foundation overexcavation to be restored with structural fill must be excavated one foot laterally for each foot of vertical overexcavation. Alternatively, unsuitable existing fill material may be replaced with additional concrete, lean concrete or flowable fill directly below foundations.

Settlement: Dynamic Earth estimates post construction settlements of proposed building foundations to be less than one inch if the recommendations outlined in this report are properly implemented. Differential settlements of building foundations should be less than one-half inch.

Frost Coverage: Footings subject to frost action should be placed at least 48 inches below adjacent exterior grades or as required by the local building code to provide protection from frost penetration. Interior footings not subject to frost action (including during the period of construction) may be placed at a minimum depth of 18 inches below the slab subgrade.

5.6 FLOOR SLAB

Dynamic Earth anticipates that the on-site soils may be suitable for support of the proposed floor slab provided these materials are properly evaluated, compacted and proofrolled in accordance with Sections 5.2 and 5.3 of this report. **Due to the existing site development, at least partial overexcavation and either recompaction and/or replacement may be required below portions of the proposed floor slab area.** Any areas that become softened or disturbed as a result of wetting and/or repeated exposure to construction traffic should be removed and replaced with compacted structural fill. The on-site soils will yield a minimum subgrade modulus (k) of 150 psi/in.

A minimum four-inch layer of stone should be installed below the floor slabs to provide a capillary break. A vapor barrier beneath the floor slab is recommended. Total and post-construction settlements of floor slabs installed in accordance with the recommendations outlined in this report are estimated to be less than one-quarter inch.

5.7 PAVEMENT DESIGN CRITERIA

General: Dynamic Earth anticipates that the majority of the on-site soils will be suitable for support of proposed pavements. **However, due to the existing fill material and site development, at least partial overexcavation and recompaction and/or replacement should be anticipated.** This pavement design is based on the assumed traffic, which consists of automobile parking and a few lightly loaded delivery/box trucks. If heavier traffic is anticipated, such as more extensive truck traffic, Dynamic Earth should be contacted to provide a specific heavy duty pavement section.

Design Criteria: A design California Bearing Ratio (CBR) value of seven has been assigned to the anticipated properly prepared fill soils for pavement design purposes. This value was correlated with pertinent soil support values and assumed traffic loads to prepare flexible and rigid pavement designs per the AASHTO *Guide for the Design of Pavement Structures.*

Pavement Sections: The recommended flexible pavement section is presented below in tabular format:

RECOMMENDED FLEXIBLE PAVEMENT SECTION		
Layer	**Material**	**Thickness (Inches)**
Surface	MHD Class 1 Top Course	1.5
Base	MHD Class 1 Binder	3.0
Subbase	MHD M1.03.0 Type C Processed Gravel	6.0

A rigid concrete pavement should be used to provide suitable support at areas of high traffic or severe turns (such as loading docks and driveway aprons). The recommended rigid pavement is presented below in tabular format:

RECOMMENDED RIGID PAVEMENT		
Layer	**Material**	**Thickness (Inches)**
Surface	4,000 psi air-entrained concrete	5.0
Base	M1.03.0 Type C Processed Gravel	6.0

Additional Design Considerations: The pavement section thickness designs presented in this report are based on the design parameters detailed herein and are contingent on proper construction, inspection, and maintenance. The designs are contingent on achieving the minimum soil support value in the field. To accomplish this requirement, all subgrade soil and supporting fill or backfill must be placed, prepared, and evaluated as detailed in Sections 5.2 and 5.3 of this report. Proper drainage must be provided for the pavement structure including appropriate grading and surface water control, as well as measures to drain water from the subgrade such as bleeder drains at inlets.

The performance of the pavement also will depend on the quality of materials and workmanship. Dynamic Earth recommends that Massachusetts Highway Department (MHD) standards for materials, workmanship, and maintenance be applied to this site. Project specifications should include verifying that the installed asphaltic concrete material composition is within tolerance for the specified materials and that the percentage of air voids of the installed pavement is within specified ranges for the respective materials. All rigid concrete pavements should be suitably air-entrained, jointed, and reinforced.

5.8 RETAINING WALLS AND LATERAL EARTH PRESSURES

Retaining walls or structures are not proposed for this project. Dynamic Earth should be notified if structures requiring lateral earth pressure estimates subsequently are proposed.

