Capisic Pond Preliminary Design Report

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COMMITMENT & INTEGRITY DRIVE RESULTS

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1. INTRODUCTION

1.1 PRELIMINARY DESIGN REPORT SUMMARY

This Capisic Pond Enhancement Plan Preliminary Design Report (Report) was prepared by Woodard & Curran in association with Boyle Associates and Regina S. Leonard landscape architecture & design, herein referred to as the "Project Team". This Report provides the project background (Section 1), rationale and design criteria (Section 2) and project specific improvements (Section 3) recommended for Capisic Pond and Park. The recommendations are based on a 30% level of design and also includes an opinion of cost (Section 4).

1.2 BACKGROUND

The Capisic Pond is the City of Portland's largest freshwater water body and the adjacent Park a favorite destination for area residents and bird watchers.

The Capisic Pond sits within a roughly 1,400 acres watershed; over the past 15 years, the City has made significant investment in improving the Capisic Brook watershed through combined sewer overflow abatement and stormwater management and planning. With recent Capisic Pond Park habitat enhancements through the West Side Interceptor Sewer Separation project and planned improvements to watershed quality under the Capisic Brook Watershed Management Plan, the development of a management plan for Capisic Pond will allow the community to realize the full benefits of this resource.

Capisic Pond is a manmade impoundment on the Capisic Brook in Portland, Maine. The Pond receives runoff from a highly urbanized watershed and its current open water is only a fraction of its historical dimensions. The Pond has a colorful history having been an integral part of the Portland area since the late 1600s, the Pond was the site of an early gristmill and sawmill. The Pond was last dredged in the 1950s, when the Pond's current dam was constructed. Modifications to the dam's overflow weir were made in the late 1990s and early 2000s to manage upstream flooding. The Pond (and adjacent wetlands) is currently designated under state law as a "moderate-value" Inland Waterfowl and Wading Bird Habitat (IWWH) by the Maine Department of Inland Fisheries and Wildlife. The adjacent Capisic Pond Park was established in 1948, and has been enjoyed by Portland area residents largely as a natural area with very few traditional park amenities, which area residents enjoy.

Over the past 20-years, the Pond, the adjacent Park, and the Capisic Brook watershed have been the subject of numerous studies and plans addressing ecology, flooding, infrastructure management, recreation, and pollution prevention. The studies have been largely focused on the Capisic Brook, combined sewer overflow abatement, and habitat enhancement of the Park area; many of the plan and study recommendations have been implemented. The primary recommendations that remain to be implemented include Open Water Management and Education Station Development. More recently, concerns have been identified regarding the discharge of stormwater runoff from a stormwater outfall near Rockland Avenue. Currently, there is no specific Capisic Pond management plan in place for ongoing management of the Pond and Park for habitat, aesthetics, or recreation. The following represents a few key findings from previous studies, reports, and public meetings:

- Since the 1950s, open water in Capisic Pond has been reduced from approximately 7.7 acres to approximately 2.1 acres, approximately 27% of its 1956 dimensions.
- For sediment removal scenarios, pond sediments do not appear to preclude beneficial reuse under current Maine Department of Environmental Protection (MaineDEP) standards.

- Capisic Pond dam weir modifications undertaken to reduce flooding above the dam have increased the overflow capacity, accommodating the passage of more water without raising the Pond's water level. The weir modifications may have increased the likelihood of cattails and other vegetation to colonize in near-shore pond sediments.
- Capisic Pond is a moderate-value IWWH area with low scores for wetland diversity, interspersion and open water. The reduction of open water is compromising the "Percent of Open Water Habitat" value and subsequently the overall value of the area as Significant Wildlife Habitat.
- The Rockland Avenue stormwater outfall discharges runoff from approximately 160-acres of highly developed residential and commercial area. Given the extensive size of the drainage area discharging runoff at the Rockland Avenue outfall, there is potential for migration of pollution and sediments into the Pond. Erosion of the channel below the outfall has been identified as a problem that will require a solution before undermining of the outfall pipe compromises infrastructure.

The following preferences were identified through the recent public meetings (February and October, 2012):

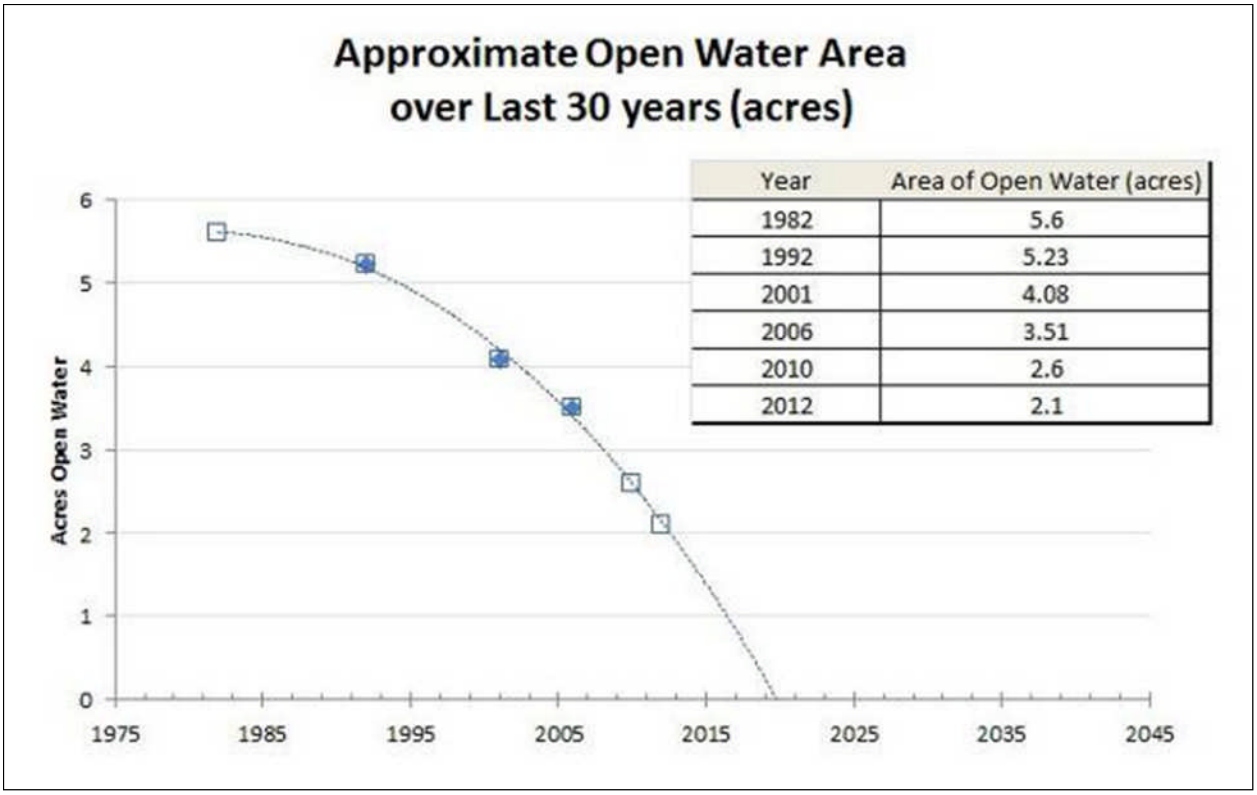
- Open Water: Pursue open water and habitat restoration by strategically removing accumulated sediments and cattail vegetation, increase open water to wetland ratios consistent with IWWH rating system, and enhance and manage wetlands for increased wetland diversity.
- Rockland Avenue Outfall: Pursue retrofits to enhance trash capture and stormwater quality treatment to the extent practicable. End of pipe stormwater treatment systems (i.e. wet pond, wetland treatment) must be context sensitive to park uses, and "upstream" management consistent with the Capisic Brook Watershed Management Plan (i.e. aggressive street sweeping, drainage system operations and maintenance, resident education on catch basin dumping) is preferable to end of pipe structural treatment solutions.
- Education Station: Education stations, including elevated platforms and signage, may not be appropriate or consistent with park uses. Utilize entrance way kiosks for educational materials associated with water resource management and Pond improvement updates.

Capisic Pond was last dredged by the City of Portland in the 1950s. There has been a marked decrease in the open water component of the Pond over the last few decades, with the majority of cattail expansion taking place within the last 10-15 years, as shown in Figure 2-1 and Figure 2-2.

As development has increased over the past 50-years in the Capisic Brook watershed, runoff into Capisic Pond has presumably increased, and sediments have built up in Capisic Pond. The sedimentation, combined with a widening of the dam weir in the late 1990s designed to alleviate upstream flooding, have reduced frequent pond water elevation changes in the pond. The shallow, slow-moving, and nutrient-rich water favors the growth of cattails (Typha spp.). Cattails are aggressive colonizers when they take hold and are often able to out-compete most other wetland plant species and form large monocultures (i.e. stands of a single plant species). The cattail stands can be very dense and help slow surface water. This causes additional sediments to settle, furthering the sedimentation of the pond and favoring additional cattail growth. While emergent marsh habitat (including cattails) is utilized by a variety of waterfowl species, a monoculture is not the most beneficial scenario, as it does not provide habitat for as wide of a variety of species as a diverse wetland habitat. Additionally, as the cattails expand, the percentage of the wetland system that is dominated by open water begins to shrink, and so does the pond's rating for wading bird and waterfowl habitat.

Figure 1-1: 2001 aerial imagery (top) compared with a 2009 image (bottom) indicates expansive growth of cattails around the pond margins and interior

Figure 1-2: Change in open water as derived from aerial photographs (1992, 2001, 2006, 2010, and 2012). Data point for 1982 was assumed.



Year	Area of Open Water (acres)
1982	5.6
1992	5.23
2001	4.08
2006	3.51
2010	2.6
2012	2.1

The pond and its surrounding habitat are currently mapped by the Maine Department of Inland Fisheries and Wildlife (MDIFW) as moderate-value Inland Wading Bird and Waterfowl Habitat (IWWH). Moderate value IWWHs are considered Significant Wildlife Habitat (SWH) under state law. This law provides additional protection for most land within 250-feet of the edge of the pond. According to MDIFW, "wading bird habitats consist of breeding, feeding, roosting, loafing, and migration areas. Wading bird breeding habitat includes upland and wetland areas used for courtship and mating, nesting, and rearing young. Feeding habitats include areas used by breeding adults, juveniles, and sub-adults or non-breeding birds. Roosting and loafing habitats include areas used for resting and overnight roosting. Migration habitat includes areas used for feeding, roosting, and loafing during spring and fall migration and post-breeding dispersal" (MDIFW, 2010).

MDIFW rates IWWHs based on five categories. For each potential habitat, points are assessed in the following categories: dominant wetland class, wetland diversity, size of the wetland, interspersion of different wetland types, and percentage of open water. All points are tallied, and a score is given to the habitat to determine its ranking as a low-, moderate-, or high-value IWWH. Capisic Pond is currently ranked as moderate value, but is trending quickly towards a low-value rating. Cattail encroachment is causing a loss of open water habitat, and is slowly leading to a degradation of the IWWH habitat and reduction of the scenic and recreational aspects of the pond. With cattail encroachment, the pond is losing its ranking points for percent open water. Table 1-1 provides an overview of the current rating of Capisic Pond.

