PARSONS CREEK WATERSHED STORMWATER TREATMENT BMPS

prepared for the TOWN of RYE, NEW HAMPSHIRE

FEBRUARY 2014

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TOWN OF RYE, NEW HAMPSHIRE

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STORMWATER TREATMENT BMPS

FEBRUARY 2014

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PARSONS CREEK WATERSHED

STROMWATER TREATMENT BMPS

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INTRODUCTION

1.1 BACKGROUND

The Town of Rye has been awarded a Section 319 Watershed Restoration Grant through the New Hampshire Department of Environmental Service (NHDES) Watershed Assistance Section. The goals of this grant-funded project are to provide for enhanced stormwater protection measures and provide for improved septic treatment systems adjacent to Parsons Creek. The Town has been working with the NHDES and private landowners on the implementation of these efforts for several years.

The Parsons Creek Watershed covers approximately 2.3 square miles in the eastern part of the Town of Rye, New Hampshire. A watershed map of Parsons Creek is provided as Figure 1. High levels of bacteria have been identified in the Parsons Creek watershed, which drains to the popular coastal beaches at Wallis Sands in Rye. The impaired water quality affects the health of the creek, and represents a health and safety risk to recreational users of Parsons Creek and the beaches. The issue of water quality in Parsons Creek has been a concern for many years and the Town, along with local and state partners, worked to develop and implement strategies to monitor, clean up, and protect the Creek. The 2011 Parsons Creek Watershed-Based Management Plan (WBMP), developed by FB Environmental Associates, Inc. in cooperation with the Town of Rye and the NHDES Beach Program, provides specific recommendations for practices that will improve water quality within the Creek.

The Parsons Creek WBMP documents that elevated bacteria levels are primarily due to stormwater runoff from developed areas and low or malfunctioning septic systems. Bacteria levels are increased when polluted runoff is routed directly overland or through pipes into the Creek and its tributaries. The fact that the Parsons Creek watershed, according to USDA soil surveys, has numerous and extensive soil limitations for septic systems suggests that as outdated or poorly maintained systems malfunction, natural soil and landscape condition alone cannot be expected to protect surface water quality. The Parsons Creek WBMP identifies several areas within the watershed where impervious surfaces from densely developed neighborhoods drain directly into Parsons Creek, vegetated buffers between developed areas and streams are missing, and pet waste is abandoned in the environment near surface waters. Best management practices (BMPs) which address both structural and non-structural needs are critical in these areas to protect water quality.

The Town would like to employ engineered stormwater treatment BMPs in the vicinity of two identified outfalls located on Wallis Road. The first of these outfalls discharges stormwater runoff from the Appledore Avenue neighborhood directly into Parsons Creek immediately upstream of a large concrete double box culvert. The second of these outfalls discharges stormwater from the intersection of Wallis Road and Ocean Boulevard directly into Parsons Creek immediately downstream of a stone box culvert. These selected locations are shown on Figure 2.

1.2 PURPOSE OF REPORT

The goals of this grant-funded project are to provide for enhanced stormwater treatment measures, provide protection of the Creek and its tributaries, and provide for improved septic treatment systems adjacent to Parsons Creek.

The purpose of this report is to summarize the drainage analysis conducted on the selected outfalls along Wallis Road, identify potential stormwater treatment BMPs, and present recommended BMP options for each outfall location. Recommendations for stormwater treatment BMP options include an approximate location and configuration for the BMP, and an approximate cost for construction of the BMP. This report will also identify key issues and/or potential challenges associated with each option.

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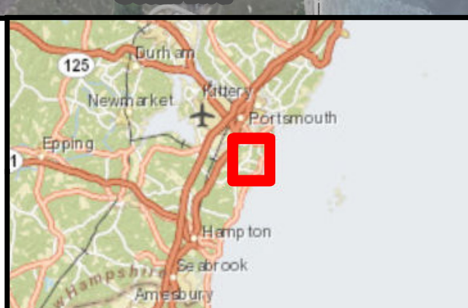
Watershed Boundary (2.3 sq. mi.)
Stream
Town Boundary