5.9 SEISMIC AND LIQUEFACTION CONSIDERATIONS

The soils are most consistent with a Site Class D defined by the *International Building Code.* Based on the seismic zone and soil profile, liquefaction considerations are not expected to have a substantial impact on design.

5.10 TEMPORARY EXCAVATIONS

The natural gravelly sand and sandy gravel soils encountered during the investigation are consistent with Type C Soil Conditions as defined by 29 CFR Part 1926 (OSHA) which require a maximum unbraced excavation angle of 1.5:1 (horizontal: vertical). Running sand conditions should be anticipated if excavations extend below groundwater. Actual conditions encountered during construction should be evaluated by a competent person (as defined by OSHA) to ensure that safe excavation methods and/or shoring and bracing requirements are implemented.

5.11 SUPPLEMENTAL POST-INVESTIGATION SERVICES

Construction Phase Inspection of Subgrade Soils and Inaccessible Areas: The conditions disclosed by the soil borings preliminarily indicate that the on-site soils may be suitable for support of the proposed structures if evaluated and prepared as described herein. If encountered, existing fill material will need to be overexcavated and replaced with structural backfill in a controlled manner. Therefore, the composition of the existing fill should be verified by visual observation and test pit excavations prior to or during the early phase of construction to enable further assessment of the depth, possible presence of voids, uncontrolled conditions, or possible deleterious materials. If unsuitable conditions are encountered, alternative recommendations, possibly including overexcavation and replacement, may be required. Since the majority of the proposed building footprint was occupied with an existing building, the subsurface conditions in presently inaccessible areas below existing structure also should be evaluated following demolition to verify if the underlying soil conditions are consistent with the soil conditions encountered during this subsurface exploration.

Construction Monitoring and Testing: The recommendations presented herein are contingent on the Owner retaining Dynamic Earth to perform inspection, testing, and consultation during construction as described in previous sections of this report. **Construction phase consulting will be necessary to further evaluate the existing fill material and/or natural soils for floor slab and pavement support and to identify potential salvageable areas or stabilization measures.** Monitoring and testing should also be performed to verify that suitable materials are used for controlled fill, and that they are properly placed and compacted over suitable subgrade soils. Testing of fill placement will also be critical to limiting differential settlement.

SECTION 6.0

General Comments

Supplemental recommendations may be required upon finalization of construction plans or if significant changes are made in the characteristics or location of the proposed structure. Dynamic Earth should be included as a consultant to the design team and should be provided final plans for review to confirm these criteria apply or to modify recommendations as necessary.

The recommendations presented herein should be utilized by a qualified engineer in preparing the project plans and specifications. The engineer should consider these recommendations as minimum physical standards that may be superseded by local and regional building codes and structural considerations. These recommendations are prepared for the use of the Client for the specific project detailed and should not be used by any third party. These recommendations are relevant to the design phase and should not be substituted for construction specifications.

The possibility exists that conditions between borings may differ from those at specific boring locations, and conditions may not be as anticipated by the designers or Contractors. In addition, the construction process may itself alter soil conditions. Therefore, Dynamic Earth geotechnical engineers or their representatives should observe and document the construction procedures used and the conditions encountered, as well as conduct testing and inspection to ensure the design criteria are met or recommendations to address deviations are implemented.