Table 1-1: IWWH Rating System - Capisic Pond Category and Score

IWWH Characteristic	Description	Scoring Range		Capisic Pond Score
Dominant Wetland Type	Based on classification system published by MDIFW. Score based on value of type to birds.	Inland Fresh Water Marsh	6	4
		Shallow Open Water	4	
		Shrub Swamp	2	
		Bog	2	
		Meadow	2	
		Wooded Swamp or Deep Open Water	0	
Wetland Diversity	Based on number of wetland types present in the wetland complex. Each individual type must be greater than 10% of total complex.	4+ Wetland Types	3	0
		3 Wetland Types	2	
		2 Wetland Types	1	
		1 Wetland Type	0	
Wetland Size	There are six size categories.	>300 acres	5	1
		200-300 acres	4	
		100-199 acres	3	
		10-99 acres	2	
		5-9 acres	1	
		<5 acres	0	
Interspersion	A measure of the level of "edge" between wetlands and adjacent upland habitats.	Category 3	3	2
		Category 2	2	
		Category 1	1	
		Negligible Interspersion	0	
Percent Open Water	There are four categories.	35-65% Open	3	3
		10-34% or 66-90%	2	
		1-10% or 90-99%	1	
		0% or 100%	0	
High 13-18, Moderate 10-12, Low 6-9, Not an IWWH 0-5		Total Score for Capisic Pond		10

Based on IWWH Rating Form, March 2008

2. DESIGN CRITERIA AND RECOMMENDATIONS

2.1 INTRODUCTION

The intent of this section is to identify the criteria and rationale used to develop the enhancement strategy for Capisic Pond and the management strategy for the Rockland Avenue outfall. This section also includes recommendations that have been utilized for preliminary opinion of cost.

2.2 POND ENHANCEMENT

The goal of the enhancement plan is to improve the existing habitat for the variety of species that currently utilize the pond, maintain the current IWWH habitat as moderate value, and improve the aesthetic quality of the pond, while balancing the concerns of local residents and maintaining the existing character of the park; this will be achieved by sediment removal in portions of the pond to increase pond water depth, removal of the current population of cattails in selected areas and increasing the open water component of the pond. We propose the addition of riparian floodplain shrub habitats along portions of the pond margin currently dominated by shallow cattail marsh. This woody transitional wetland zone will be created from the sediments removed from portions of the Pond.

There are several approaches to cattail removal that have been evaluated for Capisic Pond, including mowing, chemical treatment, and flooding. Mowing alone has shown limited success for controlling cattails due to the cattail's ability to rebound utilizing the energy reserves in the underground rhizomes, and cattails' prolific seed producing qualities. Chemical treatment in open water systems can be difficult in part due to difficulties with applications in standing water, permitting, and public perceptions about herbicide use in public spaces. Flooding may help to reduce cattail habitat, but much of the cattail plant would first need to be removed in order to stop the oxygen transfer, and there may be upstream flooding repercussions as a result of an increased pond elevation. While flooding cut stems may control cattail expansion, it may not guarantee the reduction of cattails in shallow water depths less than two feet.

2.2.1 Open Water Enhancement Recommendation

Due to the pervasive nature and tenacious expansion of cattails, removal of both the cattails and the sediments upon which they grow, followed by a few seasons of draining, cutting, and flooding is our recommended strategy to regain and maintain open water habitat in Capisic Pond. It is our recommendation that the pond open water should be expanded to the area shown in Figure 3-2 of this Report to minimize the likelihood of future regrowth by cattails.

The current depths in the open water portion of the pond range from approximately 18-inches on the fringes to 36-inches in a few deeper pockets (with the exception of deeper areas just south of Capisic Street). Pond depths were surveyed through the use of depth measurements and sub-meter accuracy Global Positioning System (GPS) for horizontal location in September 2012. Pond bathymetry was mapped utilizing measured depths in reference to a known benchmark at the Capisic Pond dam weir.

Currently, cattail growth is primarily limited to the shallower reaches of the pond (less than two feet), with sporadic floating-mat populations in the deeper areas. Based on these existing conditions and research cited below, an average depth of three feet would be an appropriate depth for cattail exclusion; greater depths would make cattail regrowth less likely, but it would also incur more expense and impacts from the removal of additional material. Additionally, managing the depth at approximately three feet is

conducive to wading birds and waterfowl habitat; three feet will allow diving ducks to fish from the pond interior, while dabbling ducks and wading birds can still hunt and forage along the pond's edge.

The area proposed open water expansion would result in approximately four acres of open water. This open water would keep the Pond at moderate value on the IWWH scale. MDIFW lists the Capisic Pond IWWH habitat as 6.38 acres. The recommended Pond enhancement plan will create approximately 60% open water habitat within the existing wetland.

The MDIFW guidelines describe 35% - 65% open water habitat as the best habitats:

"...high value habitats can be characterized as medium to large freshwater marshes or small to medium sized freshwater wetlands with 3 or more wetland types, moderate to high wetland interspersion, and optimum amounts of open water [>35 - <65 percent]. Moderate value habitats are freshwater wetlands of moderate to large size containing a variety of wetland types with a moderate level of open water [<35 percent]." (MDIFW, 2010)

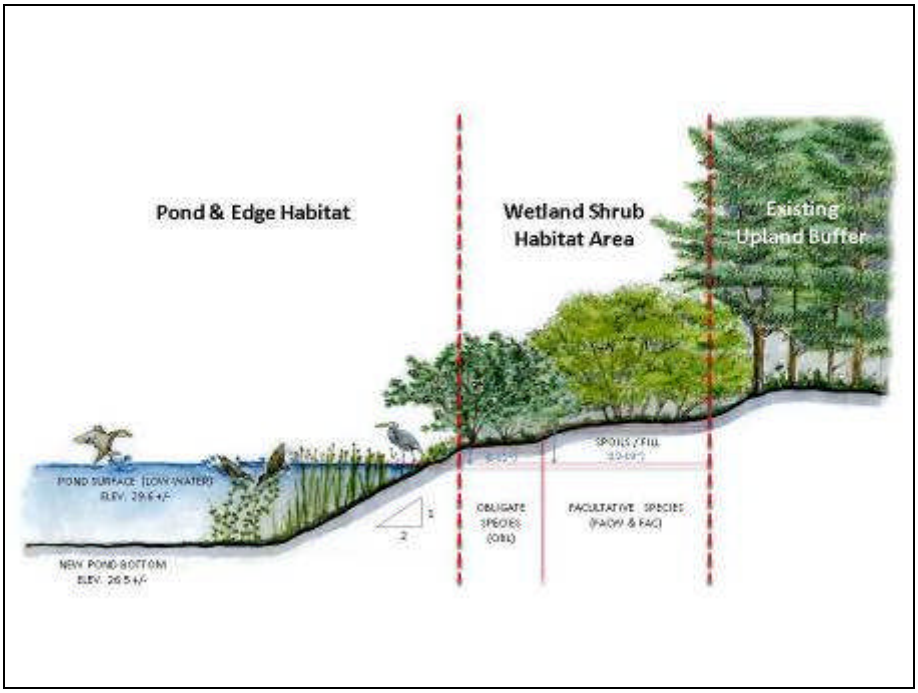
2.2.2 Wetland Diversity and Interspersion Recommendation

As described earlier, MDIFW rates IWWHs based on five categories. One of the categories, Interspersion, ranks the intermixing of various wetland types surrounding the open water component of the habitat. Another category of the ranking system is diversity of wetland types. While Capisic Pond contains a mix of wetland types (see Capisic Pond Delineation Report – Appendix A), MDIFW rates this wetland as limited to low diversity. It was noted in the wetland delineation report that shrub habitat in particular is limited within this wetland complex. Additionally, due to encroachment of the cattail monoculture, the open water portion of the marsh is largely surrounded by either cattail marsh or upland trees. In order to increase the habitat interspersion and diversity, part of our recommendation includes the addition of a dense, low-growing, woody transitional wetland zone along the western edge of the pond. An increase in woody plant density and diversity along the pond will help create habitat for feeding, nesting, and refuge for a variety of species.

The western edge of the pond is more isolated from Park use disturbances (i.e. dogs and humans) and will provide a beneficial area to increase shrub habitat surrounding the pond. Additionally, areas have been identified for shrub habitat along the eastern shore of the Pond to complement transition to upland vegetation, and where sediment removal would compromise underlying utility infrastructure (storm drain pipe).

In all cases, these wetland enhancement areas will be sited to minimize visual obstruction from Park viewpoints. Adding woody plants along this riparian area will increase wildlife habitat, improve the aesthetic qualities of the pond, and provide additional shading for the pond and marsh. In order to achieve the appropriate growing medium for shrubs, the cattails currently covering these areas of the pond will be removed, and sediments and substrate from dredged open water areas of the pond will be deposited in order to raise the elevation of the area up to 18-inches above the average elevation of the adjacent pond. This area will be covered with geotextile fabric or woven netting, and numerous native shrubs will be installed to jumpstart the new riparian habitat. Additionally, vegetative enhancement of recently installed rip-rap areas along the western shore of Capisic Pond and south of Capisic Street will be included in final design plan.

Figure 2-1: Concept for Wetland Shrub Habitat Areas



In order to achieve a dense cover and to help compete with regenerating cattails, the initial planting effort should achieve an overall density of 800 shrubs per acre in the riparian shrub transition wetland. Native woody plant species have been selected that can tolerate a range of hydrology, are resistant to pollution and wind damage, grow quickly, and that provide habitat (food and shelter) for native birds and animals. Bare root and live stakes are fairly easy to install and cost savings can be realized when ordered from suppliers in large quantities. Table 2-2 provides a list of recommended species that would be appropriate for these areas.

Table 2-1: Plant Species List

Species Common Name	Species Latin Name	Bare Root (BR)/Live Stake (LS)	Wetland Indicator
Buttonbush	Cephalanthus occidentalis	LS	OBL
Red-osier Dogwood	Cornus sericea	LS	FAC
Winterberry	Ilex verticillata	BR	FACW
Pussy Willow	Salix discolor	LS	FACW
Speckled Alder	Alnus incana var. rugosa	BR	FACW
Mountain Holly	Ilex mucronata	BR	OBL
Arrow-wood	Viburnum recognitum	BR	FACW

A mix of bare root nursery stock and live stakes will be installed across the created shrub habitat areas. Wet tolerant species will be planted in lower elevations along the pond, and drier species will be planted along the upper reaches of the slope or in mounded central locations. In areas not completely covered with geotextile fabric, a native wetland seed mixture should be applied at a rate of 18-lbs/acre following

planting. The seed mixture should be applied to loose sediments and lightly raked in once applied. Straw mulch should be applied over newly seeded areas at a rate of 70-90 pounds (about 2 bales)/ 1,000 square feet.

