9 & 11 SLOCUMB PLACE SITE IMPROVEMENTS

STORMWATER DRAINAGE EVALUATION

JULY 2018

Medway Community Church
Medway, MA

TATA & HOWARD

ATTACHMENT 1

Attachment 1

TATA & HOWARD

MEDWAY COMMUNITY CHURCH

9 & 11 SLOCUMB PLACE SITE IMPROVEMENTS

STORMWATER DRAINAGE EVALUATION

TATA & HOWARD, INC.
Consulting Engineers
Marlborough, Massachusetts

R-05328

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MEDWAY COMMUNITY CHURCH

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PURPOSE

The purpose of this Evaluation is to summarize the Stormwater Drainage Analysis performed for the proposed Parking Area Improvements. The proposed parking areas would be constructed on parcels located at 9 and 11 Slocumb Place, in Medway, Massachusetts owned by Medway Community Church.

The location of the proposed Parking Area site is shown on Figures No. 1A and 1B, page 4 and 5 respectively.

GENERAL BACKGROUND

Medway Community Church has seen increased attendance with a subsequent increase in the need for additional parking. Overflow parking occurs on adjacent streets and properties including Main Street, High Street, and the Medway Public Library's parking lot. Due to churchgoers crossing Main Street/Route 109, a police detail is required for safety during peak hours (typically on Sunday). Additional parking is necessary; therefore the church recently purchased two properties located at 9 and 11 Slocumb Place adjacent to the existing church campus. The proposed project includes the construction of approximately 66 parking spaces on 11 Slocumb Place (Lot Area of 49,049 square feet), and 12 parking spaces on 9 Slocumb Place (Lot Area of 18,731 square feet).

The parcels are not located within any wetlands or floodplains. A flood zone map is included in Appendix A. No construction activities, equipment or supplies associated with the project, are anticipated to extend beyond the parcel boundaries.

METHODOLOGY

This stormwater drainage evaluation is submitted to document compliance with the Stormwater Management Standards.

The Natural Resources Conservation Service (NRCS), formerly known as U.S. Soil Conservation Service (SCS), methodology and the 24-hour Type III rainfall distribution were used to calculate the peak discharges for the modeled storm events under existing and proposed conditions. The HydroCAD Version 9.10 computer program was used to perform the calculations. The peak discharge under existing and proposed conditions were calculated for the 2-year through the 100-year storm event. The HydroCAD Report, and copies of calculation sheets are included as appendices to this report.

HYDROLOGIC ANALYSIS

Existing Conditions

Under existing conditions, stormwater runoff from the site flows toward adjacent properties and Slocumb Place. From the high ground located to the north, off-site stormwater runoff flows south into the property. Soil types were obtained from the NRCS mapping website and were found to be Hydrologic Soil Group (HSG) B (See Appendix B). Tata & Howard, Inc. performed soil evaluation investigations and percolation tests in December 2017 and June 2018 to determine soil characteristics and estimate depth of high groundwater. The soil evaluation data and percolation test results are presented in Appendix C. Based on soil textures encountered at the time of testing, these areas were found to be “Sand”. To be conservative, an exfiltration rate of 4.3 inches/hour was used in the stormwater calculations for the underground storage infiltration systems.

Proposed Conditions

Under the post-development conditions, parking lots will be constructed on 9 and 11 Slocumb Place parcels with an access driveway to Slocumb Place. Due to topographic constraints, the runoff from the new driveway (sub-watershed 1S-3) will flow to the open-bottom catch basins and the public right-of-way (Slocumb Place). Figures 2A and 2B show existing flow directions and land use for each sub-watershed. To accommodate the site configuration, two separate stormwater management systems will be constructed. Both systems have been designed to store and infiltrate up to and including the 100-Year design storm. No emergency overflow will connect to the public stormwater system. The stormwater runoff from the landscaped areas between the edge of the proposed pavement and the property lines will flow overland out of the properties similar to existing conditions. Figures 3A and 3B show proposed flow directions and land use for sub-watersheds. The runoff from sub-watershed 1S-3 and paved areas on 11 Slocumb Place will be routed into Deep Sump (hooded) Catch Basins for required pre-treatment and then the flow will be directed into 88.25’ x 59.00’ Underground Storage Unit No. 1 (with 10,844.35 cubic feet of storage volume provided) comprised of Cultec R-280HD chambers (see attached calculations and plans for more details). The runoff from 9 Slocumb Place will be directed into Deep Sump (hooded) Catch Basins for required pre-treatment and routed into 57.92’ x 38.00’ Underground Storage Unit No. 2 (provided storage volume of 4,534.12 cubic feet).

