# Stormwater Report

Submitted: December 4, 2012

Applicant:

Wellesley Country Club
300 Wellesley Avenue
Wellesley, MA 02481

Submitted for:

Project of Significant Impact Review

Prepared by:

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**A&M PROJECT #1917-01**

**December 4, 2012**

# STORMWATER MANAGEMENT REPORT

## WELLESLEY COUNTRY CLUB – WELLESLEY, MA

*PROPONENT:*

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294 WELLESLEY AVENUE
WELLESLEY, MA 02481

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## INTRODUCTION

The purpose of this drainage report is to provide a detailed review of the stormwater runoff, both quality and quantity, as it pertains to the existing and proposed developed conditions. The report will show by means of narrative, calculations and exhibits that appropriate best management practices have been used to mitigate the impacts from the proposed redevelopment. The report will demonstrate that the proposed site development reduces the rate of runoff at the overall site runoff point during all storm events. Further, the report will show that the proposed stormwater management system complies with the ten stormwater standards as presented in the Massachusetts Department of Environmental Protection (MA DEP) Stormwater Management Regulations.

The proposed project consists of the replacement and renovation of the existing pool facility at the Wellesley Country Club. The pool area is located on the northern side of Wellesley Avenue southwest of the existing clubhouse building. The project proposes the removal of the existing pool buildings, pool, patio and appurtenant structures. The existing parking area to the west of the pool buildings will be removed and located elsewhere onsite.

The existing site is mostly developed and used for recreational purposes. This will classify the project as a mix of new development and redevelopment under the Massachusetts Stormwater standards. The project does not have a component that requires filing under the Wetlands Protection Act and the Wellesley Wetland Protection Committee. Increases in impervious surfaces will be mitigated by the use of underground infiltration systems to promote recharge to groundwater. These systems will be constructed on preformed HDPE chambers in stone envelopes that will serve to temporarily store the runoff, while allowing recharge into the ground.

## SITE LOCATION AND DESCRIPTION

The project site is located at 300 Wellesley Avenue in Wellesley, MA. The site is bounded to the south by Wellesley Avenue, Brookside Road to the east, Forest Street to the west, and Oakland Street to the north. Residential areas abut the site on all sides with conservation lands to the east along Brookside Road. The primary area of existing development is the clubhouse building surrounded by amenities including tennis courts and swimming pools. Clubhouse parking, both vehicle and golf cart is located directly in front of the main building with access to Wellesley Avenue. The site has three access points along Wellesley Avenue. Two are for club patrons while the third is used as a golf cart crossing to access fairways five through nine on the course. An existing maintenance and storage building is located to the east of the main clubhouse. An additional amenities area is located on the south side of Wellesley Avenue containing paddle ball courts and club storage facilities.

The project site falls entirely within the Business A Zone as defined by the Town of Wellesley Zoning Map as amended through June 13, 2005.

Portions of the eastern line of the site fall within buffer zones to bordering vegetated wetlands and the riparian zone to Rosemary Brook. A potential vernal pool is located on the property on the western side of Brookside Road. No work under the current application falls under the jurisdiction of the Wellesley Wetlands Protection Committee. The site was design in accordance with the Stormwater regulations and the US EPA National Pollution Discharge Elimination System regulations.

The site is bisected by two administrative boundaries. On the southern portion of the site, below fairway eight is the town line separating the Town of Wellesley from the Town of Needham. The Sudbury transmission Aqueduct runs north to south across the site. The aqueduct is owned and operated by the Massachusetts Water Resources Authority (MWRA).

The slopes of the property vary widely. In long portions of the site, slopes are generally flat sloping between 2%-5%. In other areas, steep slopes act as transition areas between course elements. In general, the property slopes from west, at a high elevation of 150'±-, to the east, at a low elevation of 80'±, towards the identified wetland areas that are tributary to Rosemary Brook.

An underlying soil report was obtained from the Natural Resources Conservation Service, formerly Soil Conservation Service, and varies across the site. The soil types include:

- *30* Raynham silt loam Hydrologic Soil Group (HSG) –C
- *51* Swansea muck Hydrologic Soil Group (HSG) –D
- *245 (B,C,D)* Hinckley sandy loam Hydrologic Soil Group (HSG) –A
- *253D* Hinckley sandy loam Hydrologic Soil Group (HSG) –A
- *254B* Merrimac Hydrologic Soil Group (HSG) –A
- *260B* Sudbury fine sandy loam Hydrologic Soil Group (HSG) –B
- *305C* Paxton fine sandy loam Hydrologic Soil Group (HSG) –C
- *310B* Woodbridge fine sandy loam Hydrologic Soil Group (HSG) –C
- *420B* Canton fine sandy loam Hydrologic Soil Group (HSG) –B
- *602* Urban Land HSG- N/A (see below)
- *626B* Merrimac-Urban Land Hydrologic Soil Group (HSG) –A
- *653* Udorthents Hydrologic Soil Group (HSG) –B

The Urban Land soil type does not have a hydrologic soil group. Following the Soil Evaluation procedure in the MA Stormwater Management Handbook, Volume 3, Chapter 1, the hydrologic capacity of the soil needs to be determined onsite. Since no area of development is proposed in this mapped area, a soil assessment was not conducted.