2.3 ROCKLAND AVENUE OUTFALL STORMWATER MANAGEMENT DESIGN

Over recent years, visitors to the park have expressed concerns to the City about the visible impacts associated with the outfall, most notably the trash and sediment that resides in the channel below the outfall, erosion that occurs along the banks of the channel during high flow/high velocity storm events, and the overall "look" of the outfall pipe and associated aluminum trash rack. Park visitors and concerned citizens have also expressed concern over what impact the stormwater discharges from this outfall has on the overall water quality of the Pond and the wildlife that relies on the habitat that the park offers.

In February 2012, project stakeholders (via public meeting) expressed a desire to identify a stormwater quality treatment retrofit for the outfall that would include the installation of both a trash capture component and a water quality treatment system below the outfall. The intent of this section of the Report is to identify retrofitting options to enhance trash capture and stormwater quality treatment.

The collection area that contributes flow to the outfall has limited stormwater quality controls primarily in the form of deep sump catch basins and Casco Traps on the outlets of many of the connected catch basins. Deep sump catch basins provide limited, non-floatable trash and sediment reduction. Casco Traps provide limited controls for floatable trash and oils and grease. Non-structural stormwater management in this watershed primarily consists of public education and outreach programs, catch basin cleaning programs, and street sweeping. The system is fully separated (with exception of low flow outlets discussed below), so the primary sources of pollutants are from runoff from roadways, yards, and parking lots. It is our understanding that the catch basins in the existing collection area for the Rockland Avenue outfall have two outlets - one lower outlet with a hydro brake to the sanitary sewer and an upper outlet to the storm drain. The low flow outlet to the sanitary sewer was not considered as a part of the hydrologic modeling evaluation as discussed in Section 2.3.1. Pollutants in stormwater can be variable and broad ranging; however, the pollutants that are visibly present at the outfall and channel include floatable and non-floatable trash and sediment. Less visible, but common, pollutants in stormwater runoff are metals, petroleum by-products, chlorides, bacterial indicators, and nutrients.

Figure 2-2: Rockland Avenue Outfall

The following is a summary of the design evaluation and recommendations to improve the Rockland Avenue Outfall.

2.3.1 Hydrologic Analysis

The first step in designing the proposed stormwater quality improvement retrofit was to analyze the hydrology of the watershed, so that the proposed system could be adequately sized to provide water quality treatment for common storm events while accommodating high flow from large or high intensity storm events. A hydrologic analysis of the watershed was therefore conducted as part of the preliminary engineering. The hydrologic analysis utilized a HydroCAD® stormwater model prepared by DeLuca-Hoffman Associates, Inc. as part of a Design Report for the City of Portland's Rockland Avenue Sewer Separation Project, dated October, 2000. The sewer separation project and outfall were constructed in 2001. Our hydrologic analysis consisted of expanding the existing model to account for additional areas that have been separated from the City's sewer system and added to the Rockland Avenue Outfall catchment area since 2001. In order to account for the additional areas that were not included in the hydrologic model prepared by DeLuca-Hoffman, additional data was obtained from the City's Geographic Information System (GIS) database, such as soil types, topography and land use.

The hydrologic model of the Rockland Avenue Outfall was created using the HydroCAD® Stormwater Modeling System by Applied Microcomputer Systems. HydroCAD® uses TR20 runoff calculation methodology. The runoff curve numbers (CN) for the subcatchments have been computed using the TR55 methodology and are included in the HydroCAD® model. The subcatchments were divided based on land use, and area measurements were used to compute a weighted (composite) CN. The CN values were calculated using hydrologic soil group data provided by the City of Portland GIS database. Time of Concentration (TC) computation for the most hydrologically remote point in each subcatchment was developed from runoff time calculations based on length, slope, and surface runoff characteristics of sheet flow, shallow concentrated flow, channel flow, and direct entry flow; a minimum TC value for any subcatchment of five minutes was utilized.

For this project, the 25-year return frequency storm of 24-hour duration was analyzed to verify pipe stormwater conveyance capacity, and the 1-inch storm was analyzed to determine an appropriate sized system for water quality treatment. A Type-III rainfall distribution was applied to these storms. To best model the interconnected impervious and developed areas of the watershed, an Antecedent Moisture Condition of III was utilized when modeling different storm events (representing saturated soils). The 25-year 24-hour precipitation measurement for Cumberland County, Maine (5.5 inches) was taken from Appendix D of the November 1995 revision of Stormwater Management for Maine: Best Management Practices, prepared by the Maine Department of Environmental Protection. A spreadsheet based hydraulic model utilizing Manning's equation was used to verify the capacity of the existing outfall. Refer to Appendix B for the spreadsheet hydraulic model calculations.

2.3.2 Trash Capture Retrofit

There are several proprietary water quality treatment systems available that can be installed below grade and upstream of the outfall to provide trash capture and sediment removal. These systems include catch basin inserts, hydrodynamic separators, end of pipe devices, baffle boxes, trash booms, and netting. After considering the various types of systems that are available, it was determined that a hydrodynamic separator or baffle box would best align with the project goals. These devices, typically housed in precast concrete vaults, are installed underground so that the structure is mostly out of site, with the exception of the top-side manhole covers that provide access to maintain and clean out the device.

Hydraulic vortex and baffle wall systems provide sediment removal without utilizing power or mechanized equipment within the structure. These structures can be installed in an on-line or off-line configuration. The term "off-line" refers to the adjacent, parallel configuration of the system to the main line of the storm drain. In an off-line configuration the runoff from storm events below a certain size or rainfall intensity would be routed into the treatment system. In either configuration, a vortex or swirling flow action or a series of baffles enhance the gravitational settling of solids entrained in the flow, separating denser particles from the flow stream and reducing the sediment load entering Capisic Pond. Various internal configurations including baffles, weirs, or screens can provide additional removal of floatable trash and other pollutants. Flows in excess of the design storm would bypass the system and continue within the storm drain.

The two proprietary system alternatives that were selected for further consideration as part of preliminary engineering for the Rockland Avenue Outfall Design project were: CONTECH's Hydrodynamic Separator and Suntree Technologies' Nutrient Separating Baffle Box. Both design alternatives are subsurface systems that can be installed upstream of the existing outfall pipe, limiting impact on aesthetics of the site where the unit is installed.

2.3.2.1 CONTECH Hydrodynamic Separator

CONTECH, a provider of proprietary stormwater pretreatment systems, was contacted on October 12, 2012, to discuss recommendations for suitable trash and sediment-focused treatment systems for the Rockland Avenue Outfall. Upon considering the site's need for sediment and debris removal in an existing 60-inch Reinforced Concrete Pipe servicing a 160 acre watershed, CONTECH recommended the installation of an off-line system and diversion structure. Based on the flows provided from the hydraulic analysis for a one inch storm event (approximately 20 cfs), and a target removal efficiency of 80% Total Suspended Solids (TSS), CONTECH's most cost-effective and space-efficient recommendation is their CDS system. According to CONTECH's preliminary recommendations, a CONTECH CDS system designed to accommodate flow from the Rockland Avenue 60-inch Reinforced Concrete Pipe (model 5678) would need to be approximately 20-feet deep.

Maintenance considerations for this type of system include quarterly inspections in the first year to monitor sediment and debris loading, followed by at minimum annual cleaning via vac-truck thereafter.

2.3.2.2 Suntree Technology Nutrient Separating Baffle Box

Suntree Technologies was also consulted on October 12, 2012, regarding their Nutrient Separating Baffle Box (NSBB) as a potential treatment system for the Rockland Avenue Outfall. Based on information provided to Suntree Technologies on the site hydraulics, Suntree recommended the installation of their on-line NSBB system for target removal efficiency of 80% TSS. Stormwater flow would not be routed off-line for treatment and head loss is minimal. Consequently, the sizing of the NSBB is based primarily on pipe size, and less on peak flows. According to Suntree Technologies' preliminary recommendations, the model anticipated to handle the Rockland Avenue stormdrain, the NSBB-10-16, would need to be a minimum of approximately 14-feet deep. An on-line system can save space by eliminating the need for additional structures. The system contains a nutrient removing screen system, an enhanced turbulence deflector system with flow spreader, and a floating skimmer system within a single structure.

Maintenance considerations for this type of system include quarterly inspections in the first year to monitor sediment and debris loading, followed by at minimum annual cleaning via vac-truck thereafter.

2.3.3 Outfall Treatment System

The MaineDEP has design criteria on several Best Management Practices (BMPs) that provide stormwater quality treatment. Given the size of the subcatchment area and the constraints of the existing outfall site, namely limited elevation between existing outfall invert and downstream pond/groundwater elevation, a system that could provide sediment settling below the invert of the outfall pipe was preferable. Many of the stormwater management systems described by MaineDEP (including subsurface wetlands) require storage and filtration of stormwater to provide treatment. A "Wet Pond" is one of the few systems in which the primary mechanism for treatment (settling) is within the permanent pool of water retained in the system. Given the site constraints, large drainage area, high velocity of flow at the outfall, and elevation differences between the outfall invert and pond/groundwater elevation, a Wet Pond system was further evaluated.

The MaineDEP Wet Pond Sizing Criteria is outlined in Chapter 4 of Volume III of the Maine Stormwater BMP Manual. The appropriate size for a Wet Pond is determined by the size of the system's subcatchment (*the Permanent Pool of a Wet Pond should be able to accommodate a volume equal to 1.5-inches multiplied by the catchment's impervious area, plus 0.6-inches multiplied by the catchment's non-impervious developed area*). Due to the large size of the subcatchment (160 acres) draining to the Rockland Avenue Outfall, the outfall site cannot accommodate a system large enough to meet the MaineDEP sizing criteria; so, the maximum size Wet Pond that the site can reasonably accommodate was determined and compared to the Wet Pond size required by MaineDEP to evaluate whether installing such a system would provide a worthwhile level of treatment. It was determined that the Rockland Avenue Outfall could reasonably accommodate a Wet Pond that would be approximately 30% of a MaineDEP standard Wet Pond. The calculations demonstrating this are contained in Appendix B of this Report.

Wet Ponds can provide moderate levels of stormwater treatment, but are less effective at pollutant removal than the filter-based types of stormwater treatment systems. As stated above, site constraints largely dictate a Wet Pond as a viable outlet treatment option and that, in order to maximize the usefulness of this system, it would require maximum use of the available space at the project location. Wet Ponds can be attractive landscaping features if designed appropriately, and if discharges to the pond area are not excessively polluted with trash, debris or sediments. Conversely, as a stormwater treatment system designed to contain and settle pollutants, these systems can retain trash, debris and sediments, can occasionally bloom with algae, become anoxic and overgrown with cattails or other noxious vegetation without maintenance. The depth of a Wet Pond is designed to provide capacity for settled solids and to reduce stormwater runoff velocities. As with any body of water, both natural and unnatural, a Wet Pond can pose a drowning hazard.

2.3.4 Rockland Avenue Outfall Design Recommendations

After review of preliminary trash capture and wet pond concepts with the public during the October 22, 2012 public meeting, it was clear that there were several concerns with the Wet Pond component of the Rockland Avenue Outfall design recommendations. However, it should be noted that the installation of a pretreatment structure alone, such as the one noted above, does not resolve the velocity and associated erosion at the outfall channel. For these reasons, we recommend moving forward with the trash capture/sediment pretreatment system and outfall channel stabilization only.

