STORMWATER EVALUATION

Project Location:

654 Mystic Avenue
Somerville, Massachusetts 02145

Date: April 28, 2016

Strong Civil Design, LLC (SCD) has analyzed the existing and proposed stormwater runoff conditions at the proposed residential development located at 654 Mystic Avenue, Somerville, Massachusetts. This letter provides a summary of the existing conditions, proposed conditions, methodology for analysis and results. Refer to the plans titled "Mystic Ave Residences at 654 Mystic Avenue in Somerville Massachusetts" prepared by Strong Civil Design, LLC dated April 28, 2016 for existing conditions and proposed improvement design.

Existing Conditions:
The site is a 0.224-acre developed commercial lot with a building located at the center, asphalt parking located on either side of the building with retaining walls along the western and southern boundaries, and a small riprap sloped embankment located in the southeastern portion of the lot. Surface runoff drains northernly toward Mystic Avenue and is picked up by two catch basin located along the curb line.

The site soils are classified as Urban Land by the Natural Resources Conservation Services (NRCS), and therefore do not have a specified hydrologic soil group classification. Chapter 7 of Part 630 of the National Engineering Handbook provides a methodology for classifying the hydrologic soil group based on the soils saturated hydraulic permeability, depth to groundwater, and depth to impermeable horizon. Roux Associates, Inc. performed 4 soil borings (as located on the referenced plans) on March 3, 2016. The soil borings indicated soil material, depth to groundwater, and no indication of impermeable horizon. Based on the soil descriptions within the boring report, the saturated hydraulic permeability was determined based on the values established by Rawls (as described in the MassDEP Hydrology Handbook for Conservation Commissioners). The hydrologic soil group classification for the underlying soils is "B".

Proposed Conditions:
The site will be razed and redevelopment with a residential building encompassing 55% of the lot. The proposed structure will contain a basement level parking garage, with a minimum of one foot (1') of fill placed of the its rooftop on the rear section of the structure to allow for additional landscaping and decking. The front entrances to the structure will consist of pervious pavers and landscaping. Surface runoff will continue to drain northerly around the building toward Mystic Avenue, with the driveway entrances collecting surface runoff within trench drains, that will discharge directly into the street catch basins.

The proposed decking and landscaping located on the rooftop of the parking structure will have a hydraulic soil group classification of "D" as the rooftop is the impermeable horizon within this area. All other sections of the property will continue to have a hydraulic soil group classification of "B".

Methodology:
The SCS runoff curve number method determines the depth (in inches) of runoff generated from a specific storm event by the following equation:

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

where:
Q = runoff (inches)
P = rainfall (inches)
S = potential maximum retention after runoff begins (inches)
I_a = Initial Abstraction (inches)

Initial abstraction (I_a) is all losses before runoff begins (surface depressions, water intercepted by vegetation, evaporation and infiltration). I_a is approximated by the following equation.

$$I_a = 0.2S$$

Substituting the equation for I_a into the original equation:

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

S is related to the soil and cover conditions of the watershed through the curve number (*CN*). *CN* is an empirical value ranging for 0 to 100. An appropriate *CN* value for each soil hydrologic group and ground cover condition is tabulated in the USDA "Urban Hydrology for Small Watersheds" Technical Release 55. The CN value is influenced by the hydrologic soil group classification of the underlying soils. The value of *S* related to *CN* is as follows:

Existing Surface Conditions

Surface Condition	Area (Acres)	Hydrologic Soil Group	CN Value
Building	0.036	B	98
Asphalt	0.142	B	98
Riprap	0.023	B	86
Grassed (Fair)	0.023	B	69

Weighted Average CN Value = 94

Proposed Surface Conditions

Surface Condition	Area (Acres)	Hydrologic Soil Group	CN Value
Building	0.124	B	98
Concrete	0.010	B	98
Pavers	0.011	B	86
Decks	0.021	D	94
Rooftop Landscaping	0.023	D	85
Landscaping	0.035	B	62

Weighted Average CN Value = 90

Surface Runoff Volume Comparison

Runoff Volumes (cubic feet)

Storm Event	Pre Development	Post Development	Difference
2-Year	1,973	1,694	279
10-Year	3,084	2,767	317
100-Year	4,690	4,344	346

Rainfall Depths (inches):
2-Year = 3.1
10-Year = 4.5
100-Year = 6.5

Site Area = 0.224 Acres

The Rational method determines the peak runoff rate (in cubic feet per second) generated from a specific storm event by the following equation:

$$Q = CIA$$

where:
Q = runoff (cubic feet per second)
C = runoff coefficient
I = rainfall intensity (inches per hour)
A = Area (acres)

The runoff coefficient can be converted from the CN value based on the Rossmiller Conversion Equation as described below:

$$C = (7.2\times10^{-7})CN^{3}RI^{0.05}[(0.1CN)^{0.6}]^{-S^{0.2}}(0.001CN^{1.48})^{0.15-0.1I}\left[\frac{(Imp+1)}{2}\right]^{0.7}$$

where:
C = runoff coefficient
CN = SCS curve number
RI = recurrence interval (years)
S = average watershed slope (percent)
I = rainfall intensity (inches per hour)
Imp = watershed imperviousness (decimal)

Rainfall Intensity (inches per hour):
2-Year = 4.9
10-Year = 6.5
100-Year = 9.0

Average watershed slope (percent):
Existing = 3.4
Proposed = 2.0

Runoff Coefficient

Runoff Volumes (cubic feet)

Storm Event	Pre Development	Post Development
2-Year	0.64	0.54
10-Year	0.71	0.61
100-Year	0.84	0.73

Surface Runoff Rate Comparison

Runoff Rate (cubic feet per second)

Storm Event	Pre Development	Post Development	Difference
2-Year	0.70	0.60	0.10
10-Year	1.04	0.89	0.15
100-Year	1.69	1.48	0.21

Summary:
The proposed development will result in a decrease to offsite stormwater runoff and volume impacts to Mystic Avenue.

If you have any questions please feel free to contact me at (781) 974-5844, or email me at darmstrong@strongcivil.com.

Respectfully,

Daniel R. Armstrong, P.E. LEED AP date
Principal