N

0 2,000 4,000 Feet



Parsons Creek Watershed

Rye, New Hampshire

PROJ NO: 12782A	DATE: Dec 2013	FIGURE: 1

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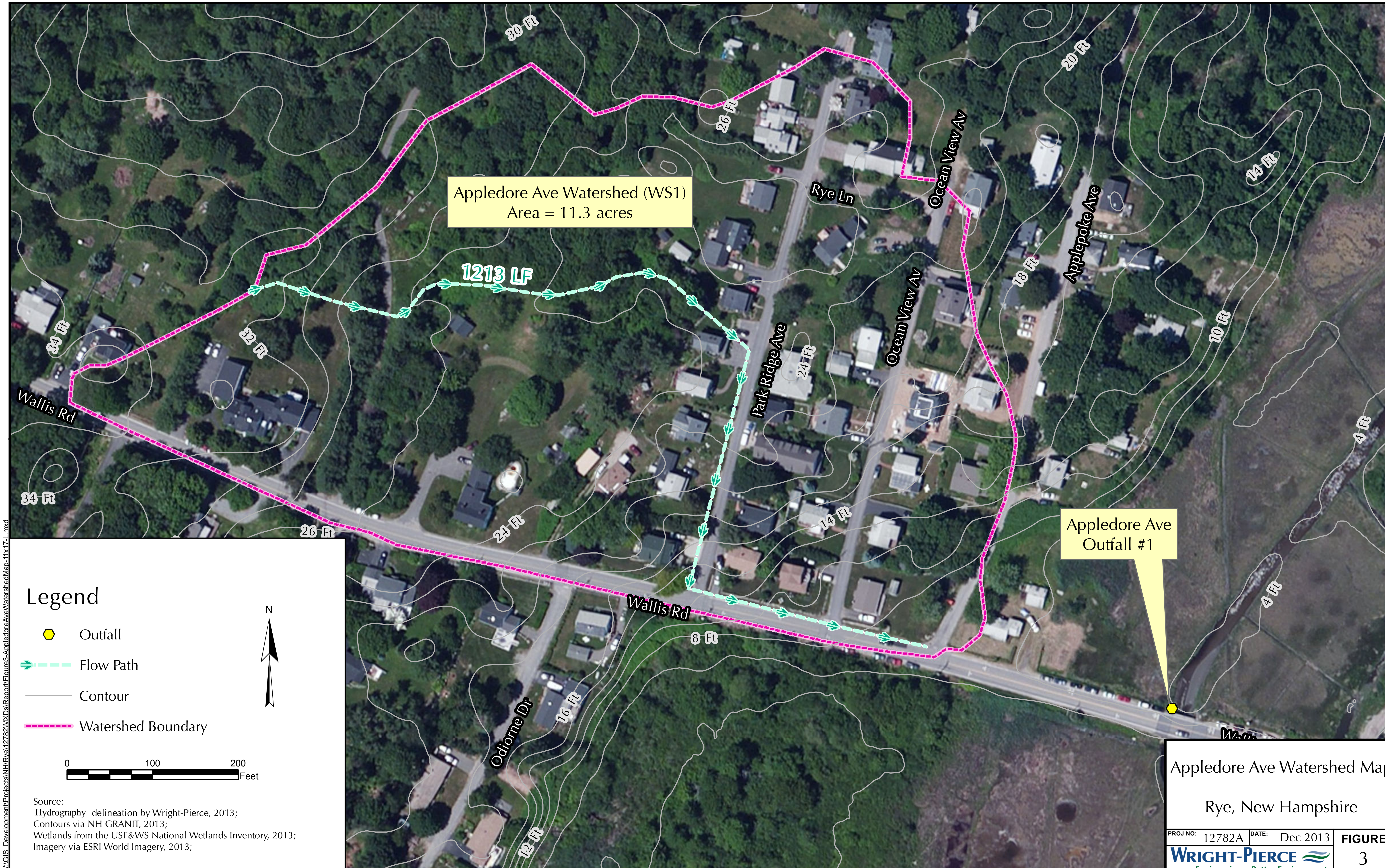
SECTION 2
HYDROLOGIC ANALYSIS

2.1 SCS TR-20 METHODOLOGY

The SCS TR-20 methodology was selected to determine stormwater flows for this report and HydroCAD (version 9.00) computer modeling software was utilized to perform the computations. This method relies heavily upon watershed characteristics and historical rainfall data to model estimated peak discharges at selected recurrence intervals. Printed results of the HydroCAD modeling and hydrologic computations are contained in Appendix B. The information utilized for these computations and resulting peak flow rates are described in the following sections.