We recommend a naturalized stabilization of the channel downstream of the outfall to resolve velocity and scour issues associated with the outfall channel. The traditional angular granite rip-rap stone may not be appropriate for channel lining in the Park, as the constructed appearance of rip-rap lining goes against

the Park improvements and restoration efforts outlined in previous studies. Instead, we recommend selectively placing natural river boulders mixed with appropriate vegetation along the length of the channel to the Pond edge to soften the appearance of the channel stabilization efforts. While the stabilization effort will not result in stormwater treatment, the reduced erosion within the outfall channel will have net benefit on pollution of Capisic Pond.

Based on our review of the trash and sediment removal components of the two trash capture retrofit options, coupled with the ability for the Suntree NSBB system to be installed in an online configuration with minimal headloss, we recommend installation of the Suntree NSBB system.

2.4 POND SEDIMENTATION EVALUATION

As described within this report, Capisic Pond is a manmade impoundment which receives runoff from approximately 1,400 acres of urbanized watershed. Since last dredged about 60 years ago, it has been observed over time that the open water area of the Pond has decreased. This change in open water can be attributed to two factors, sedimentation and plant growth. The exact interrelationship of the two factors cannot be discerned, only that both have contributed to the decrease in visible pond size.

Rates of sedimentation cannot be precisely measured without extensive sampling and analysis, but it is known that the accumulation of sediment and plants which now fill the pond occurred over decades. Accurate predictions of sedimentation from history are impractical because of inherent changes to the watershed over time. The watershed has and continues to experience land use change; separation of sanitary and storm sewers has occurred; and there has been modifications made to the dam weir made in the 1990's to manage upstream flooding that have likely influenced sedimentation within the Pond.

Hydrologically, the Pond's watershed can generate ample runoff to displace the Pond's water volume during many precipitation events. Based on our evaluation, a 2-inch 24 hour storm can displace the water volume in the current Pond within approximately 60 minutes. Although lesser precipitation amounts increase the retention time within the Pond, the relatively short duration of stormwater detention in Capisic Pond diminishes opportunity for deposition of suspended particulate matter. A field sampling event supports this. Suspended sediment concentration data collected at the pond inlet and outlet on September 5, 2012 did not offer indication of sedimentation within the Pond. Outflow concentration of suspended sediment from the Pond was similar to the concentration entering the Pond.

Overall, fine particulate matter has opportunity to flush from the pond, thus would not accumulate at a rapid rate. The primary contribution to sedimentation may be bed load movement within the Capisic Brook where stream bed material slowly creeps down the channel during high velocity runoff events and perhaps to a lesser extent from road sanding practices and where discharges occur directly into Capisic Brook or Pond.

The Pond's current dam was constructed in the 1950's. A typical cross section and note contained on a 1949 plan would indicate the pond bottom was set to elevation 28' at the time it was last dredged and a water elevation of 30' established. This 2-foot dredged depth clearly created open surface water for many years. The cattail dominance which subsequently developed could be construed as sedimentation. At this time, it is our judgment that sedimentation is less a concern for ongoing Pond maintenance than cattail regrowth.

A sediment forebay, a small somewhat deeper zone at the Pond inlet, was considered in this design process. Forebays are occasionally used in stormwater detention basin settings as a means to trap a portion of the inbound sediment prior to deposition in the pond, and to serve as a maintenance location for

sediment removal. In the instance of Capisic Pond, a forebay does not appear to provide substantial benefit for capturing sediments. The throughput flushing caused by the watershed's flow volumes would preclude a detention period for early settling within a forebay and was not considered further in Pond enhancement design.

2.5 PERMITTING CONSIDERATIONS

A wetland delineation and functional assessment study was completed for the project area. The delineation and assessment was carried out by Boyle Associates in the summer and fall of 2012, and a final report was completed in September, 2012. Please refer to Appendix A of this Report for description of wetlands referred to in the following discussion. The discussion below is limited to the mapped wetland areas in which habitat enhancement or stormwater management is proposed.

Wetland F is the open water habitat of Capisic Pond and the associated freshwater herbaceous, shrub, and stream wetlands. It covers approximately 10-acres of the study area. In general, Wetland F consists of a dammed, freshwater pond immediately bordered by treed uplands and emergent floodplain wetlands. The wetland is bordered by some of the cleared grasslands and trails of the park to the east and suburban homes and lawns to the west. Wetland F is fed by Capisic Brook from the northwest. Capisic Brook has a narrow, mostly herbaceous floodplain near the northwestern end of the park before it drains into the pond. Wetland F meets the criteria of a Wetland of Special Significance (WOSS) due to the fact that it is located entirely within a FEMA 100-year floodplain, contains greater than 20,000 square feet of open water or emergent marsh vegetation, and contains significant wildlife habitat (moderate-value IWWH as described in the Natural Resource Protection Act Permit Application). Additionally, all wetlands located within 25-feet of Capisic Brook are considered WOSS. The Pond enhancement project work as proposed includes sediment and vegetation removal and spoils placement (for shrub wetland expansion) within Wetland F. Based on the 30% design plans, the project will expand existing open water from 2.15 acres to approximately 4.3 acres, and create an additional 2.7 acres of shrub wetland area at the perimeter of the Pond.

Wetland D is located just southwest of the Rockland Avenue Outfall. This wetland is a mixed herbaceous and shrub wetland, and is considered a WOSS because it is located within the 100-year FEMA floodplain and contains Significant Wildlife Habitat. Based on the 30% design plans, it is not anticipated there will be wetland impacts in Wetland D associated with the reconstruction of the Rockland Ave outfall. Restoration and stabilization of the drainage channel below the outfall is discussed further below.

It is our understanding that a full Individual Natural Resource Protection Act (NRPA) permit will be required by the Maine Department of Environmental Protection (MaineDEP), and meetings with regulators on September 21, 2012, indicated that, given the nature of the Pond enhancement project, compensation will not be a likely requirement. However, compensation may be required for impacts associated with the Rockland Outfall treatment system. In our review of project file history, it appears that the MaineDEP allowed a previous project (West Side Interceptor) to discount any impacts within the "restoration area", as there was a restoration plan that they found to be acceptable. Based on that precedent, we anticipate MaineDEP would consider bank stabilization below the Rockland Avenue outfall to be a restoration activity that does not count as impact; this issue will be further explored during the next Permit Scoping meeting with regulators (to be scheduled for December, 2012).

In conjunction with the submission to the MaineDEP, the NRPA permit application will need to be submitted to the Army Corps of Engineers (ACOE). The ACOE has jurisdiction over all tidal waters and wetlands, and the project site is connected to the tidal Fore River estuary. With ACOE review, Maine Historic Preservation Commission review will also be required.

Depending on the location of sediment disposal and/or reuse, a Beneficial Reuse Permit may also be required as a part of this project. Pond sediments were analyzed under the previous phase of work (Capisic Pond Sediment Sampling memo to Doug Roncarati from W&C dated December 2, 2011) for parameters in accordance with "Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods, SW-846, 2nd Edition, 1982" and compared against the MaineDEP limits for beneficial reuse, as described in MaineDEP Chapter 418, Section A. This analysis has indicated that the material to be removed from the Pond is of sufficient quality to meet Beneficial Reuse criteria.

The project is also located within the City of Portland Resource Protection Zone, and partly within the Shoreland Zone (within 250-feet of the Fore River Estuary). This project is being completed by the City of Portland as a habitat enhancement project, however, a Level III Site Plan Application will need to be prepared and submitted to the City of Portland for review by the Planning Board and the City of Portland's Zoning Administrator for the impacts associated with the project. Level III Site Plan review is required for land disturbance of three acres or more, which includes stripping, grading, grubbing, filling, or excavation activities; this project will trigger the land disturbance threshold requiring Level III Site Plan review.

All required erosion control BMPs will be included in the final design, and will need to be carefully followed during construction to minimize the impact on the important ecological features within the project area.

2.6 UTILITY COORDINATION

At this time, impacts to public and private utilities from the construction of this project are not anticipated; however, advancement of the design plans may reveal utility conflicts. If utility impacts are identified, we will contact the impacted utility company during the next phase of design to inform them of the planned work to incorporate any requirements.

2.7 EASEMENTS

Much of the project is located on public land owned by the City of Portland; however, the Pond area to the south of Capisic Street is entirely within private property. Any work that is to be conducted on private property, and any land owners that are identified as potentially being impacted by this project, will need to be notified and appropriate easements from private land owners secured prior to performing work; we assume the City will coordinate an agreement and secure the necessary easements. We will coordinate with the City of Portland Department of Public Services to further review and refine property boundaries around the park during the next phases of design.

3. PROJECT DESIGN ELEMENTS AND NEXT STEPS

3.1 INTRODUCTION

The following section provides an overview of specific design elements and further considerations necessary for advancing the Pond enhancement plan and the Rockland Avenue Outfall.