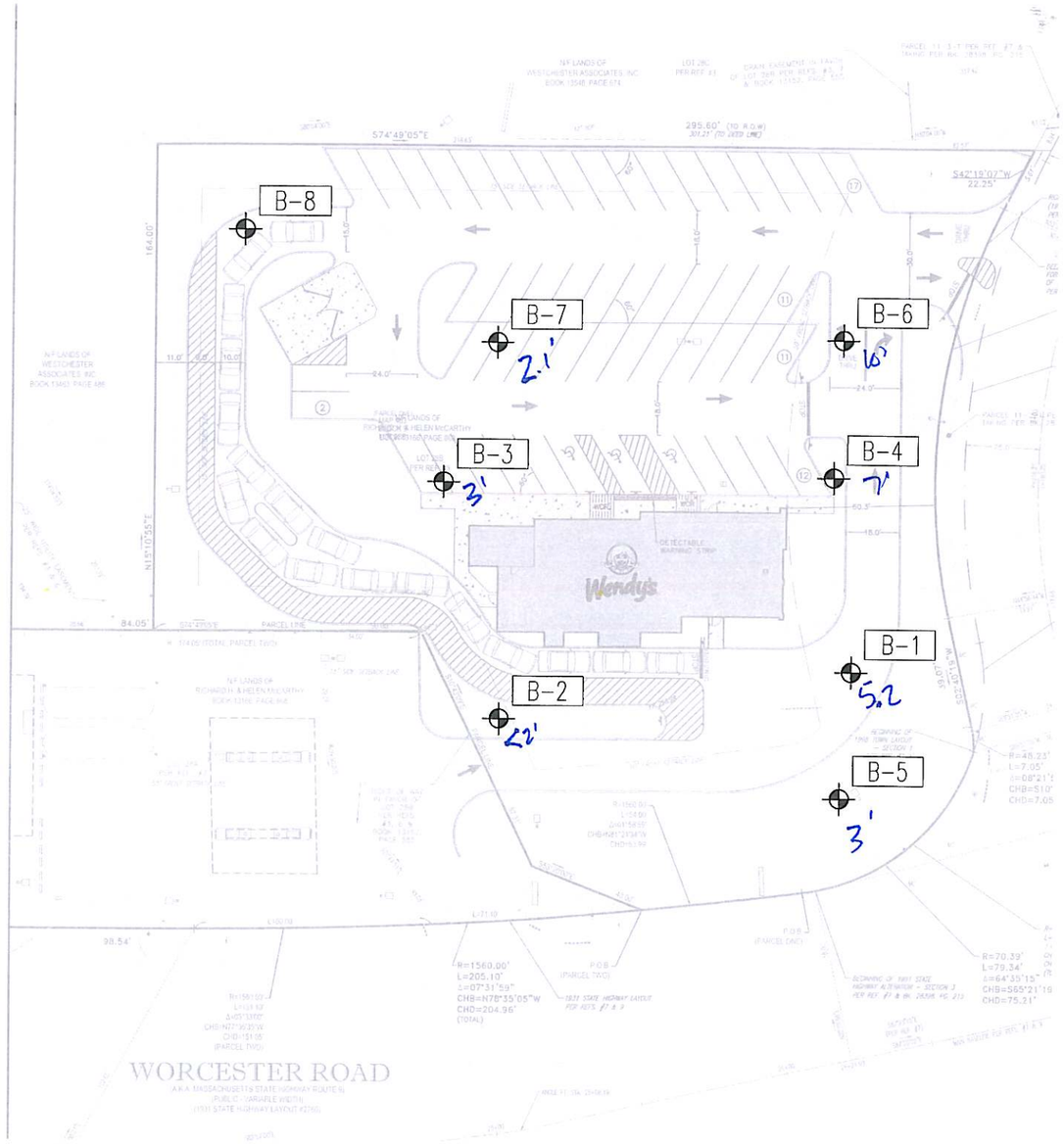
Dynamic Earth assumes that a qualified Contractor will be employed to perform the construction work, and that the Contractor will be required to exercise care to ensure all excavations are performed in accordance with applicable regulations and good practice. Particular attention should be paid to avoiding damaging or undermining adjacent properties and maintaining slope stability.

The exploration and analysis of the foundation conditions reported herein are presented to form a reasonable basis for foundation design. The recommendations submitted for the proposed construction are based on the available soil information and the preliminary design details furnished or assumed. Deviations from the noted subsurface conditions encountered during construction should be brought to the attention of the geotechnical engineer.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been promulgated after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics, and engineering geology. No other warranties are implied or expressed.

Boring Location Plan

Records of Subsurface Exploration



SCALE: (H) 1"=50' (V)	JOB No: 0127-14-018EC	TITLE: BORING LOCATION PLAN
SHEET No: 1 OF 1	DRAWN BY: JD DESIGNED BY: PHH CHECKED BY: PHH	PROJECT: WENDY'S INTERNATIONAL, LLC *PROPOSED WENDY'S RESTAURANT* BLOCK 9, LOTS 28A, & 28B, MAP 463 1699 & 1701 WORCESTER ROAD FRAMINGHAM, MIDDLESEX COUNTY, MASSACHUSETTS
DATE: 09/15/14	Rev. # 00	DEC Client Code: 0127