Hydrologic Parameters

Drainage Areas: The existing and proposed drainage areas were delineated using field surveyed contours of the site and the FEMA 2011 Lidar Contours acquired from the National Oceanic and Atmospheric Administration (NOAA) for the portion of the watershed off site. The field topographic survey of the site was performed by Colonial Engineering in December 2017. The drainage area tributary to the point of interest (Analysis Points 1 to 9) range from is 0.03 to 0.54 acres under existing conditions. The drainage areas are 0.90 and 0.29 acres for the proposed Underground Storage Unit No. 1 (sub-watershed 1S-1 and sub-watershed 1S-3) and Underground Storage Unit No. 2 (sub-watershed 2S-1), respectively. The watershed maps are shown on Figure 2B, page 7, and Figure 3B, page 9, for existing conditions and proposed conditions respectively.

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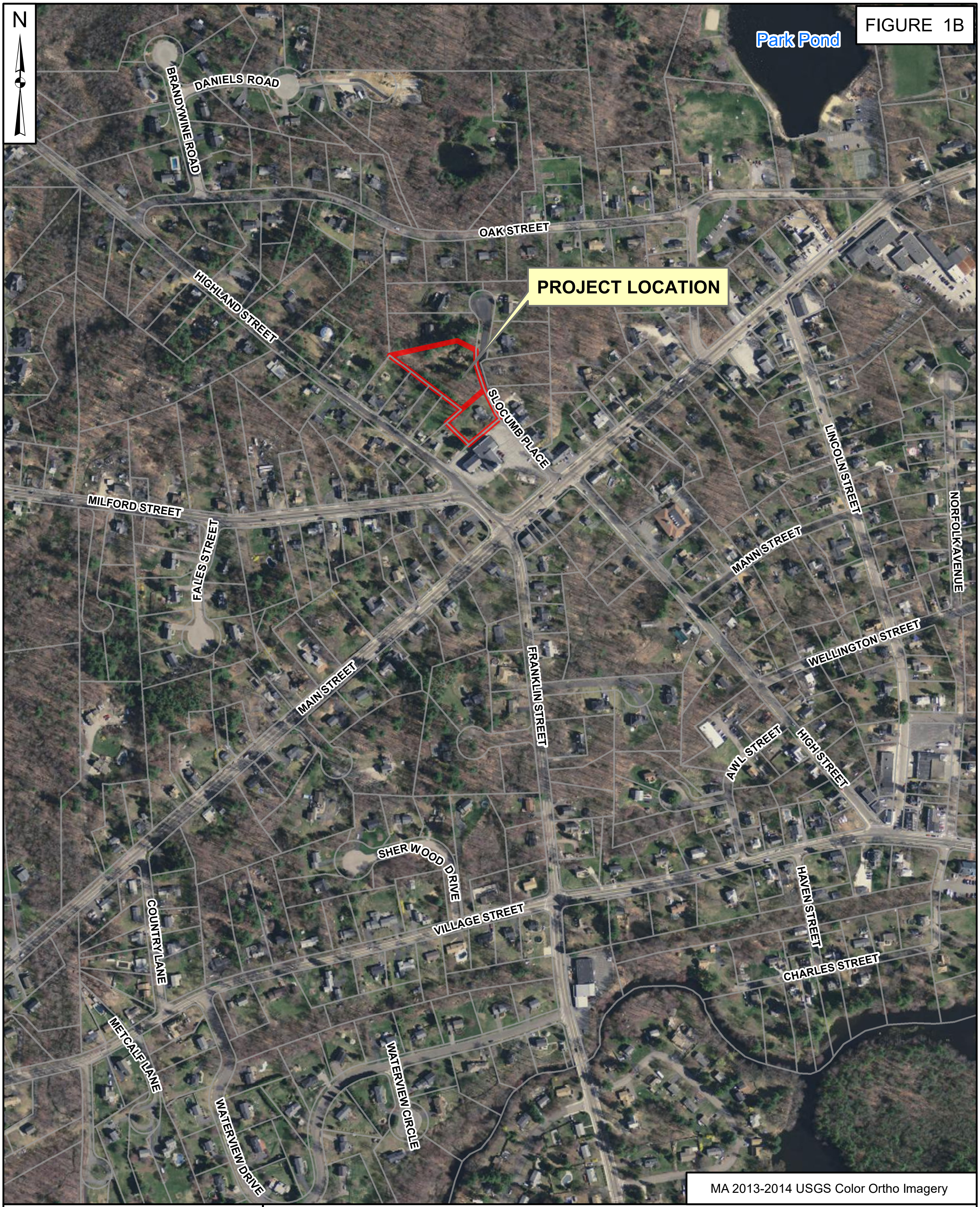
Scale: 1 " = 1,000 ' July 2018