3.2 POND ENHANCEMENT

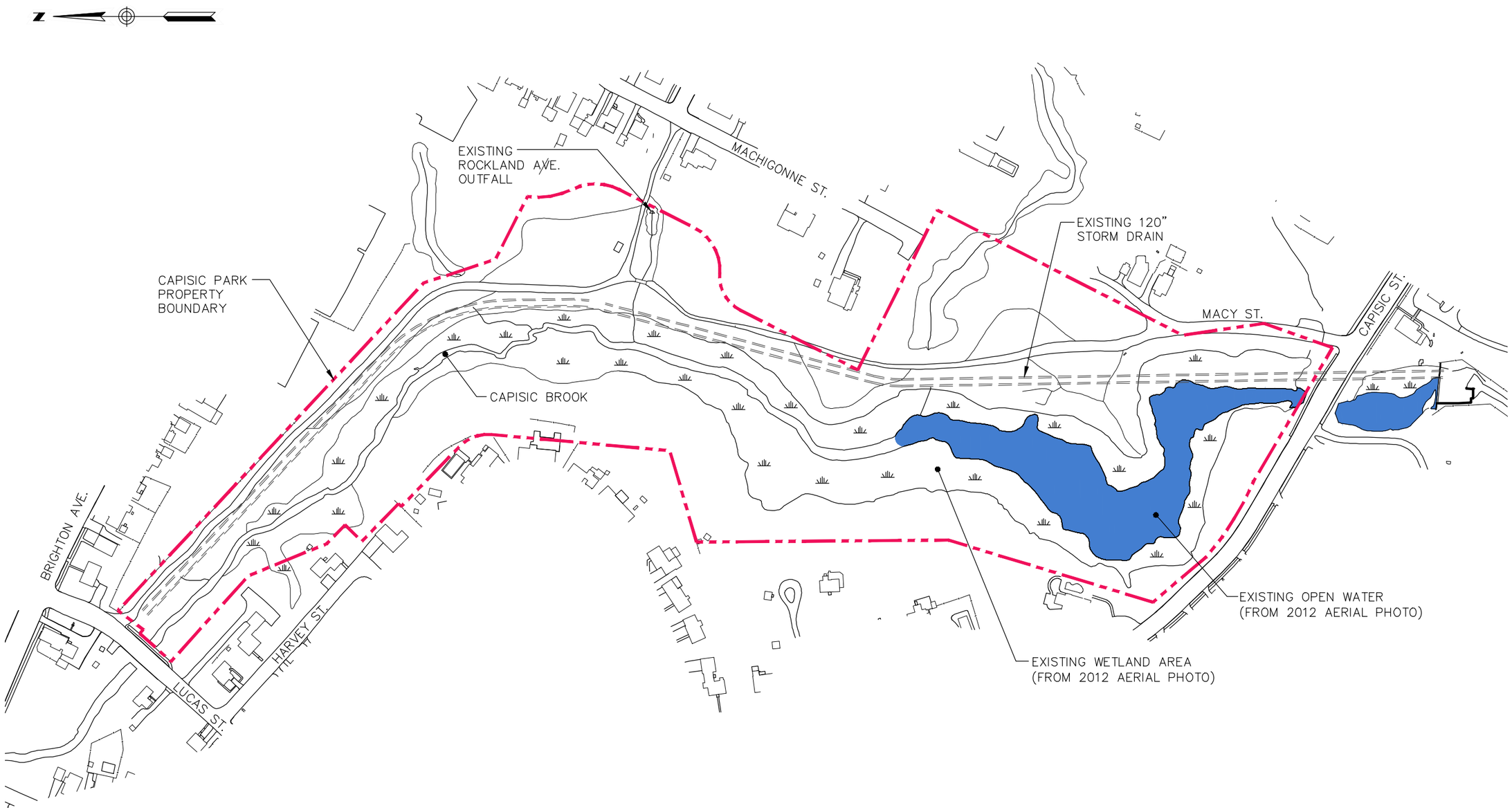
The design approach to improving Capisic Pond involves creation of both open water and transitional wetland shrub shoreline. This involves removal of vegetation, organic debris and soil sediments for open water area, and the placement of materials, primarily the dredged sediments, along the shoreline to produce the wetland shrub zones. As shown in Figure 2-1. the typical cross section proposed for the Capisic Pond is a trapezoidal-shaped underwater segment with a bottom elevation of ±26.5 feet, and a 2H:1V (27°) submerged side slope transitioning to a much flatter section enhanced with wetland shrubs. The proposed approach is to remove sediment within the identified open water areas and construct the wetland shrub habitat with spoils. Figure 3-1 and Figure 3-2 show existing and proposed Pond conditions.

A conceptualized grading plan for the Pond restoration was prepared by applying the typical cross section noted and targeting a shape that produces approximately 4-acres of open water. The proposed pond shaping also accounts for avoiding a 120-inch storm drain pipe that passes beneath the pond's southeastern margin. The bottom elevation shall be higher in this specific region to clear the top of this large pipe, thus pond depth is shallower near the pipe. A sanitary sewer pipe which crosses beneath the pond at another location appears to be installed at sufficient depth to allow a pond bottom at elevation 26.5 feet above the pipe.

The grading concept offered the ability to estimate the quantity of material to move. It is estimated that over 10,000 cubic yards of in-place materials will be removed, and over 6,000 cubic yards of that will be placed in shoreline zones for the transitional shrub habitat. This will leave approximately 3,500 cubic yards of surplus material to discard. This is an in-place volume measure and material will swell 30 percent or more as it is excavated and loosely placed. Swelled material volumes were utilized for the cost estimate. It is possible that 5,000 cubic yards of surplus material will need to be managed and removed.

Management of the excavation and plant matter does require attention in order to advance the design. The spoils will contain a mix of fine grained soil, water and plants. An intermediate processing to dewater the spoils and/or remove vegetation may be conducted in proximity to the excavation, producing spoils which are of suitable character for use in transitional wetlands shaping or for transport off site. The options for the processing step need to be examined further, recognizing it may occur at the point of placement or on an adjacent upland area. Separation of vegetation from sediment is a mechanical operation. Dewatering of the sediment fraction to yield a manageable material can occur by settling, mechanical means, addition of coagulant polymers, geotextile tubes, or a combination of these. The selected processing methods will in part be driven by permit requirements related to turbidity or the sediments discharged during dewatering.

Sediment removal can be by either mechanical dredging or hydraulic dredging. Mechanical dredging equipment includes clamshells, draglines, backhoes or other machinery for excavating bottom sediments. Hydraulic dredging uses mechanical cutting head, pumps and piping to suck a slurry mixture of dredged material and water from the pond bottom and discharge it to the disposal or dewatering area. Hydraulic dredging equipment is also typically floated on a barge and towed to the dredge area.



200' 0 200' 400'

BAR SCALE
1" = 200'
CHECK GRAPHIC SCALE BEFORE USING

PLAN REFERENCE:
SITE PLAN INFORMATION TAKEN FROM DRAWING ENTITLED "CAPISIC.DWG" BY KAPPA MAPPING, INC., BANGOR, MAINE 04401 AND BASED ON AERIAL ORTHO PHOTO DATED 4/16/2012, MAINE WEST ZONE SPCS, NAD83, NGVD29, FEET.

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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

EXISTING CONDITIONS

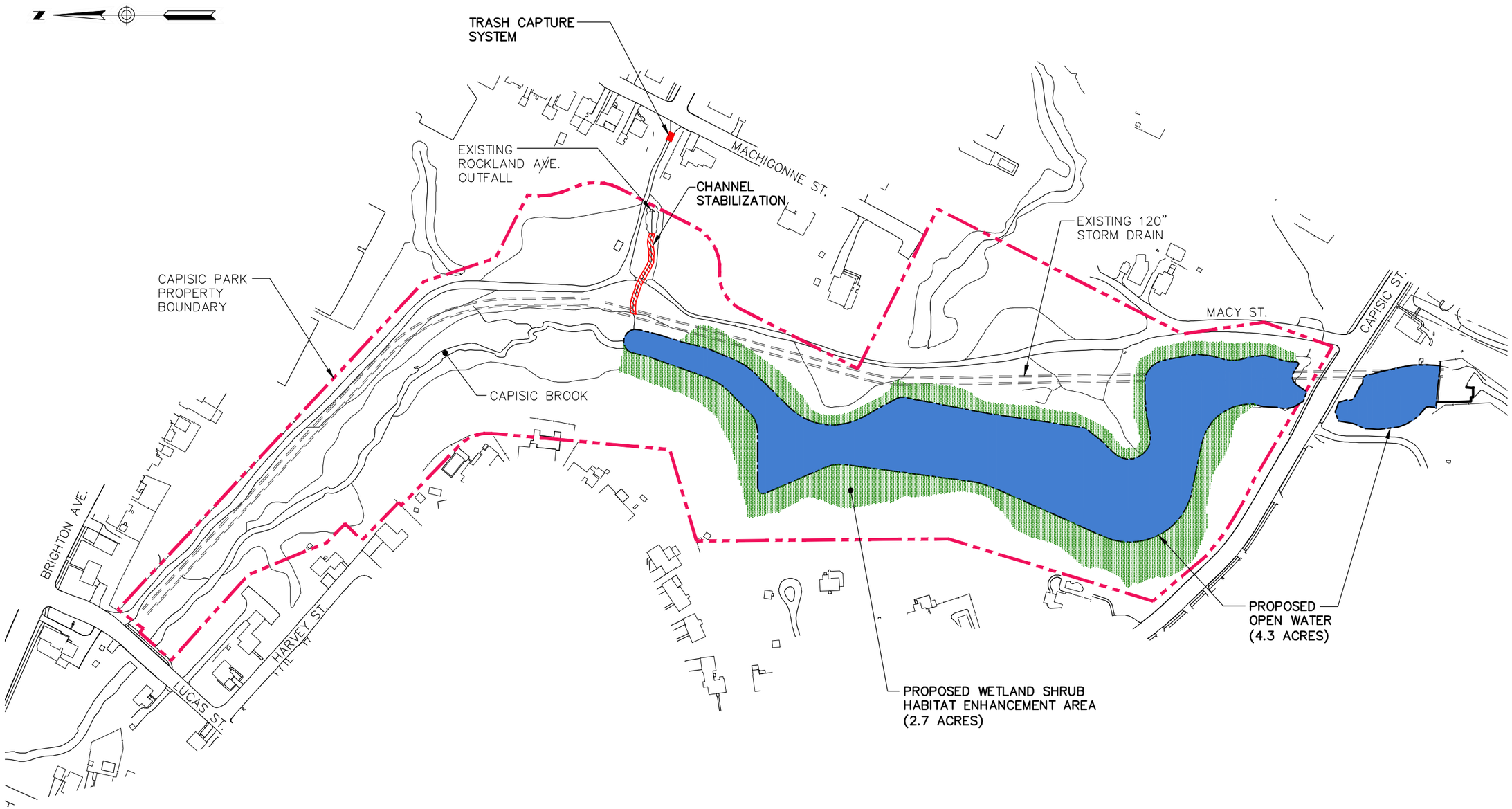
DESIGNED BY: PJP
DRAWN BY: BCM
CHECKED BY: DAS
2256672.15 C10X.DWG

CITY OF PORTLAND
PORTLAND, MAINE

CAPISIC POND
MANAGEMENT PLAN

JOB NO: 225672.15
DATE: NOV. 2012
SCALE: 1"=200'

FIG. 3-1



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200' 0 200' 400'

BAR SCALE
1" = 200'
CHECK GRAPHIC SCALE BEFORE USING

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PROPOSED CONDITIONS

DESIGNED BY: PJP
DRAWN BY: BCM
CHECKED BY: DAS
225672.15 C10X.DWG

CITY OF PORTLAND
PORTLAND, MAINE

CAPISIC POND
MANAGEMENT PLAN

JOB NO: 225672.15
DATE: NOV. 2012
SCALE: 1"=200'

FIG. 3-2

For Capisic Pond it is envisioned that mechanical dredging will be used to produce the cross-section shape. The Pond has limiting depth for floating a hydraulic dredge barge and the pond's water level can be lowered through dam regulation for access by machinery under a mechanical dredge scenario. The practicable option to conduct the dredging and transitional habitat creation appears to be a long reach excavator working from wooden crane mat platforms. It is assumed that dump trucks and low ground pressure equipment involvement will be necessary to support the excavation, removal, and placement of material. Anticipated construction method for costing has material removed to create open water areas placed in the adjacent transitional shrub areas for dewatering. Surplus material and vegetative residuals shall be hauled away in watertight dump trucks.

A beneficial reuse or a disposal site for the surplus dredge spoils and removed plant matter has not been located at this level of design. The water and plant matter may or may not have to be separated out prior to reuse and the methods to accomplish it will depend upon the end management location(s) subsequently identified. Presently the cost estimate is based on the material being beneficially reused within a 10-mile haul distance with no tipping fee associated with disposal.

Although efforts will be made to lower the pond level for dredging, at times dredging will occur in wet conditions. The pond's dam contains a sluice gate and drawdown pipe with elevation of 26.85 feet. The pond will need to be drained in advance of the grading, but the bottom of the excavation will be slightly below the low draw down point. Furthermore, the pond will continue to receive inflow and result in an inconsistent water level as precipitation events ensue.