2.2 WATERSHED CHARACTERISTICS

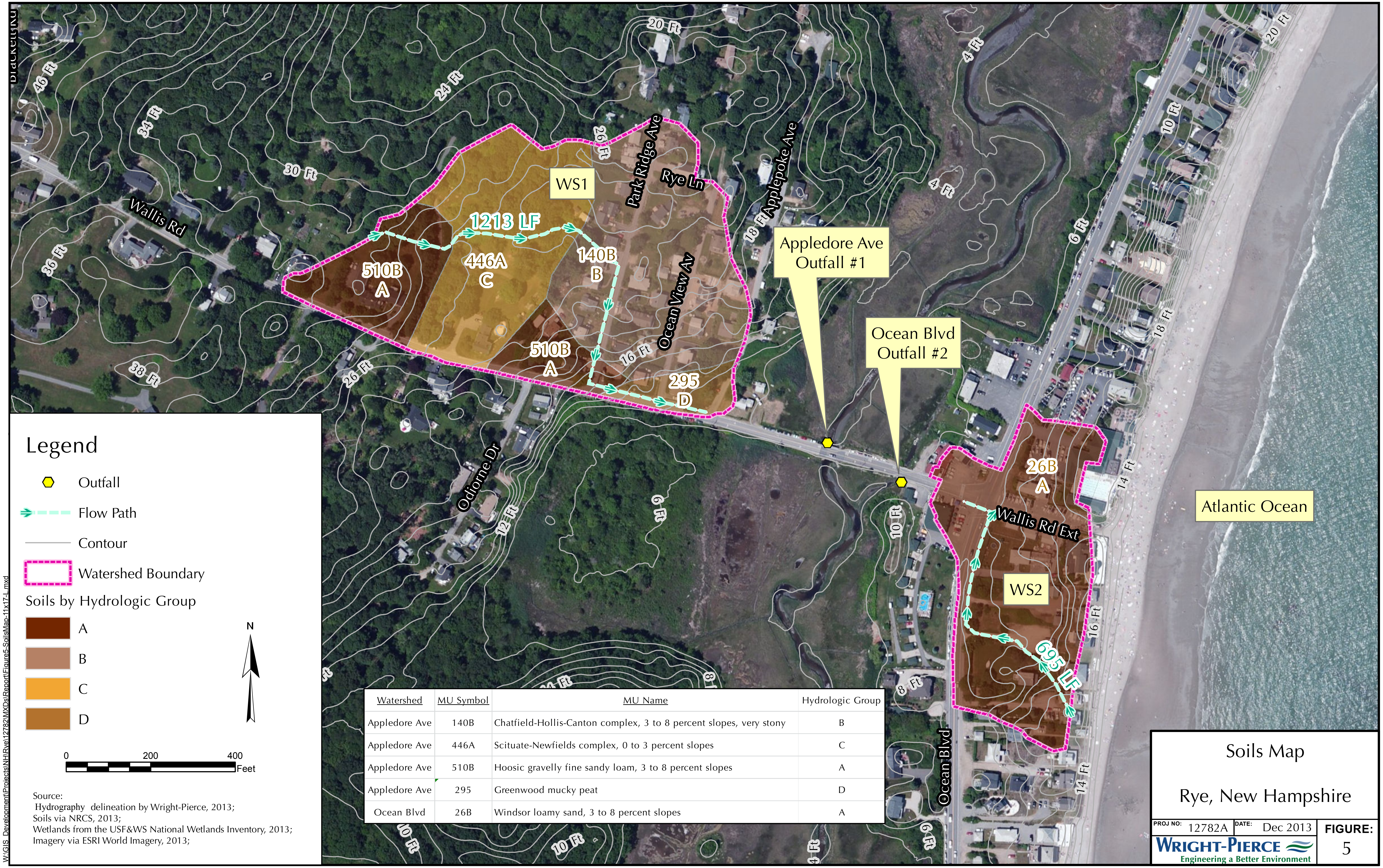
For the purposes of this study, the watershed areas tributary to each of the selected outfalls were delineated and analyzed independently. The first watershed, Appledore Ave Watershed (WS1), consists of the area surrounding Appledore Ave, Oceanview Ave, Park Ridge Ave, Rye Lane, and a section of Wallis Rd. Runoff from WS1 is collected by a series of catch basins and pipes running along Park Ridge Ave and Wallis Rd, ultimately discharging directly into Parsons Creek immediately upstream of a large concrete double box culvert. The second watershed, Ocean Boulevard Watershed (WS2), consists of the area surrounding the intersection of Wallis Rd and Ocean Blvd. Runoff from WS2 is collected by a series of catch basins and pipes located at the four corners of the intersection, ultimately discharging directly into Parsons Creek immediately downstream of an old stone box culvert. Watershed boundaries were delineated utilizing the topographic information obtained from the USGS dataset entitled LIDAR for the Northeast. From this data, contours were generated at a two-foot interval. The watershed boundaries are shown on Figures 3 and 4.