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DYNAMIC EARTH

BORING LOG

Boring No.: B-1

Project:	Proposed Wendy's Restaurant	**Proj. No.:**	0127-14-018EC
Location:	1699 Worcester Road, Town of Framingham, Middlesex County, Massachusetts	**Client:**	Wendy's International, LLC
Surface Elevation:	Not Surveyed	**Date Started:**	8/29/2014
Termination Depth:	5.2 feet	**Date Completed:**	8/29/2014
Proposed Location:	Building	**Logged by:**	R. Wojcik
Drill/Test Method:	HSA/SPT	**Contractor:**	Seaboard Drilling
Hammer Type:	AUTO/140#	**Rig Type:**	53 Foremost Mobile

Groundwater Data	Depth (ft)	El. (mse)	Additional Groundwater Data	Depth (ft)	El. (mse)
While Drilling:	NE	--			
At Completion:	NE	--			

Sample Information										
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (min/ft)	N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
								Surface Cover	4.5" Asphalt, no apparent subbase	
0 - 2	S1	SS	14	--	2, 7, 8, 11	15		Glacial Till Deposits	Gray and brown medium to fine sand, little coarse to fine gravel, moist, medium dense (SW)	
2 - 2.7	S2	SS	6	--	14, 50/2"	50/2"			Gray and brown medium to fine sand and coarse to fine gravel, moist, dense (GW)	Possible boulder
4 - 5.2	S3	SS	15	--	14, 18, 50/2", --	68/8"	5		Gray and brown coarse to fine sand, little coarse to fine gravel, trace clay, moist, dense (SW)	
							10		Boring B-1 was terminated at 5.2 feet below the ground surface due to auger and split spoon sampler refusal	Refusal on apparent rock
							15			
							20			
							25			

DYNAMIC EARTH

BORING LOG

Boring No.: B-2

Project:	Proposed Wendy's Restaurant			**Proj. No.:**	0127-14-018EC
Location:	1699 Worcester Road, Town of Framingham, Middlesex County, Massachusetts			**Client:**	Wendy's International, LLC
Surface Elevation:	Not Surveyed	**Date Started:**	8/29/2014		
Termination Depth:	0.8 feet	**Date Completed:**	8/29/2014		
Proposed Location:	Building	**Logged by:**	R. Wojcik		
Drill/Test Method:	HSA/SPT	**Contractor:**	Seaboard Drilling		
Hammer Type:	AUTO/140#	**Rig Type:**	53 Foremost Mobile		

Groundwater Data	Depth (ft)	El. (mse)	Additional Groundwater Data	Depth (ft)	El. (mse)
While Drilling:	NE	--			
At Completion:	NE	--			

Sample Information										
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (min/ft)		N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
0 - 0.8	S1	SS	8	--	13	60/4"	60/4"		Surface Cover	3" Asphalt, no apparent gravel subbase	Weathered rock
									Glacial Till Deposits	Brown coarse to fine gravel and coarse to fine sand, little silt, moist, dense (GW)	1.5'-2.0'
										Boring B-2 was terminated at 0.8 feet below the ground surface due to auger and split spoon sampler refusal	Apparent bedrock at 2.0'
								5			
								10			
								15			
								20			
								25			

DYNAMIC EARTH

BORING LOG

Boring No.: B-3

Project:	Proposed Wendy's Restaurant	**Proj. No.:**	0127-14-018EC
Location:	1699 Worcester Road, Town of Framingham, Middlesex County, Massachusetts	**Client:**	Wendy's International, LLC
Surface Elevation:	Not Surveyed	**Date Started:**	8/29/2014
Termination Depth:	3.7 feet	**Date Completed:**	8/29/2014
Proposed Location:	Building	**Logged by:**	R. Wojcik
Drill/Test Method:	HSA/SPT	**Contractor:**	Seaboard Drilling
Hammer Type:	AUTO/140#	**Rig Type:**	53 Foremost Mobile

Groundwater Data	Depth (ft)	El. (mse)	Additional Groundwater Data	Depth (ft)	El. (mse)
While Drilling:	NE	--			
At Completion:	NE	--			