The following is a list of issues that will require additional consideration before 80% design is finalized:

- Construction site access;
- Usefulness of a separate step to remove plant (organic) matter;
- Dredging machinery options;
- Seasonal constraints; and
- Locations and permit conditions for off-site use or disposal.

Additionally, the following item will require additional consideration between 80% and 100% design:

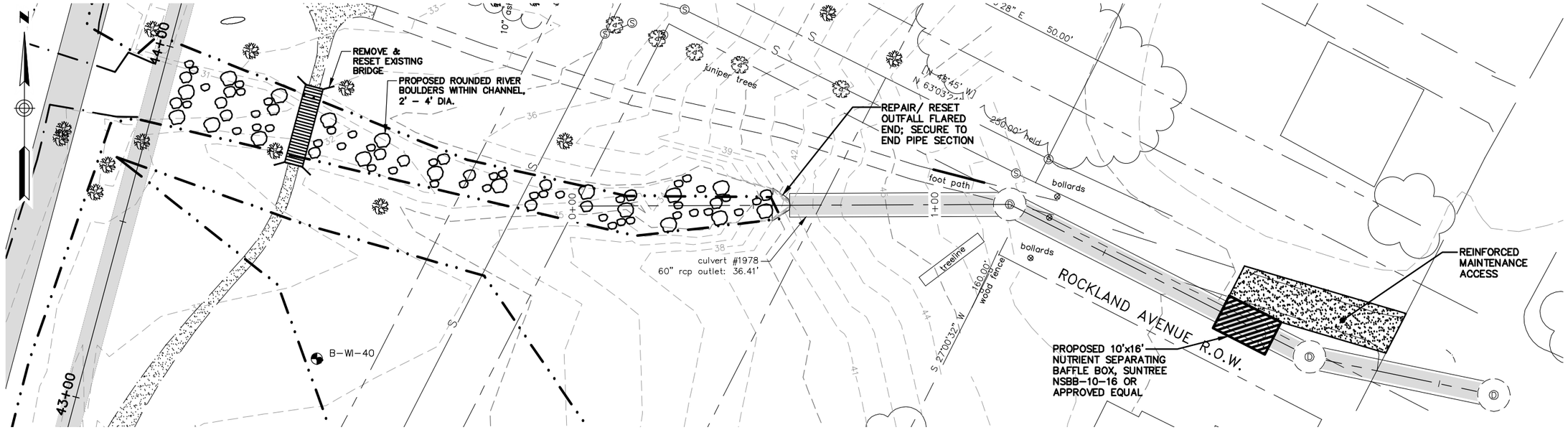
- Further engineering evaluation for placement methods and stability of spoils along wetland habitat shoreline, preferably evaluated via test pits during Pond drain down scenario.

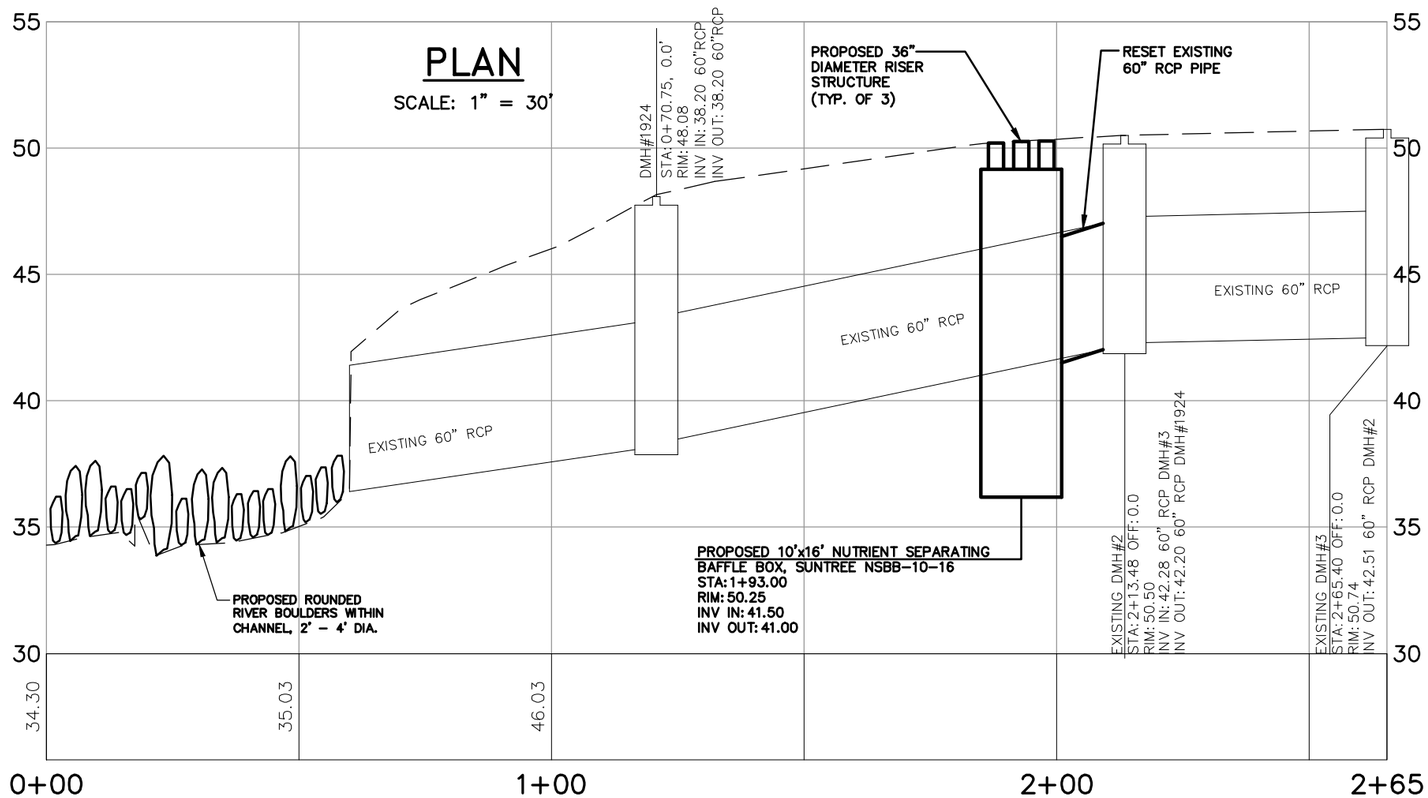
3.3 ROCKLAND AVENUE OUTFALL

Refer to Figure 3-3, which shows the proposed Rockland Avenue Outfall Design, as discussed in the following sections.

The construction of a reinforced maintenance access from Machigonne Street to the proposed NSBB will be necessary. The NSBB system will have three 36-inch diameter access portals, and will be located near the intersection of Rockland Avenue and Machigonne Street. However, the NSBB will need to be placed approximately 30-feet away from Machigonne Street to avoid conflicts with existing utilities, so that the construction of a reinforced maintenance access to provide access for maintenance vehicles will be necessary. This maintenance access will disturb portions of the Capisic Brook Trail system that connects to Machigonne Street, but will be designed so that access improvement aesthetics are consistent with the existing trail system. Depending on feedback from local residents, this access could potentially be constructed of gravel or grassed pavers for consistency with existing trail aesthetics.

A more detailed hydraulic analysis of the Rockland Avenue Outfall catchment will be conducted prior to final design, which considers Hydraulic Grade Line calculations in determining an appropriate sized system. Upon development of more detailed project information, including finished grade elevations, invert elevations, site descriptions, anticipated flow rates, more detailed site plans and specifications for will be developed.





PROFILE STA. 0+00 TO STA. 2+65

HORIZONTAL SCALE: 1" = 30'
VERTICAL SCALE: 1" = 6'

BAR SCALE
1" = 30'
CHECK GRAPHIC SCALE BEFORE USING

NOTE: PLAN DEPICTS A SCHEMATIC ALTERNATIVE TO THE ROCKLAND AVE OUTFALL. ADDITIONAL ENGINEERING AND EVALUATION IS REQUIRED PRIOR TO IMPLEMENTING ANY OF THE PRESENTED ALTERNATIVES. NOT FOR CONSTRUCTION.

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PLAN & PROFILE CHANNEL STABILIZATION & SEPARATING BAFFLE BOX

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DRAWN BY: BCM
CHECKED BY: DAS
225672.15 RAO.DWG

CITY OF PORTLAND
PORTLAND, MAINE

CAPISIC POND
ROCKLAND AVE. OUTFALL

JOB NO: 225672.15
DATE: NOV. 2012
SCALE: AS NOTED

FIG. 3-3

4. OPINION OF COST

The following outlines an opinion of cost for the Capisic Pond Enhancement Plan. Project costs include General Conditions (i.e. administrative requirements and temporary facilities and controls), Construction Materials & Labor, Permitting and Final Design, Engineer's Construction Administration, and Insurance, Overhead and a Contingency.

Project costs shown below assume that the project will be bid and constructed as one project. More detailed evaluation of project costs is provided in Appendix C.

Rockland Ave. Outfall Construction	$230,000
Pond Enhancement	$1,550,000
SubTotal	**$1,780,000**
Permitting & Final Design (6% of Construction)	$107,000
Construction Administration (8% of Construction)	$143,000
SubTotal	**$250,000**
Project Contingency (20% of Project Cost)	**$406,000**
Total Project	**$2,436,000**

5. REFERENCES

Apfelbaum, S.I. 1985. Cattail (Typha spp.) management. Natural Areas Journal 5(3): 9-17.

Maine Department of Inland Fisheries and Wildlife, Recommended Land Use Guidelines in Inland Waterfowl and Wading Bird Habitats. November, 2010.

APPENDIX A: WETLAND ASSESSMENT AND DELINEATION

Capisic Pond Park - Portland, Maine
Wetland Delineation Report & Functional Assessment
September 2012

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1. INTRODUCTION

Capisic Pond Park is an approximately 18-acre, city-owned property located in a suburban area of Portland, Maine (Figure 1). Capisic Pond Park is bounded by Capisic Street to the south and west, Lucas Street to the north and Machigonne Street to the east, with several of the property boundaries consisting of residential home lots. The park consists of emergent marsh and mixed forested, shrubby and grassy uplands and wetlands surrounding Capisic Pond. Within the park, a gravel footpath traverses the east side of the pond, generally following over a Portland Water District sewer line. The path runs from a small parking area on the corner of Capisic Street and Macy Street north to a small gravel lot on Lucas Street. There is a small side path that connects to Rockland Avenue. Several mowed trails veer from the main path, allowing access to additional viewpoints of the pond and surrounding habitats. The park is a popular destination for local residents and visitors who use the park primarily for hiking, walking, biking, and nature watching. Uplands within and around the site consist of small areas of woodlands, shrublands and grasslands surrounded by suburban development. Woodlands consist mainly of large tree species such as white pine (*Pinus strobus*) with a shrubby understory of invasive plant species such as honeysuckle (*Lonicera spp.*) and buckthorn (*Frangula* and *Rhamnus spp.*). Residential homes and yards surround most of the site. There are some larger house lots on the western side of the pond. Many areas along the pond are being maintained as lawn up to or very near the edge of the pond.