W:\GIS_Development\Projects\NH\Rye\12782\MXDs\Report\Figure3-AppledoreAveWatershedMap-11x17-L.mxd

W:\GIS_Development\Projects\NH\Rye\12782\MXDs\Report\Figure4-OceanBlvdWatershedMap-11x17L.mxd

Soil survey information within the watershed was taken from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), National Cooperative Soil Survey for Rockingham County in the State of New Hampshire. This data was obtained electronically from the New Hampshire GRANIT GIS database. Soil coverage by hydrologic soil group is shown on Figure 5.



Watershed	MU Symbol	MU Name	Hydrologic Group
Appledore Ave	140B	Chatfield-Hollis-Canton complex, 3 to 8 percent slopes, very stony	B
Appledore Ave	446A	Scituate-Newfields complex, 0 to 3 percent slopes	C
Appledore Ave	510B	Hoosic gravelly fine sandy loam, 3 to 8 percent slopes	A
Appledore Ave	295	Greenwood mucky peat	D
Ocean Blvd	26B	Windsor loamy sand, 3 to 8 percent slopes	A

Source:
Hydrography delineation by Wright-Pierce, 2013;
Soils via NRCS, 2013;
Wetlands from the USF&WS National Wetlands Inventory, 2013;
Imagery via ESRI World Imagery, 2013;

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Soils Map

Rye, New Hampshire

PROJ NO: 12782A DATE: Dec 2013 FIGURE: 5

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Computer software was utilized to compile the aforementioned watershed data and was used to delineate the watersheds and individual land coverage areas to be used in the hydrologic model. In general, each watershed was broken into three major land coverage types (impervious, landscaped and wooded) that spanned one to four major hydrologic soils groups, subsequently each of these areas was assigned an appropriate runoff curve number (CN) to allow the model to calculate a weighted curve number. Attributes associated with each of these areas are summarized below in Tables 2.1 and 2.2.

TABLE 2.1
APPLEDORE AVE WATERSHED (WS1)
DELINEATED AREAS AND RUNOFF CURVE NUMBERS

Land Use Cover	Hydrologic Soil Group (HSG)	Runoff Curve Number (CN)	Area (Acres)
Impervious	--	98	2.89
Landscaped	A	39	0.93
Landscaped	B	61	2.71
Landscaped	C	74	1.02
Landscaped	D	80	0.35
Wooded	A	30	0.94
Wooded	B	55	0.20
Wooded	C	70	2.25
TOTAL	**--**	**70**	**11.29**

TABLE 2.2
OCEAN BLVD WATERSHED (WS2)
DELINEATED AREAS AND RUNOFF CURVE NUMBERS

Land Use Cover	Hydrologic Soil Group (HSG)	Runoff Curve Number (CN)	Area (Acres)
Impervious	--	98	3.20
Landscaped	A	39	1.79
Wooded	A	30	0.09
TOTAL	**--**	**76**	**5.08**

2.3 RAINFALL DATA

Statistical rainfall data is another important input parameter to the SCS TR-20 model. As outlined by the SCS TR-20 methodology, 24-hour rainfall events were utilized. The Northeast Regional Climate Center (NRCC) has published statistical rainfall data for the northeastern United States, which was used for this analysis. The NRCC 24-hour duration rainfall data for the Town of Rye is shown, for various recurrence intervals, in Table 2.3.