Location Map

PARKING IMPROVEMENTS / MINOR SITE PLAN APPLICATION
9 & 11 SLOCUMB PLACE, MEDWAY, MA 02053

Medway Community Church



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Scale: 1 " = 500 '

July 2018

Aerial Photograph

PARKING IMPROVEMENTS / MINOR SITE PLAN APPLICATION
9 & 11 SLOCUMB PLACE, MEDWAY, MA 02053

Medway Community Church

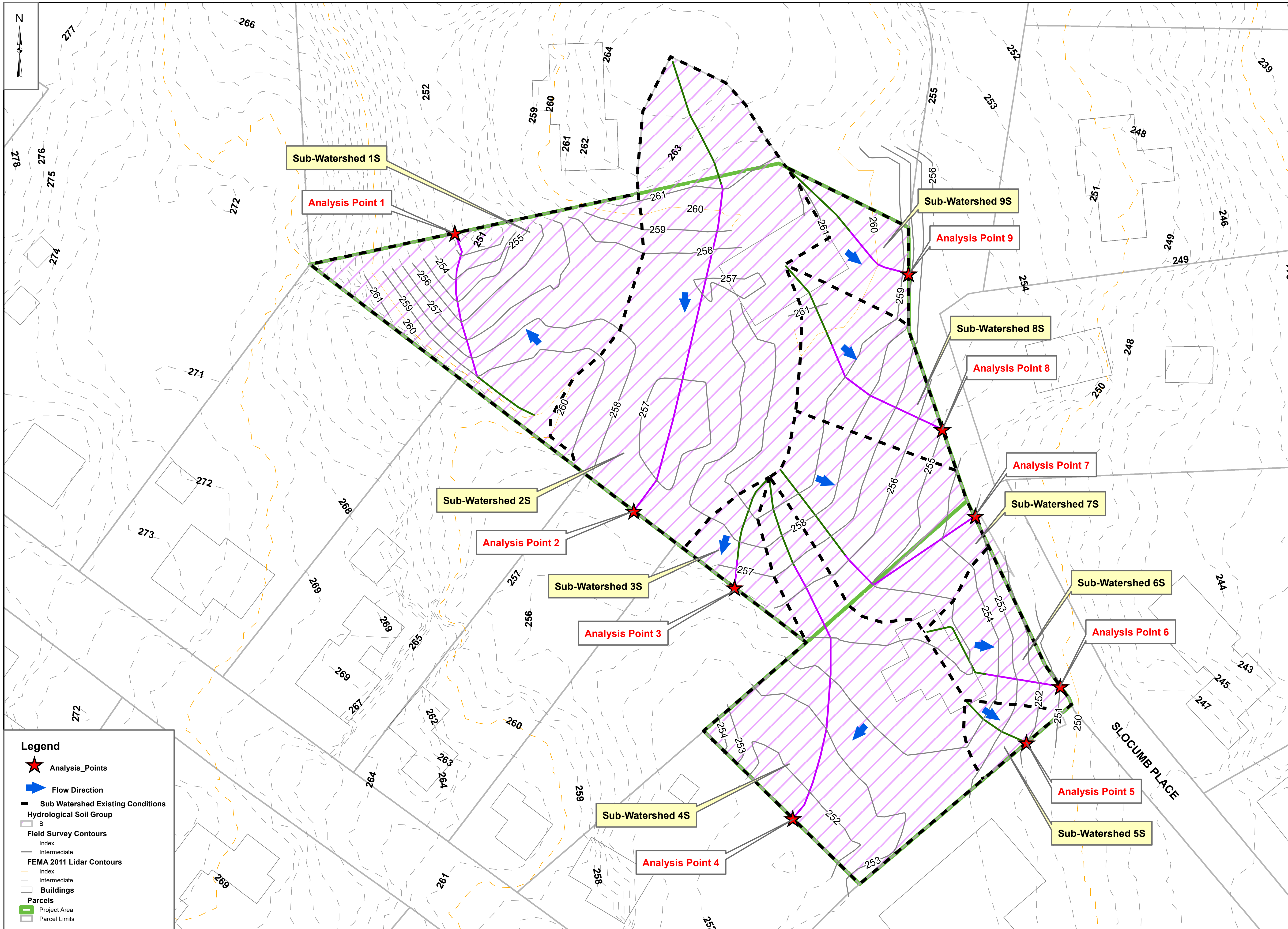

Figure No.
2A

PARKING IMPROVEMENTS/ MINOR SITE PLAN APPLICATION
9 & 11 SLOCUMB PLACE, MEDWAY, MA 02053

EXISTING CONDITIONS - TC FLOWPATHS

Medway Community Church

TATA & HOWARD

July 2018

Scale: 1":50'