Sample Information									
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (min/ft)	N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
0 - 2	S1	SS	16	--	7 10 16 30	26		Surface Cover	4" Asphalt, no apparent gravel subbase	
								Glacial Till Deposits	Brown coarse to fine sand, little coarse to fine gravel, trace silt, moist, medium dense (SW)	
2 - 3.7	S2	SS	18	--	11 28 49 50/2"	77			Brown coarse to fine gravel and coarse to fine sand, trace silt, moist, very dense (GW)	
							5		Boring B-3 was terminated at 3.7 feet below the ground surface due to auger and split spoon sampler refusal	Refusal on apparent rock
							10			
							15			
							20			
							25			

DYNAMIC EARTH

BORING LOG

Boring No.: B-4

Project:	Proposed Wendy's Restaurant			**Proj. No.:**	0127-14-018EC
Location:	1699 Worcester Road, Town of Framingham, Middlesex County, Massachusetts			**Client:**	Wendy's International, LLC
Surface Elevation:	Not Surveyed	**Date Started:**	8/29/2014		
Termination Depth:	7 feet	**Date Completed:**	8/29/2014		
Proposed Location:	Building	**Logged by:**	R. Wojcik		
Drill/Test Method:	HSA/SPT	**Contractor:**	Seaboard Drilling		
Hammer Type:	AUTO/140#	**Rig Type:**	53 Foremost Mobile		

Groundwater Data	Depth (ft)	El. (mse)	Additional Groundwater Data	Depth (ft)	El. (mse)
While Drilling:	NE	--			
At Completion:	NE	--			

Sample Information										
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (min/ft)	N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
0 - 2	S1	SS	15	--	2 6 / 8 14	14		Surface Cover	4" Asphalt, no apparent subbase	
								Glacial Till Deposits	Gray medium to fine sand, little coarse to fine gravel, moist, medium dense (SW)	
2 - 4	S2	SS	10	--	9 17 / 31 30	48			As above, some coarse gravel (SW)	Rock stuck in shoe
							5			
5 - 7	S3	SS	10	--	6 9 / 16 17	25			Gray and light brown coarse to fine gravel and coarse to fine sand, trace silt, moist, medium dense (GW)	Difficult advancing auger
									Boring B-4 was terminated at 7 feet below the ground surface due to auger and split spoon sampler refusal	Refusal on apparent rock
							10			
							15			
							20			
							25			

DYNAMIC EARTH

BORING LOG

Boring No.: B-5

Project:	Proposed Wendy's Restaurant			**Proj. No.:**	0127-14-018EC
Location:	1699 Worcester Road, Town of Framingham, Middlesex County, Massachusetts			**Client:**	Wendy's International, LLC
Surface Elevation:	Not Surveyed	**Date Started:**	8/29/2014		
Termination Depth:	2.8 feet	**Date Completed:**	8/29/2014		
Proposed Location:	Building/Pavement	**Logged by:**	R. Wojcik		
Drill/Test Method:	HSA/SPT	**Contractor:**	Seaboard Drilling		
Hammer Type:	AUTO/140#	**Rig Type:**	53 Foremost Mobile		

Groundwater Data	Depth (ft)	El. (mse)	Additional Groundwater Data	Depth (ft)	El. (mse)
While Drilling:	NE	--			
At Completion:	NE	--			

Sample Information										
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (min/ft)		N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
0 - 2	S1	SS	15	--	5	9	19		Surface Cover	3" Asphalt, no apparent subbase	
					10	15			Glacial Till Deposits	Grayish brown medium to fine sand, some coarse to fine gravel, moist, medium dense (SP)	
2 - 2.8	S2	SS	8	--	21	50/3"	50/3"			Grayish brown and pinkish white coarse to fine gravel, some medium to fine sand, moist, dense (GW)	
								5		Boring B-5 was terminated at 2.8 feet below the ground surface due to auger and split spoon sampler refusal	Refusal on apparent rock
								10			
								15			
								20			
								25			

DYNAMIC EARTH

BORING LOG

Boring No.: B-6

Project:	Proposed Wendy's Restaurant	**Proj. No.:**	0127-14-018EC
Location:	1699 Worcester Road, Town of Framingham, Middlesex County, Massachusetts	**Client:**	Wendy's International, LLC
Surface Elevation:	Not Surveyed	**Date Started:**	8/29/2014
Termination Depth:	10.6 feet	**Date Completed:**	8/29/2014
Proposed Location:	Pavement	**Logged by:**	R. Wojcik
Drill/Test Method:	HSA/SPT	**Contractor:**	Seaboard Drilling
Hammer Type:	AUTO/140#	**Rig Type:**	53 Foremost Mobile