Allen & Major Associates, Inc. conducted test pits in December 2011 and July 2012 in the proposed areas for stormwater recharge for other projects. The sampled soils were consistently loamy sand or sand capable with percolation rates less than 2 minutes per inch. This is consistent with Hydrologic Soil Group A characteristics. Soil testing for the stormwater system within the proposed development area is currently being scheduled. However, based on familiarity with the site and its use, the soil conditions are anticipated to be the same as encountered previously. Hydrologic group 'A' is being used for this project.

A copy of the NRCS Soil Map and test pit data from 2011 and 2012 is provided in the Appendix of this report.

## EXISTING DRAINAGE PATTERNS

To demonstrate compliance with the stormwater regulations, the existing drainage patterns were analyzed at two "design points". The points were chosen based on available data and the survey information obtained in the field by Allen & Major Associates, Inc. The points were selected to determine any areas that may receive stormwater flow or be affected by the proposed project. The review was localized to the development area of the pool project.

Existing watershed plan (EW-1) illustrates the existing drainage areas and study points for the project.

The summary of the existing drainage is as follows:

1. Study Point #1 is located at an existing double catch basin located within the parking lot. Flows from this double catch basin then drain into the municipal stormwater system in Wellesley Avenue. The drainage area picks up stormwater runoff via a closed drainage collection network starting in the parking area to the west of the pool facility. The drainage area picks up the driveway, building area and hardscape for the pool. Due to the limited size of the watershed, a minimum Time of Concentration (Tc) of 6.0 minutes was assumed. The drainage area is 2.30 acres (100,188 square feet) with a weighted curve number of 83.

2. Study Point #2 is a bituminous asphalt swale that routes some surface runoff directly to the gutter line of Wellesley Avenue. This small watershed drains a portion of the existing golf cart path and some landscape area. Flow from Study Point 2 will drain easterly along Wellesley Avenue and collect into the Municipal system adjacent to Study Point 1. The watershed totals 0.03 acres (1,307 square feet) with a weighted curve number of 74. The minimum time of concentration of 6 minutes was used.

3. Study Point #3 is primarily manicured lawn area that drains to an existing waterway west of the proposed pool area. It drains uncontrolled directly into the waterway. The watershed area totals 2.17 acres (94,525 square feet) with a weighted curve number of 44. A calculated time of concentration of 23.0 minutes was used.

The following table summarizes the drainage areas:

| Drainage Area | Total Area (ac) | Curve Number | Time of Concentration |
|---|---|---|---|
| SP-1 | 2.30 | 83 | 6 min(assumed) |
| SP-2 | 0.03 | 74 | 6 min(assumed) |
| SP-3 | 2.17 | 44 | 23.0 min (calculated) |

**Table 1 – Existing Drainage Areas**

Existing Runoff flows are summarized later in this report, see the "Peak Rate of Runoff" section. See the rear of this report for a copy of the Existing Watershed Plan (EW-1).

## PROPOSED DRAINAGE PATTERNS

Proposed drainage patterns will be maintained in existing conditions. Where existing watersheds are altered by construction, the stormwater generated by the proposed structures will be recharged to groundwater to mitigate peak flows and volume.

The site improvements will comply with the standards to the maximum extent practicable by reducing the overall amount of runoff, provide recharge on the site, and create an operation and maintenance plan for the drainage system in accordance with the Massachusetts Department of Environmental Protection.

A hydrologic study of the site was conducted in order to determine the impact of the proposed development on the existing stormwater runoff. The study determined the rates of runoff at the three design points discussed in the existing conditions analysis. Below is a discussion of the drainage areas:

1. Study Point #1 – Sub-catchment areas P-1, P-2, P-3, P-4, P-5, P-8 & P-9 contribute flow to Study Point 1 under proposed conditions. These areas collect the runoff from the developed portions of the project which include the pool deck, hardscape, and sidewalks. Runoff from the building and pool deck with be collected and routed through an underground system of 66 preformed HDPE StormTech SC-310 underground chambers. The chamber system will hold

through the twenty–five year storm event. Over the twenty-five year event will bypass the underground system through a diversion structure. The overflow will then flow into the existing collection piping and towards the Study Point. Flow from sidewalks and paved driveway will be collected via catch basins and routed to the existing drainage system. Prior to entering the existing drain line, a water quality treatment unit (Stormceptor 900 or equal) will be installed capable of removing 80% of Total Suspended Solids. The units will also remove heavy metals and soluble phosphorous. Within this watershed, the minimum time of concentration of 6.0 minutes was used with a total drainage area of 2.22 acres (96,759 square feet ) and curve number of 85.