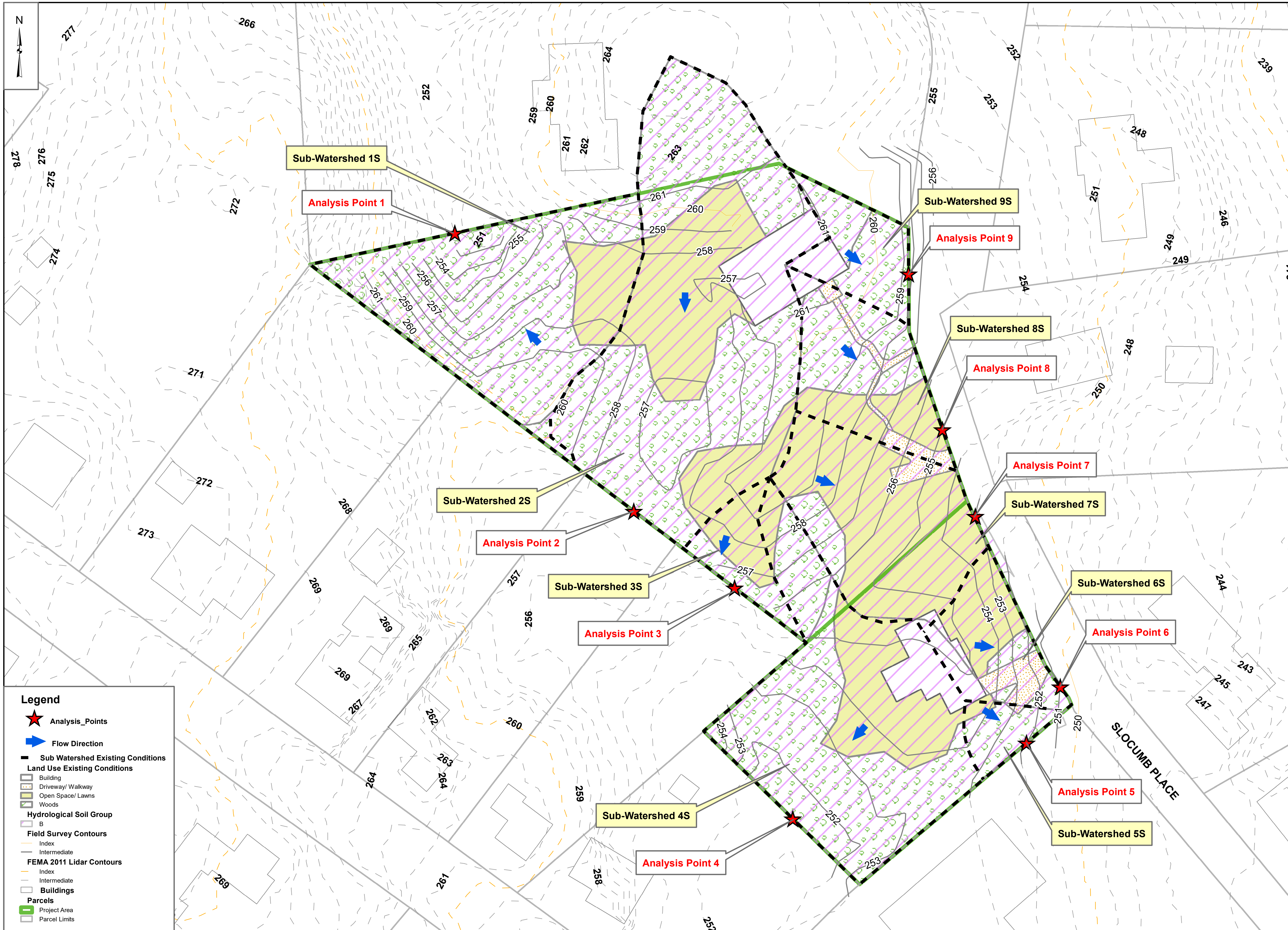

Figure No. 2B

PARKING IMPROVEMENTS/ MINOR SITE PLAN APPLICATION
9 & 11 SLOCUMB PLACE, MEDWAY, MA 02053

EXISTING CONDITIONS - LAND USE

Medway Community Church

TATA & HOWARD

Scale: 1":50'