Groundwater Data	Depth (ft)	El. (mse)	Additional Groundwater Data	Depth (ft)	El. (mse)
While Drilling:	NE	--			
At Completion:	NE	--			

Sample Information								Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (min/ft)	N					
0 - 2	S1	SS	14	--	10 16 / 10 17	26			Surface Cover	4" Asphalt, no apparent subbase	
									Glacial Till Deposits	Brown silty sand, little coarse to fine gravel, moist, medium dense (SP)	
2 - 4	S2	SS	15	--	16 23 / 16 23	39				Grayish brown and brown medium to fine sand, some coarse to fine gravel, little silt, moist, dense (SM)	
4 - 6	S3	SS	21	--	20 20 / 18 22	38		5		As above, moist, dense (SM)	
6 - 8	S4	SS	24	--	17 15 / 18 22	33				Brown coarse to fine gravel, some coarse to fine sand, some silt, moist, dense (SM)	
8 - 10	S5	SS	6	--	8 8 / 13 18	21		10		Brown medium to fine sand, little coarse to fine gravel, trace silt, moist, medium dense (SP)	
10 - 10.6	S6	SS		--	6	50/1"	50/1"				
										Boring B-6 was terminated at 10.6 feet below the ground surface due to apparent refusal	Refusal on apparent rock
								15			
								20			
								25			

DYNAMIC EARTH

BORING LOG

Boring No.: B-7

Project:	Proposed Wendy's Restaurant	**Proj. No.:**	0127-14-018EC
Location:	1699 Worcester Road, Town of Framingham, Middlesex County, Massachusetts	**Client:**	Wendy's International, LLC
Surface Elevation:	Not Surveyed	**Date Started:**	8/29/2014
Termination Depth:	2.1 feet	**Date Completed:**	8/29/2014
Proposed Location:	Pavement	**Logged by:**	R. Wojcik
Drill/Test Method:	HSA/SPT	**Contractor:**	Seaboard Drilling
Hammer Type:	AUTO/140#	**Rig Type:**	53 Foremost Mobile

Groundwater Data	Depth (ft)	El. (mse)	Additional Groundwater Data	Depth (ft)	El. (mse)
While Drilling:	NE	--			
At Completion:	NE	--			

Sample Information										
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (min/ft)	N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
0 - 2	S1	SS	12	--	12 13 / 15 15	28		Surface Cover	4" Asphalt, no apparent subbase	
								Fill	Brown and dark brown gravelly sand, some silt, little clay, moist, medium dense, trace debris (wood) (FILL)	Rock in shoe
2 - 2.1	S2	SS	1	--	50/1"	50/1"		Glacial Till Deposits	Whitish pink rock in shoe	Whitish pink rock
									Boring B-7 was terminated at 2.1 feet below the ground surface due to auger and split spoon sampler refusal	Refusal on apparent rock

DYNAMIC EARTH

BORING LOG

Boring No.: B-8

Project:	Proposed Wendy's Restaurant			**Proj. No.:**	0127-14-018EC
Location:	1699 Worcester Road, Town of Framingham, Middlesex County, Massachusetts			**Client:**	Wendy's International, LLC
Surface Elevation:	Not Surveyed	**Date Started:**	8/29/2014		
Termination Depth:	10 feet	**Date Completed:**	8/29/2014		
Proposed Location:	Pavement	**Logged by:**	R. Wojcik		
Drill/Test Method:	HSA/SPT	**Contractor:**	Seaboard Drilling		
Hammer Type:	AUTO/140#	**Rig Type:**	53 Foremost Mobile		

Groundwater Data	Depth (ft)	El. (mse)	Additional Groundwater Data	Depth (ft)	El. (mse)
While Drilling:	9.0	--			
At Completion:	NE	--			