The park's main visual and habitat feature is Capisic Pond and its surrounding wetlands and riparian habitats. Capisic Pond roughly bisects the property. Fed primarily by Capisic Brook, the pond flows (slowly) from the north to south. Capisic Pond is an approximately 8-acre, manmade freshwater pond. A concrete dam just south of Capisic Street regulates water levels in the pond. Below the dam, Capisic Brook flows south into the Fore River and then to Casco Bay (Figure 2).

Current and past land uses of the park and the upstream and surrounding area have led to significant changes within the pond and its surrounding habitats. The water level in Capisic Pond has decreased due to an increase in sedimentation from upstream sources and to an intentional lowering of the pond to alleviate upgradient stormwater flooding. The lack of depth and increased inflow of nutrients has allowed a flourish of aggressively colonizing cattails (*Typha latifolia* and *T. angustifolia).* The cattails and sediments are changing the pond, making it shallower and reducing the amount of open water habitat. The pond receives inflow from Capisic Brook. Capisic Brook is listed by the Maine Department of Environmental Protection (MDEP) as an Urban-Impaired Stream (Chapter 502 of the Maine Stormwater Management Law). In an effort to improve water quality in Capisic Brook, the City of Portland has initiated several stormwater upgrades, habitat improvements and public outreach campaigns throughout the Capisic Brook watershed. Part of the overall strategy for watershed improvement includes a plan to enhance the wildlife habitats, water quality and land use qualities of Capisic Pond Park. Boyle Associates is working with the City's Engineering and Project Design consultant - Woodard & Curran, to provide wetland and wildlife ecology expertise on portions of the Capisic Pond Park habitat improvement plan. This report provides findings from Boyle Associates investigation of wetland boundaries and functions and values conducted in August, 2012.

1.1 STUDY AREA

The study area includes Capisic Pond Park and a 0.5-acre area south of Capisic Street on which the dam and a portion of the pond are located (see Figures 1 and 2). There is no public access to the portion of the study area south of Capisic Street.

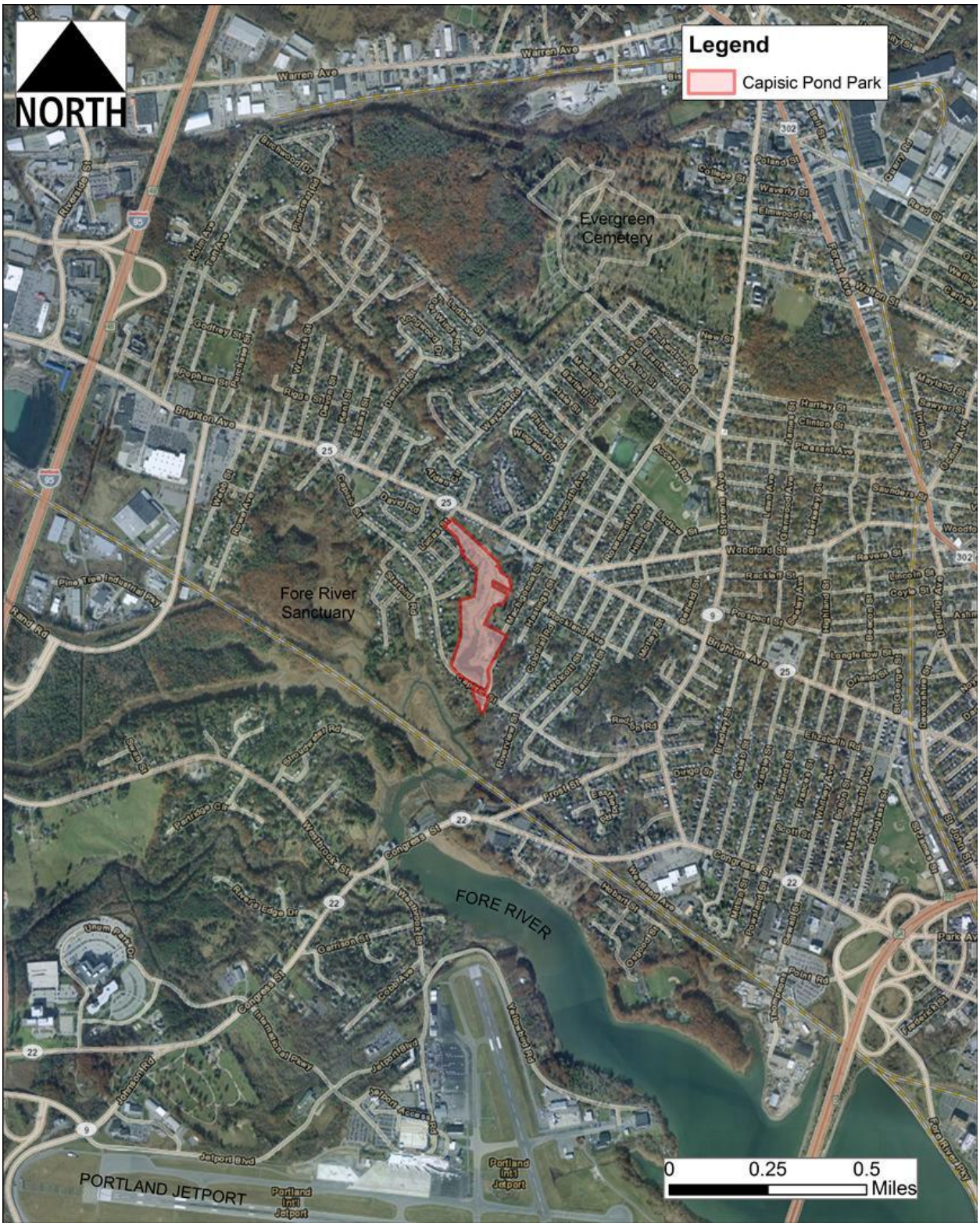

Figure 1. Capisic Pond Park location map (*Oct. 2009 aerial photo – ESRI*).

Figure 2. Capisic Pond Park Wetland Delineation and Functional Assessment Study Area (*Oct. 2009 aerial photo – ESRI*).

2. METHODS

2.1 WETLAND DELINEATION

2.1.1 Selection of Delineation Methodology

Based on current state and United States Army Corps of Engineers (USACE) policy for identifying jurisdictional wetlands, wetland boundaries were determined using the methods described in the *1987 USACE Wetlands Delineation Manual* (Environmental Laboratory, 1987) and the *Regional Supplement to the Corps of Engineer's Wetland Delineation Manual: Northcentral and Northeast Region, v2.0*. These methods use a three factor approach for identifying wetlands. The three factors are evidence of hydrology, a dominance of hydrophytic vegetation and the presence hydric soils.

2.1.2 Background Research

Prior to conducting fieldwork, Boyle Associates conducted a thorough review of existing site information including the following:

- United States Geologic Survey (USGS) 7.5-minute (24K) series topographic quadrangle map;
- Cumberland County soil survey from the United States Department of Agriculture/Soil Conservation Service (USDA/SCS, 1974) to determine presence and extent of hydric and upland soils;
- National Wetlands Inventory (NWI) 7.5-minute series quadrangle map from the United States Fish and Wildlife Service (USFWS) to determine the presence of mapped, federally-designated wetlands;
- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) of Cumberland County, Maine; and,
- Historical records, indexes, reports, and maps (aerial and topographic) of the park and surrounding region – (see Section 4.0 for more information).

2.1.3 Onsite Wetland Boundary Determination

Following a review of the background information, Wetland Scientists from Boyle Associates performed systematic field surveys of the study area. The surveys were initiated with a walk-over inspection of the entire site to identify topographic, drainage and vegetation features that would indicate the presence of wetlands. Next, sample plots were analyzed along transects in order to determine the wetland boundary. Specific methods for sampling, characterizing and evaluating the soils, vegetation, and hydrologic indicators were based on the manual mentioned in Section 2.1.1.

2.1.4 Wetland Vegetation Covertype Mapping

Vegetative covertypes within each wetland were mapped using a combination of GPS location, field sketches and aerial photo interpretation. Each wetland covertype was classified using the *Classification of Wetlands and Deepwater Habitats of the United States* (1979) created by the U.S. Fish and Wildlife Service (also known as the *Cowardin Classification System*). This classification "*is intended to describe*

ecological taxa, arrange them in a system useful to resource managers, furnish units for mapping, and provide uniformity of concepts and terms." Systems form the highest level of classification hierarchy; these are Marine, Estuarine, Riverine, Lacustrine, and Palustrine. Each system is then further defined using subsystems and classes based on substrate material, hydrologic regime, and vegetative composition. Several modifiers can also be used to further describe each subsystem or class. For example, a freshwater wetland dominated by a forested or woody overstory with mixed deciduous and evergreen vegetation greater than 20 feet tall and seasonally flooded/saturated would be described under Cowardin as: *PFO 1/4E*. The appropriate classification based upon Cowardin system was determined and assigned for each wetland.

2.2 MAPPING

Data collected on the site were mapped using a mapping-grade Global Positioning System (GPS) unit (Trimble GeoXH). A minimum of 30 epochs were collected at each point and data were differentially corrected against fixed data from a commercial base station to ensure sub-meter accuracy. Data were exported to the following coordinate system and datum: NAD 1983, State Plane, Zone Maine West, 1802.

2.3 WETLAND FUNCTIONAL ASSESSMENT

A wetland functional assessment was performed pursuant to the approach described by the Army Corps Highway Methodology Workbook Supplement: Wetland Functions and Values. In this "Descriptive Approach" to functional assessment, the evaluators first determine if particular functions and values are *present* and why, followed by a determination of what functions and values are *principal* and why. Functions and values can be considered "principal" if they are an important physical component of a wetland ecosystem (function only), and/or are considered of special value to society, from a local, regional, and/or national perspective. When making determinations on the wetland, evaluators are encouraged to determine whether the wetland has the *potential* to serve the functions and values as well.

Functions are self-sustaining properties of a wetland ecosystem that exist in the absence of society and that result from both living and non-living components of a specific wetland resource. These include all processes necessary for the self-maintenance of the wetland ecosystem such as primary productivity and nutrient cycling, among others. Therefore, functions relate to the ecological significance of wetland properties without regard to subjective human values.

Values are benefits that derive from one or more functions and the physical characteristics associated with a wetland. Most wetlands have corresponding societal value. The value of a particular wetland function, or combination of functions, is based on human judgment of the worth, merit, quality or importance attributed to those functions.

Groundwater Recharge/Discharge: This function considers the potential for the wetland to serve as a groundwater recharge and/or discharge area. It refers to the fundamental interaction between wetlands and aquifers, regardless of the size or importance of either.

Floodwater Alteration (Storage & Desynchronization): This function considers the effectiveness of the wetland in reducing flood damage by attenuation of floodwaters for prolonged periods following precipitation events and the gradual release of floodwaters. It adds to the stability of the wetland ecosystem or its buffering characteristics and provides social or economic value relative to erosion and/or flood prone areas.

Fish and Shellfish Habitat: This function considers the effectiveness of seasonal or permanent watercourses associated with the wetland in providing fish and shellfish habitat.