July 2018

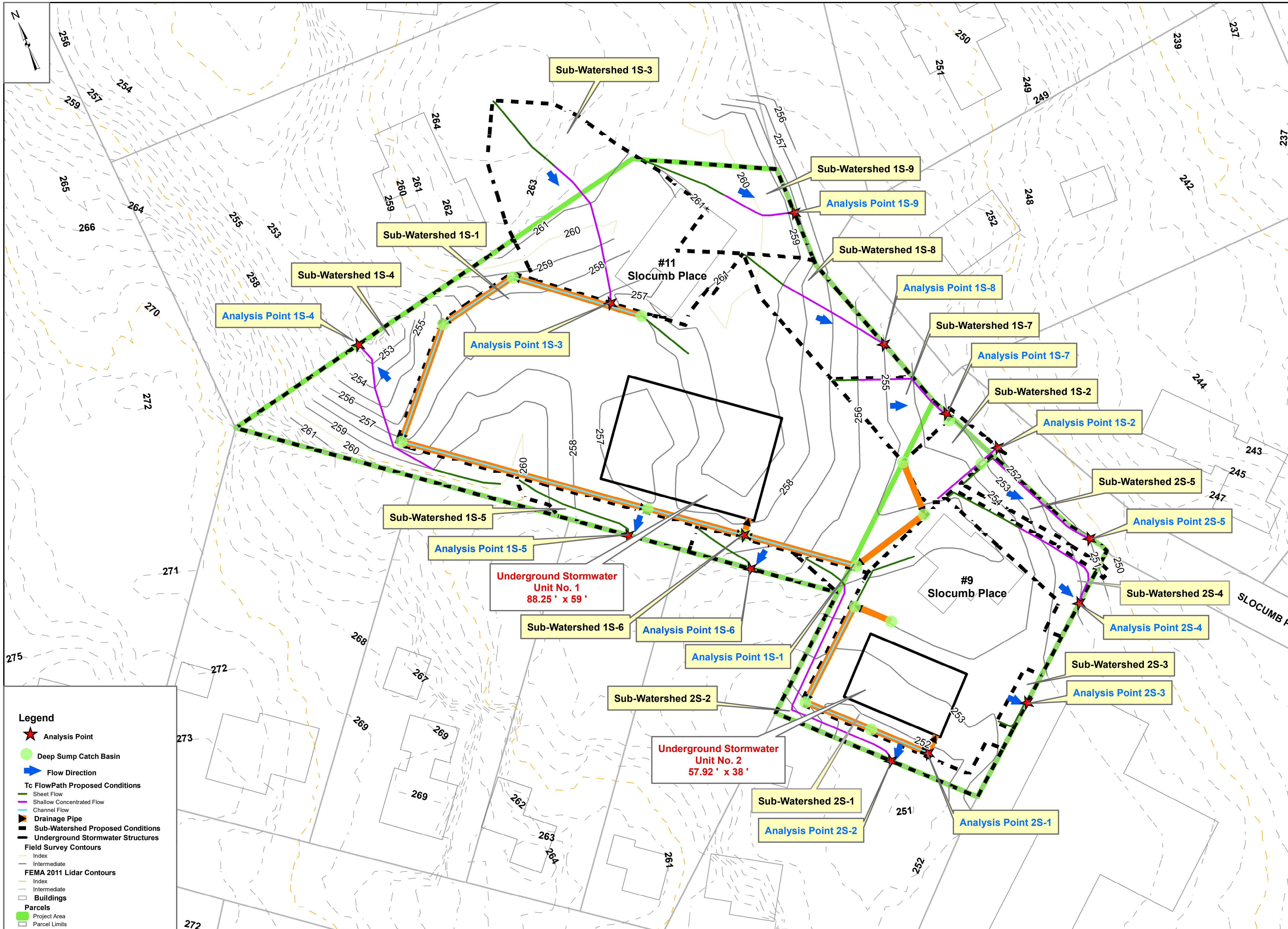

Figure No.
3A

PARKING IMPROVEMENTS/ MINOR SITE PLAN APPLICATION
9 & 11 SLOCUMB PLACE, MEDWAY, MA 02053

PROPOSED CONDITIONS - TC FLOWPATHS

Medway Community Church

TATA & HOWARD

Scale: 1":50'