Sample Information										
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (min/ft)	N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
0 - 2	S1	SS	17	--	6 10 10 12	20		Surface Cover	4" Asphalt, no apparent subbase	
									Grayish brown medium to fine sand, little coarse to fine sand, gravel, trace silt, moist, medium dense (SP)	
2 - 4	S2	SS	12	--	14 39 39 50	78			As above, little silt, trace clay, moist, very dense (SW)	
4 - 6	S3	SS	18	--	3 18 26 30	44	5	Glacial Till Deposits	Brown medium to fine sand, some coarse to fine gravel, little silt, trace clay, moist, dense (SW)	
6 - 8	S4	SS	20	--	7 13 13 12	26			Brown sandy lean clay, little coarse to fine gravel, very stiff, moist (CL)	
8 - 10	S5	SS	19	--	14 21 30 38	51			As above, hard (CL)	
							10		Boring B-8 was terminated at 10 feet below the ground surface	
							15			
							20			
							25			

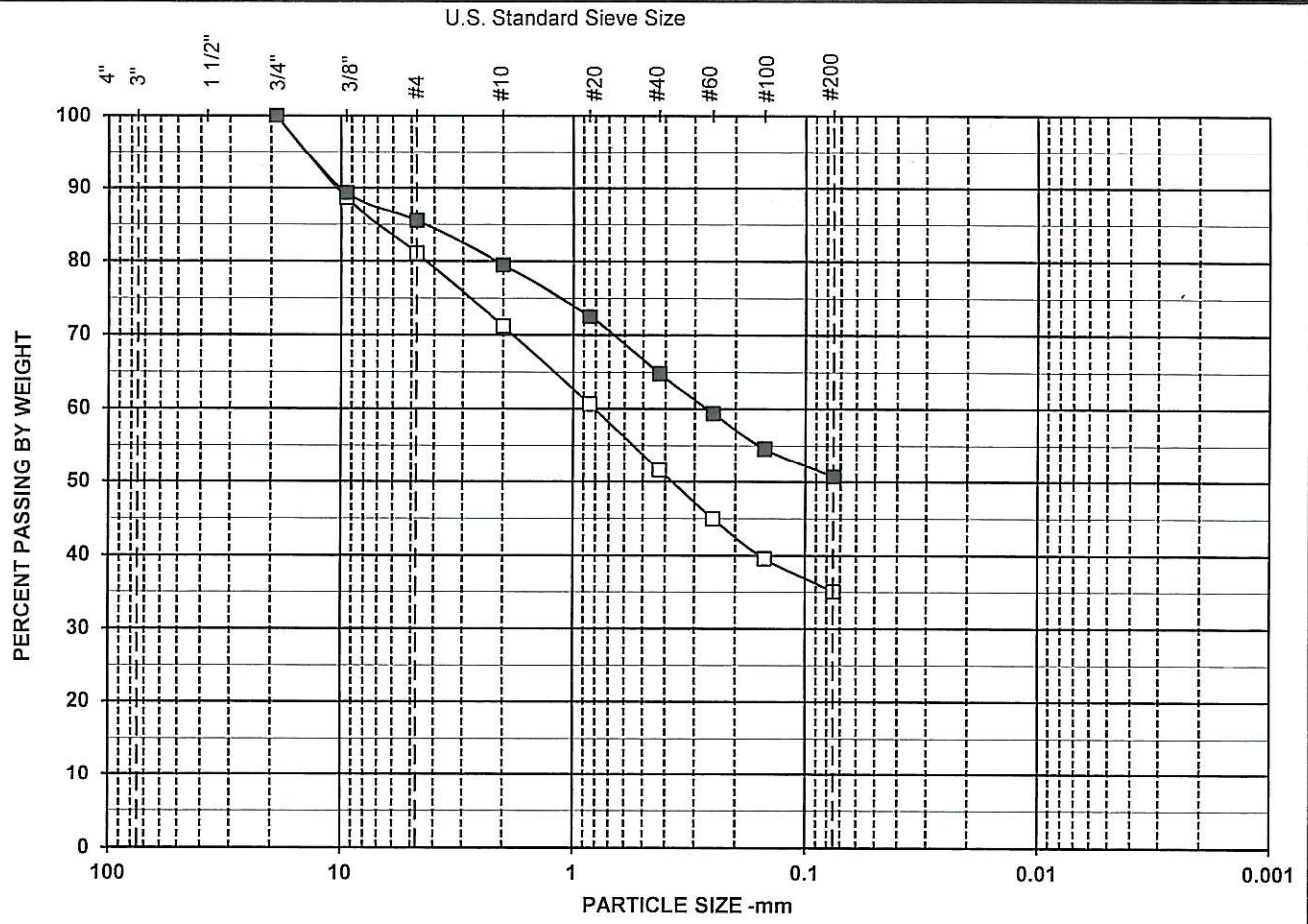
Laboratory Test Results

Dynamic Earth #0127-14-018EC
Proposed Wendy's Restaurant
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS						REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	
B-6	S-4	6-8	6.0				SM	35.1	
B-8	S-4	6-8	9.9	25	15	10	CL	50.7	