2. Study Point #2 – Sub-catchment area P-7 is the resultant area after construction. The area will continue to drain to the bituminous asphalt swale as in existing conditions. The area is modified slightly for reconfiguration of the golf cart path and sidewalks. Within this watershed, a minimum time of concentration of 6.0 minutes was used with a total drainage area of 0.10 acres (4,356 square feet) and weighted curve number of 57.

3. Study Point #3 – Sub-catchment area P-10 is the resultant area after construction. The area is largely unaffected by construction. The drainage area will be affected by the addition of a bituminous asphalt cart path. To mitigate the effect of the pavement, a stone infiltration trench will be installed on the southwest side of the walk. The stone trench will be three feet wide by two feet deep and will run parallel to the walk. The trench will infiltrate close to the one hundred year event. In the higher events, flow form the trench will discharge and flow down the existing slope towards the waterway.

| Drainage Area | Total Area (ac) | Curve Number | Time of Concentration |
|---|---|---|---|
| P-1 through P-9 | 2.22 | 69 | 6 min (assumed) |
| P-7 | 0.10 | 57 | 6 min (assumed) |
| P-10 | 1.98 | 46 | 22.8 min (calculated) |

**Table 1 – Proposed Drainage Areas**

Proposed Watershed Plan (PW-1) illustrates the watershed boundaries post-construction.

## PEAK RATE OF RUNOFF

The storm water runoff analysis of the existing and proposed conditions includes an estimation of the peak rate of runoff from various rainfall events. Peak runoff rates were developed using TR-55 Urban Hydrology for Small Watersheds, developed by the U.S. Department of Commerce, Engineering Division and the HydroCAD 8.50 computer program. Further, the analysis has been prepared in accordance with the Town of Wellesley Zoning By-law requirements as well as standard engineering practices. The peak rate of runoff has been estimated for each watershed during the 2, 10, 25, and 100-year storm events.

The stormwater runoff model shows that the proposed development reduces the rate of runoff for each design point analyzed. This is accomplished by providing subsurface infiltration systems for each building. The following table provides a summary of the estimated peak rate of runoff at each study point during each storm event.

**Study Point #1**

| | 2-Year | 10-Year | 25-Year | 100-Year |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Existing Runoff (CFS) | 4.04 | 7.44 | 9.43 | 12.13 |
| Developed Runoff (CFS) | 1.27 | 4.79 | 6.70 | 10.10 |

**Study Point #2**

| | 2-Year | 10-Year | 25-Year | 100-Year |
|---|---|---|---|---|
| Existing Runoff (CFS) | 0.04 | 0.08 | 0.11 | 0.15 |
| Developed Runoff (CFS) | 0.01 | 0.08 | 0.14 | 0.23 |

**Study Point #3**

| | 2-Year | 10-Year | 25-Year | 100-Year |
|---|---|---|---|---|
| Existing Runoff (CFS) | 0.01 | 0.16 | 0.47 | 1.10 |
| Developed Runoff (CFS) | 0.00 | 0.00 | 0.00 | 0.89 |

There is a minor increase in peak flows at Study Point #2 during the 25 and 100-year storm. Since flow from this point combines with flow from Study Point 1, the increased effect is offset by the large reduction at Study Point #1 and is considered negligible.

The HydroCAD worksheets and hydrographs are included in the "HydroCAD Worksheets" Section of this report.

## METHODOLOGY

The peak rate of runoff was determined using techniques and data found in the following:

1. Urban Hydrology for Small Watersheds – Technical Release 55 by the United States Department of Agriculture Soils Conservation Service, June 1986. Runoff curve numbers and 24-hour precipitation values were obtained from this reference.

2. HydroCAD© Stormwater Modeling System by HydroCAD Software Solutions LLC, version 8.50, 2007. The HydroCAD program was used to generate the runoff hydrographs for the watershed areas, to determine discharge/stage/storage characteristics for the infiltration systems, to perform drainage routing and to combine the results of the runoff hydrographs.

3. Soil Survey of Norfolk County Massachusetts, by United States Department of Agriculture, Natural Resources Conservation Service. Soil types and boundaries were obtained from this reference.

## STORMWATER MANAGEMENT STANDARDS

The proposed project is designed to meet or exceed all of the Stormwater Management Standards as determined by MassDEP to the maximum extent practicable. A description of each standard and if it is met is below.

**Standard #1 – No New Untreated Discharges or Erosion:**
Discharge points will remain unchanged from pre-construction to post-construction. No new discharges are created. Existing discharges off the site currently drain through well-established areas with vegetation and no signs of erosion.