July 2018

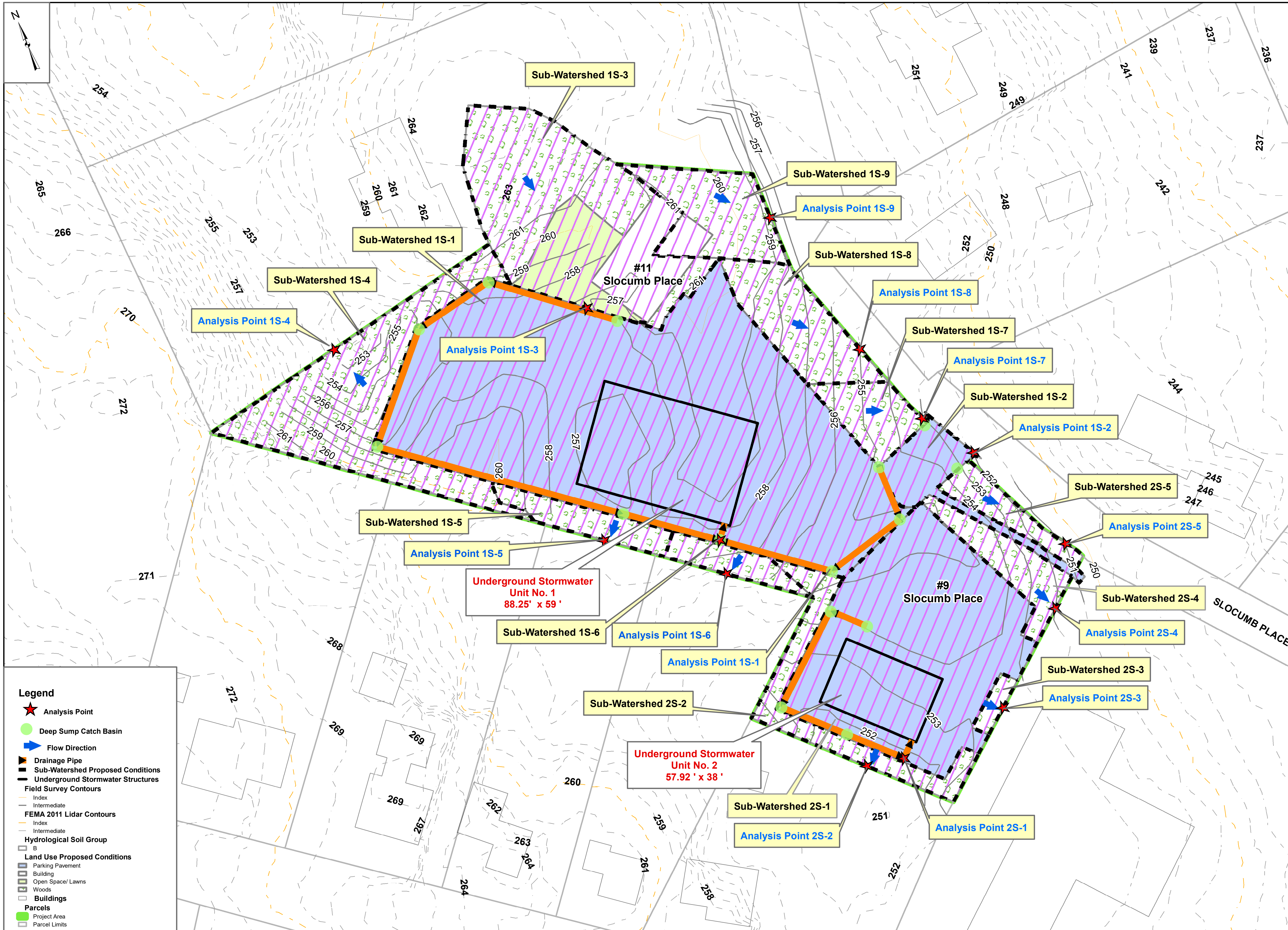

Figure No.
3B

PARKING IMPROVEMENTS/ MINOR SITE PLAN APPLICATION
9 & 11 SLOCUMB PLACE, MEDWAY, MA 02053

PROPOSED CONDITIONS - LAND USE

Medway Community Church

TATA & HOWARD

Scale: 1":50'

July 2018

Time of Concentration: The time of concentration is defined as the time for runoff to travel from the hydraulically most distant point in the watershed to the Analysis Point within the watershed. The time of concentration for the watersheds were calculated using procedures developed by the NRCS. A minimum value of 6 minutes was adopted for the time of concentration. The time of concentration calculated for the existing conditions sub-watersheds ranges from 6 minutes to about 14 minutes. For the proposed conditions watersheds, the time of concentration of about 10 minutes and 6 minutes were computed for sub-watershed 1S-1 and sub-watershed 2S-1, respectively. The time of concentration flowpaths for each sub-watershed are shown on Figure 2A, page 6, and Figure 3A, page 8, for the existing conditions and proposed conditions respectively.

Runoff Curve Number: Runoff curve numbers were calculated for existing and proposed conditions. The soil parameters were obtained from the NRCS Soil Survey Geographic (SSURGO) dataset. The runoff curve numbers were calculated for the drainage area tributary to the Analysis Points 1 to 9; the values range from 61 to 77 under existing conditions. For the proposed conditions, runoff curve numbers of 98, 98 and 69 were calculated for sub-watershed 1S-1, 1S-2, and 1S-3, respectively. A runoff curve number of 98 was calculated for sub-watershed 2S-1.