TABLE 2.3

24-HOUR DURATION RAINFALL (TOTAL DEPTH IN INCHES) INTERPOLATED FOR THE TOWN OF RYE, NH

Recurrence Interval [Annual Probability]	NRCC Extreme Precipitation Analysis
2-year Event [50%]	3.25
5-year Event [25%]	4.13
10-year Event [10%]	4.94
25-year Event [4%]	6.27
50-year Event [2%]	7.51

2.4 TIME OF CONCENTRATION

The time of concentration (Tc) is defined as the time required for runoff to travel from the most hydrologically distant point of the watershed to the point of collection. For this study, the Tc for each watershed has been calculated utilizing the SCS TR-55 method. In this method, Tc is commonly determined by summing the travel time (Tt) for each consecutive flow segment along the hydraulic path. This process requires identification of the type of flow occurring in each segment as sheet flow, shallow concentrated flow, open channel flow, pipe flow or some combination of these. Primary variables affecting Tc and Tt are surface roughness, channel shape and flow patterns, and slope of the segment.

The hydraulic flow path for each of the watersheds was determined by several manual delineations and iterations. The longest hydraulic flow path was selected for use in the model. The hydraulic flow path was then separated and each segment classified as the appropriate flow segment (sheet flow, shallow concentrated flow, open channel flow, or pipe flow). Each of these variables and the resulting Tc for each watershed is included in the TR-20 modeling data contained in Appendix B.

2.5 MODELED FLOW RATES

As stated previously, the SCS TR-20 methodology was selected to prepare the flow analysis for this report and HydroCAD (release 9.00) computer modeling software was utilized to perform the computations. Printed results of the HydroCAD modeling and hydrologic computations are contained in Appendix B. Incorporating the information as described in prior sections, the peak flow rates were calculated for the two selected outfall locations under existing conditions. These peak flow rates are shown below in Tables 2.4 and 2.5.

TABLE 2.4
APPLEDORE AVE – OUTFALL #1
PEAK FLOW RATES AT SELECT RECURRANCE INTERVALS

Recurrence Interval [annual probability]	Peak Flow Rate (cfs)
2-year Event [50%]	4.10
5-year Event [25%]	6.89
10-year Event [10%]	9.61
25-year Event [4%]	14.12
50-year Event [2%]	18.40

TABLE 2.5
OCEAN BLVD – OUTFALL #2
PEAK FLOW RATES AT SELECT RECURRANCE INTERVALS

Recurrence Interval [annual probability]	Peak Flow Rate (cfs)
2-year Event [50%]	5.16
5-year Event [25%]	7.59
10-year Event [10%]	9.80
25-year Event [4%]	13.23
50-year Event [2%]	16.30

2.6 WATER QUALITY VOLUME

According to the New Hampshire Stormwater Management Manual, Volume 2, Post construction Best Management Practices Selection and Design, the Water Quality Volume (WQV) is the amount of stormwater runoff from a rainfall event that should be captured and treated to remove the majority of stormwater pollutants on an average annual basis. The recommended WQV is the volume of runoff associated with the first 1-inch of rainfall, which is roughly equivalent to capturing and treating the runoff from the 90th percentile of all rainfall. The WQV should be calculated using the following equation:

$$WQV = (P)(Rv)(A)$$

Where: P = 1 inch,

Rv = the unitless runoff coefficient, Rv = 0.05 + 0.9(I)

I = the percent impervious cover draining to the structure, in decimal form

A = the total site area draining to the structure

In order to determine the approximate design size of the proposed stormwater BMP options, the WQV was calculated for each of the selected watersheds. The WQV for each watershed is shown below in Table 2.6.

TABLE 2.6
WATER QUALITY VOLUME (WQV) SUMMARY

Watershed	**A** Total Area (acres)	**A_I** Impervious Area (acres)	**I** Percent Impervious	**R_V** Runoff Coefficient	**WQV** (cubic feet)
Appledore Ave (WS1)	11.29	2.89	0.26	0.28	11,475
Ocean Blvd (WS2)	5.08	3.20	0.63	0.62	11,400