**Standard #2 – Peak Rate Attenuation:**
Calculations have been provided to show that the proposed redevelopment will not cause an increase in peak discharge rates. Refer to the HydroCAD calculations provided within this report for detailed breakdowns of each study point.

**Standard #3 – Recharge to Groundwater:**
In order to meet this standard the "post-development site shall approximate the annual recharge from the pre-development conditions". Under existing conditions, recharge is only attained through the large amounts of green space on the property. Under proposed conditions, recharge is provided for the impervious areas being introduced based on the table below:

| **Hydrologic Group Volume to Recharge (x Total Impervious Area)** | |
|---|---|
| Hydrologic Group | Volume to Recharge x Total Impervious Area |
| A | 0.60 inches of runoff |
| B | 0.35 inches of runoff |
| C | 0.25 inches of runoff |
| D | 0.10 inches of runoff |

The required recharge volume is given by the following equation:

$R_v$ = F x IA (Equation 1 Stormwater Handbook Volume 3)

where $R_v$ = Required Recharge Volume, $ft^3$
F = Target Depth factor (Hydrologic Group A)
IA = Impervious drainage area

For the post-developed watershed, 29,934 sf of impervious surface will be constructed.

$R_v$ = F x IA
= (0.60 inches)(12 inches/foot)(29,934 square feet)
=1,496.7 cubic feet

1,568 cubic feet of available storage is provided in the underground system. An additional 1,655 cubic feet of recharge volume is provided in the infiltration trench.

The infiltration system is based on the Static Method of calculation as outlined in the Stormwater Management Handbook).

The system drawdown time is defined as:

$Time_{drawdown} = R_v / (K)(bottom\ area)$

where $R_v$ = Required Recharge Volume, ft3
K =Saturated Hydraulic Conductivity (Rawls table)
Bottom area =bottom area of recharge structure

With a bottom area of 21.50' x 80.3'

=1,497 $ft^3$ / (8.27 in/hour)(1,726 s.f.)(1ft/12 in)
=1.26 hours (<72 hours drain time = ok)

A capture area adjustment is not required as all stormwater is treated through stormwater controls.

Therefore, this standard has been met.

**Standard 4 – Water Quality:**

An 80% Total Suspended Solids (TSS) removal rate is required for the project. Removal rates are based on the following:

*BMP Removal Rates:*
BMP Removal rates were obtained from the Stormwater Management Handbook. Proprietary devices were based on the MASTEP database: www.mastep.net. Each developed drainage area will utilize the same treatment train approach.

Each area shall include:

Street Sweeping = 5%
Deep Sump Catch Basins = 25%
Stormceptor STC-900 Separator = 81%

*TSS Removal Calculation:*

| | | |
|---|---|---|
| Street Sweeping: | 1.0 x 5% = 0.05 | 1-.05 = .95 |
| Deep Sump Catch Basins: | 0.95 x 25% = 0.24 | 0.95 - .24 = .71 |
| Water Quality Unit*: | 0.71 x 77% = 0.55 | 0.71 - .55 = .16 |

1 – 0.16 = 0.84 or 84% TSS Removal.

Therefore, this standard has been met.

*The manufacturer of the Stormceptor STC-900 reports that a TSS removal rate of 81% is achievable. However, based on MASTEP reporting, A&M has limited the efficiency to 77% per laboratory testing.

**Standard 5 – Land Use with Higher Potential Pollutant Loads (LUHPPLs):**
The proposed project is not a Land Use with Higher Potential Pollutant Loads and therefore Standard 5 does not apply to this project.

**Standard 6 – Critical Areas**
The proposed project is not located in an area defined as a Critical Area and therefore Standard 5 does not apply to this project.

**Standard 7 – Redevelopments and Other Projects Subject to the Standards only to the Maximum Extent Practicable**
Standards are met to the maximum extent practicable as described in this section thereby meeting this Standard. The construction project decreases the rate of recharge of the existing site by recharging up to and including the 25 year storm event for all hardscape and building runoff.

**Standard 8 – Construction Period Pollution Prevention & Erosion & Sediment Control**
An Erosion Control plan has been incorporated with the design plans. Also, the project requires a Stormwater Pollution Prevention Plan under the EPA NPDES program. This will be prepared prior to construction thereby meeting this standard.

**Standard 9 – Operations and Maintenance Plan**

Refer to the Operations and Maintenance Plan included in this report.

**Standard 10 – Prohibition of Illicit Discharges**

No illicit discharges exist on site. The storm water management system proposed shall not be connected to the wastewater management system and shall not be contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease per Massachusetts DEP Storm Water Standard 10. The Illicit discharge statement is included in the appendix of this report.