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	6.0				SM	Brown, Silty sand with gravel	9/10/2014
■	9.9	25	15	10	CL	Brown, Sandy lean clay	9/10/2014
○							

Symbol		
Boring	B-6	B-8
Sample	S-4	S-4
Depth	6-8	6-8
% +3"	0.0	0.0
% Gravel	19.0	14.5
% SAND	45.9	34.8
%C SAND	9.9	6.1
%M SAND	19.5	14.7
%F SAND	16.5	14.1
% FINES	35.1	50.7
% -2μ		
D_{100} (mm)	19.00	19.00
D_{60} (mm)	0.82	0.27
D_{30} (mm)		
D_{10} (mm)		
Cc		
Cu		

Particle Size (Sieve #)	PERCENT FINER	
4"		
3"		
1 1/2"		
3/4"	100.0	100.0
3/8"	88.6	89.3
4	81.0	85.5
10	71.1	79.5
20	60.6	72.5
40	51.6	64.8
60	45.0	59.4
100	39.6	54.5
200	35.1	50.7

TerraSense, LLC **Dynamic Earth**

7922-14045

PARTICLE SIZE DISTRIBUTION
Proposed Wendy's Restaurant

Analysis File: 3SV-MasterRev3

Geotechnical Terms and Symbols

DYNAMIC EARTH

245 Main Street; Suite 113
Chester, NJ 07930
908-879-9229: Fax 908-879-0222

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. or 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:	Plasiticity 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 – 1⅜" 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		

USCS Standard Classification System

UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D2488

MAJOR DIVISION			GROUP SYMBOL	LETTER SYMBOL	GROUP NAME
COARSE GRAINED SOILS CONTAINS MORE THAN 50% FINES	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVEL WITH * 5% FINES		GW	Well-graded GRAVEL
				GP	Poorly graded GRAVEL
		GRAVEL WITH BETWEEN 5% AND 15% FINES		GW-GM	Well-graded GRAVEL with silt
				GW-GC	Well-graded GRAVEL with clay
				GP-GM	Poorly graded GRAVEL with silt
				GP-GC	Poorly graded GRAVEL with clay
		GRAVEL WITH ≥ 15% FINES		GM	Silty GRAVEL
				GC	Clayey GRAVEL
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SAND WITH * 5% FINES		SW	Well-graded SAND
				SP	Poorly graded SAND
		SAND WITH BETWEEN 5% AND 15% FINES		SW-SM	Well-graded SAND with silt
				SW-SC	Well-graded SAND with clay
				SP-SM	Poorly graded SAND with silt
				SP-SC	Poorly graded SAND with clay
		SAND WITH ≥ 15% FINES		SM	Silty SAND
				SC	Clayey SAND
FINE GRAINED SOILS CONTAINS MORE THAN 50% FINES	SILT AND CLAY	LIQUID LIMIT LESS THAN 50		ML	Inorganic SILT with low plasticity
				CL	Lean inorganic CLAY with low plasticity
				OL	Organic SILT with low plasticity
		LIQUID LIMIT GREATER THAN 50		MH	Elastic inorganic SILT with moderate to high plasticity
				CH	Fat inorganic CLAY with moderate to high plasticity
				OH	Organic SILT or CLAY with moderate to high plasticity
HIGHLY ORGANIC SOILS				PT	PEAT soils with high organic contents

NOTES:

1) Sample descriptions are based on visual field and laboratory observations using classification methods of ASTM D2488. Where laboratory data are available, classifications are in accordance with ASTM D2487.

2) Solid lines between soil descriptions indicate change in interpreted geologic unit. Dashed lines indicate stratigraphic change within the unit.

3) Fines are material passing the U.S. Std. #200 Sieve.