Rainfall Data: Information from the Northeast Regional Climate Center (NRCC) Extreme Precipitation in New York and New England web site was used to estimate the 24-hour rainfall totals for the watersheds. The 24-hour rainfall totals for the storms evaluated in this Report are summarized in Table No. 1, below:

Table No. 1

Return Frequency	24-Hour Rainfall Total
2-year	3.24
5-year	4.08
10-year	4.86
25-year	6.13
50-year	7.31
100-year	8.73

The proposed Underground Storage Units No. 1 and No. 2 have storage volume of 10,844.35 cubic feet and 4,534.12 cubic feet, respectively.

The calculated drainage areas, times of concentration, runoff curve numbers, rainfall data, and Underground Storage Units parameters were inputted into the HydroCAD computer program to calculate the runoff hydrographs and perform the routing.

The HydroCAD model input and output for the existing and proposed conditions are included in Appendix A and Appendix B of this Report, respectively.

COMPLIANCE WITH STORMWATER MANAGEMENT STANDARDS

The 2008 DEP Stormwater Management Standards are listed below. For each standard, the impact of the proposed construction is described in italics.

Standard 1 – No New Untreated Discharges

No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

No Discharge to or adjacent to Wetland Resource Areas.

Standard 2 – Peak Rate Attenuation

Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

Post-development peak discharge rates do not exceed pre-development peak discharge rates. The infiltration structures are designed to significantly attenuate the peak discharges under proposed conditions.

Standard 3 – Groundwater Recharge

Loss of annual recharge to groundwater shall be eliminated or minimized with infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

Refer to Appendix F for Required Recharge Volume Computation.

Standard 4 – Water Quality

Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:

a. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;
b. Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and
c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

1. *Required Water Quality Volume:*

   Refer to Appendix K for Required Water Quality Volume.

2. *TSS Removal:*

Refer to Appendix L for Total Suspended Solid (TSS) Removal Computation.

Standard 5 – Land Use with Higher Potential Pollutants Loads (LUHPPL)

For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated there under at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

Not Applicable. The proposed project does not constitute a Land use with Higher Potential Pollutant Load (LUHPPL) as defined by 310 CMR 10.04 and 314 CMR 9.02 and the Policy.

Standard 6 – Critical Areas

Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

Not Applicable. The proposed project does not discharge to any critical areas.

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

A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

Not Applicable. The proposed project does not constitute a redevelopment project.

Standard 8 – Construction Period Pollution Preventions and Erosion and Sedimentation Control

A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

See Erosion & Sediment Control Detail, Drawing No. C-6.

Standard 9 – Operation and Maintenance Plan

A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

See Stormwater Operation and Maintenance Plan. (Appendix M)

Standard 10 – Prohibition of Illicit Discharges

All illicit discharges to the stormwater management system are prohibited.

No illicit discharges are anticipated on site and will not be allowed. An "Illicit Discharge Compliance Statement" is supplied within the Long-Term Operation and Maintenance Plan.

CONCLUSIONS

The HydroCAD results for the existing conditions at Analysis Points 1 to 9 are summarized in Summary Table A on page 15 for the 2-year storm to 100-year storm event under existing conditions.

The proposed site improvements project would increase the impervious coverage on the site resulting in an increase in the peak discharge rate during a storm event. The underground storage units No. 1 and No. 2 are designed to store and infiltrate the runoff for the storm events evaluated up to 100-year. No emergency overflow connection is proposed to the public stormwater system. Due to topographic constraints, the runoff from the new access driveway (sub-watershed 1S-3) will flow to the open-bottom catch basins and public right-of-way (Slocumb Place).

The proposed underground storage units No. 1 and No. 2 have storage volume capacties 10,844.35 cubic feet and 4,534.12 cubic feet, respectively. The provided storage volume is greater that the required recharge volume of 851 cubic feet and 368 cubic feet for underground storage units No. 1 and No. 2, respectively.

The HydroCAD results for the proposed conditions are given in Summary Table B on page 16.

<u>Summary Table A</u>: HydroCAD Results for Existing Conditions

Analysis Point	Sub-Watershed			Peak Discharge (cfs) by Return Frequency					
	Drainage Area (sq.ft)	Runoff Curve Number	Time of Concentration (min)	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Analysis Point 1	13,032	61	9.3	0.09	0.22	0.36	0.63	0.90	1.25
Analysis Point 2	23,422	66	12.7	0.27	0.52	0.79	1.26	1.74	2.34
Analysis Point 3	2,091	65	6.0	0.03	0.05	0.08	0.13	0.19	0.25
Analysis Point 4	15,585	65	8.3	0.19	0.37	0.57	0.93	1.28	1.74
Analysis Point 5	1,328	62	6.7	0.01	0.03	0.04	0.07	0.10	0.14
Analysis Point 6	3,688	77	6.0	0.12	0.18	0.25	0.36	0.46	0.58
Analysis Point 7	8,710	69	9.9	0.14	0.26	0.37	0.57	0.77	1.02
Analysis Point 8	5,536	69	6.0	0.11	0.19	0.27	0.42	0.56	0.74
Analysis Point 9	2,996	66	14.3	0.03	0.06	0.10	0.15	0.21	0.29

<u>Summary Table B</u>: HydroCAD Results for Proposed Conditions

1. All Sub-watersheds

Analysis Point	**Sub-Watershed**			**Peak Discharge (cfs) by Return Frequency**					
	Drainage Area (sq.ft)	**Runoff Curve Number**	**Time of Concentration (min)**	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Analysis Point 1S-1	29,211	98	10.1	1.85	2.34	2.79	3.53	4.21	5.04
Analysis Point 1S-2	1,900	98	6.0	0.14	0.17	0.21	0.26	0.31	0.37
Analysis Point 1S-3	10,130	69	8.8	0.17	0.31	0.45	0.69	0.93	1.23
Analysis Point 1S-4	6,894	69	9.3	0.12	0.21	0.30	0.46	0.62	0.82
Analysis Point 1S-5	1,404	69	11.8	0.02	0.04	0.06	0.09	0.12	0.16
Analysis Point 1S-6	1,054	69	7.2	0.02	0.03	0.05	0.08	0.10	0.14
Analysis Point 1S-7	1,616	69	6.0	0.03	0.05	0.08	0.12	0.16	0.22
Analysis Point 1S-8	3,015	69	6.0	0.06	0.10	0.15	0.23	0.31	0.40
Analysis Point 1S-9	2,990	73	16.4	0.06	0.09	0.13	0.19	0.25	0.32
Analysis Point 2S-1	12,596	98	6.0	0.91	1.15	1.37	1.74	2.07	2.48
Analysis Point 2S-2	2,453	69	6.5	0.05	0.08	0.12	0.18	0.24	0.32
Analysis Point 2S-3	342	69	6.0	0.01	0.01	0.02	0.03	0.03	0.05
Analysis Point 2S-4	1,778	69	11.2	0.03	0.05	0.07	0.11	0.15	0.20
Analysis Point 2S-5	1,175	69	6.0	0.02	0.04	0.06	0.09	0.12	0.16

2. Existing Conditions & Proposed Conditions without Underground Storage Units Compare

Sub-Watershed	Description	Peak Inflow (cfs) Return Period 2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Sub-Watershed 1S (Slocumb # 11)	Existing Conditions	0.67	1.30	1.97	3.16	4.37	5.89
	Proposed Conditions	2.47	3.00	4.22	6.00	7.01	9.00
Sub-Watershed 2S (Slocumb # 9)	Existing Conditions	0.32	0.58	0.86	1.36	1.84	2.46
	Proposed Conditions	1.02	1.33	1.64	2.15	2.61	3.21

3. Existing Conditions & Proposed Conditions with Underground Storage Units Compare

Sub-Watershed	Description	Peak Inflow (cfs) Return Period 2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Sub-Watershed 1S (Slocumb # 11)	Existing Conditions	0.67	1.30	1.97	3.16	4.37	5.89
	Proposed Conditions	0.45	0.69	0.98	1.43	1.87	2.43
Sub-Watershed 2S (Slocumb # 9)	Existing Conditions	0.32	0.58	0.86	1.36	1.84	2.46
	Proposed Conditions	0.11	0.18	0.27	0.41	0.54	0.73

4. Proposed Underground Storage Units

Sub-Watershed	Return Period 2-Year Peak Inflow (cfs)	2-Year Volume (cf)	5-Year Peak Inflow (cfs)	5-Year Volume (cf)	10-Year Peak Inflow (cfs)	10-Year Volume (cf)	25-Year Peak Inflow (cfs)	25-Year Volume (cf)	50-Year Peak Inflow (cfs)	50-Year Volume (cf)	100-Year Peak Inflow (cfs)	100-Year Volume (cf)
Underground Storage Unit No. 1 *Sub-Watersheds 1S-1 & 1S-3* *(Slocumb # 11)*	2.02	7,998	2.65	10,473	3.24	12,821	4.22	16,718	5.14	20,394	6.26	24,867
Underground Storage Unit No. 2 *Sub-Watershed 2S-1* *(Slocumb # 9)*	0.91	3,157	1.15	4,036	1.37	4,853	1.74	6,184	2.07	7,422	2.48	8,911