Sediment/Toxicant/Pathogen Retention: This function reduces or prevents degradation of water quality. It relates to the effectiveness of the wetland as a trap for sediments, toxicants or pathogens in runoff water from surrounding uplands, or upstream erosive wetland areas.

Nutrient Removal/Retention/Transformation: This function considers the effectiveness of the wetland as a trap for nutrients in runoff water from surrounding uplands or contiguous wetlands and the ability of the wetland to process these nutrients into other forms or trophic levels. One aspect of this function is to prevent ill effects of nutrients entering aquifers or surface waters such as ponds, lakes, streams, rivers or estuaries.

Production Export: This function evaluates the effectiveness of the wetland to produce food or usable products for man or other living organisms.

Sediment/Shoreline Stabilization: This function considers the effectiveness of the wetland in stabilizing stream banks and shorelines against erosion.

Wildlife Habitat: This function considers the effectiveness of the wetland to provide habitat for various types and populations of animals typically associated with wetlands and the wetland edge. Both resident and migrating species are considered.

Recreation: This value considers the suitability of the wetland and associated watercourses to provide recreational opportunities such as hiking, canoeing, boating, fishing, hunting and other active or passive recreational activities.

Educational/Scientific Value: This value considers the suitability of the wetland as a site for an "outdoor classroom" or as a location for scientific study or research.

Uniqueness/Heritage: This value considers the effectiveness of the wetland or its associated waterbodies to provide certain special values, including archaeological sites, critical habitat for endangered species, its overall health and appearance, its role in the ecological system of the area, or its relative importance as a typical wetland class for the geographic location.

Visual Quality/Aesthetics: This value considers the visual and aesthetic quality or usefulness of the wetland.

Endangered Species Habitat: This value considers suitability of the wetland to support threatened or endangered species.

3. RESULTS

3.1 WATERSHED

The survey area is located within the Presumpscot River and Casco Bay watershed (HUC 8: 01060001) and within the Fore River subwatershed (HUC: 0106000105).

3.2 INVASIVE SPECIES

Invasive species include introduced or non-native species brought to a location by man or some other vector, which adversely affect the natural habitat of a region that they invade economically, environmentally, and/or ecologically. Such species may be either plants or animals and may disrupt ecosystems due to the lack of the natural controls that exist in their native habitats. Typical vectors for invasive species include: water (i.e. seeds or plant fragments floating down a river or stream); wind; animals (either by eating fruits and spreading seeds or by unknowingly transporting seeds on fur and feathers); and transplanting seeds, plant fragments or contaminated soils on equipment, boots, tires, soil, mulch, or other human vectors. Invasive plants may provide some food and habitat value, but they tend to outcompete and crowd out native plants upon which the native animals and insects rely.

Several species and a high-density of invasive plants are found within Capisic Pond Park (see Appendix B for a complete list). Every wetland on the site contains the flowering invasive plant, purple loosestrife (*Lythrum salicaria*). Other invasive plants found within uplands or along wetland boundaries include: bush honeysuckle, glossy buckthorn (*Frangula alnus*), common buckthorn (*Rhamnus cathartica*), multiflora rose (*Rosa multiflora*), Japanese knotweed (*Fallopia japonica*), narrow-leaved cattail (*Typha angustifolia),* and oriental bittersweet (*Celastrus orbiculatus*) – see Appendix B for more information.

Notably absent from the site are the tenacious and common invasive plants common reed (*Phragmites australis*) and autumn olive (*Elaeagnus umbellata*). These plants can be found nearby the site (*e.g*. within the adjacent Fore River Sanctuary and along Capisic Brook), so their absence in the park is surprising. Future planning and work at the site should include provisions and strategies long-term management of these and all invasive species.

3.3 VERNAL POOLS

No areas within our study were identified as meeting the State of Maine Natural Resources Protection Act (NRPA) or Army Corps of Engineer's Maine General Permit (GP) definition of a vernal pool.

3.4 WETLANDS & STREAMS

Six wetlands and two streams were identified within the park. The following section includes wetland classifications and descriptions, and a listing of the functions and values determined for each wetland. Table 1 provides a list of wetlands with a brief description; Table 2 provides a list of the streams identified. While each wetland has the potential to provide a variety of functions and values, it should

be noted that impacts and development, both current and historic, have reduced the area's overall ability to provide habitat and value. All wetlands on the site display some sign of impacts and degradation, including draining, trash (including residential yard debris), grading, filling, excavation, and invasive species. Photographs are included in Appendix A.

Table 1. Wetland Survey Results

ID	Type	Classification[1]	WSS[2]	Brief Description
A	Scrub-shrub/ Emergent	PSS1E, PEM1E	Yes	Wetland complex draining from outside the eastern boundary into the park. Hydrology from the wetland flows to west and into Capisic Pond via a small culvert under the walking trail. The walking trail appears to be partially impounding flow in the wetland.
B	Emergent	PEM2/1E, PFO1E	No	Mostly herbaceous wet meadow adjacent to the trailhead along Macy Street. Flow tends generally to the southwest and into a culvert. The culvert appears to flow toward the pond, but the downslope outlet could not be located.
C	Emergent	PEM2/1E	No	A small, isolated wet meadow located on a knoll on the eastern side of the property. Hydrology within the wetland did not appear to flow in any particular direction. Ponding was evident post rainfall. The wetland appears to be the result of a historic excavation and provides minor functions or values.
D	Emergent / Scrub-shrub	PEM2/1E, PSS1E	Yes	Wetland complex draining from the eastern boundary and flowing to a shallow basin along the walking trail. Disturbance and fill along the walking trail appear to be impounding the lower elevations within the wetland. Ponding is evident within the wetland post rainfall and water can be seen flowing into the walking trail toward the pond.
E	Emergent / Scrub-shrub	PEM2/1E, PSS1E	Yes	Wetland complex along the eastern parcel boundary. Very little of this resource is within the survey area. The wetland drains from northwest and onto the site. Water is being impounded within the lower elevations of the wetland along the walking trail. A culvert was found draining from wetland E into the pond (wetland F).
F	Emergent / Open Water	PEM1J, PUB3	Yes	Large wetland/pond complex fed by Capisic Brook. The pond is impounded by a weir dam on the south side of Capisic Street and contains large areas of open water habitat interspersed with cattail marsh.

[1] Per **Cowardin** *et al*. 1979.
[2] Wetland of Special Significance

Table 2. Stream Survey Results

ID	Stream Type	Width	Depth	Substrate	Comments
1	Perennial	3-15’	18”	Boulder, cobble, gravel, sand, mud	Stream 1 (unnamed) begins at the Rockland Avenue outfall and flows for a short distance before entering Capisic Pond on the west side of the gravel trail. Stream is eroded and receives strong, concentrated stormwater flows post heavy rain events.
2	Perennial	15-20’	12-24”	Cobble, sand, mud	Within the survey area, stream 2 (Capisic Brook) flows south under Lucas Street through shady shrub habitat toward Capisic Pond. Directly south of Lucas Street the brook is shallow, fast moving, and rocky. As the stream approaches the pond, the habitat opens to emergent marsh and becomes deeper and meandering with slower water velocities before becoming open water and emergent marsh (*i.e.* Capisic Pond); the stream reforms as a fast-moving rocky-bottom stream below the dam south of Capisic Street (outside of study area).

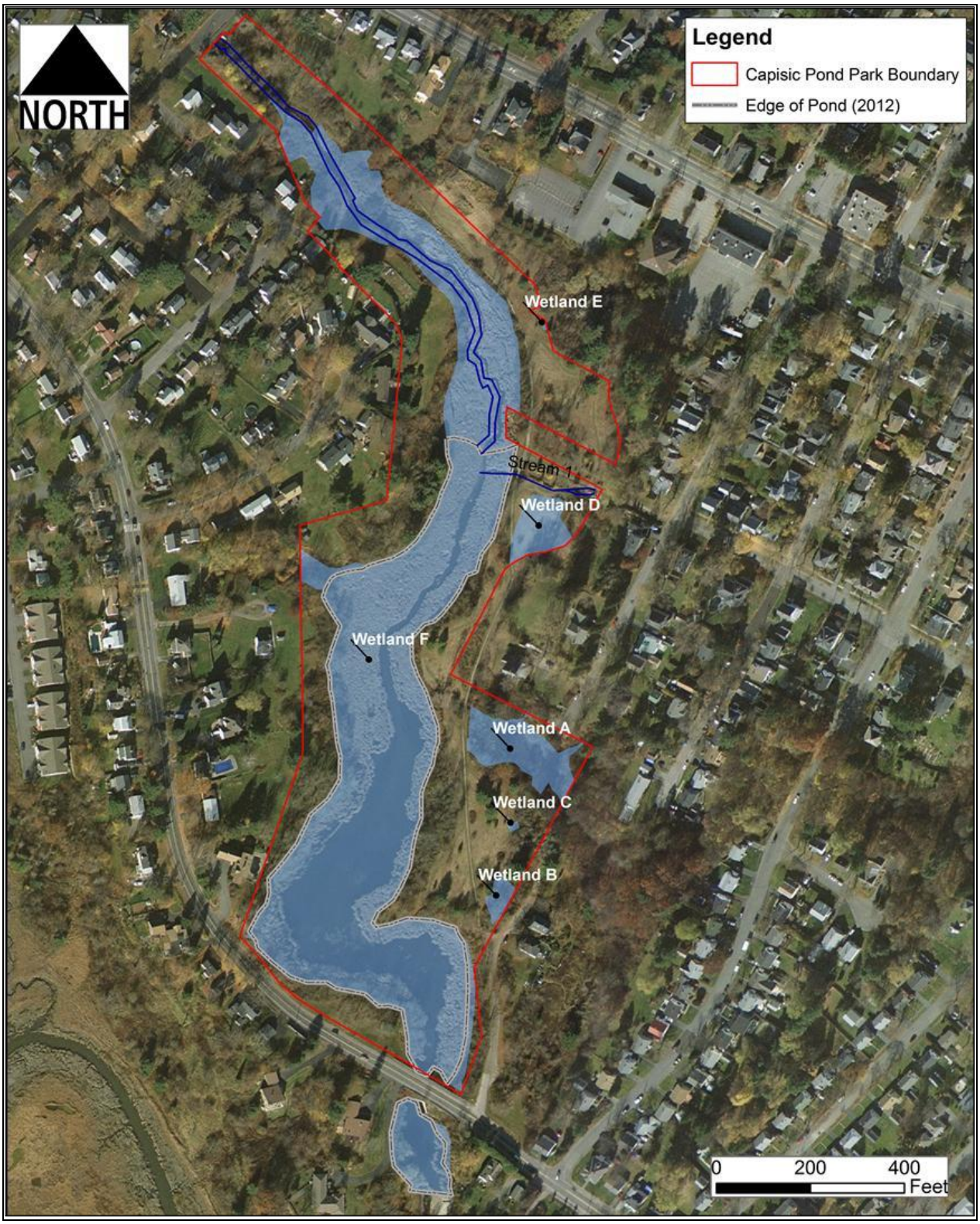

Figure 3. Capisic Pond Park Wetland Map

Figure 4. Wetland Covertypes

3.4.1 Wetland A

Cowardin Classification: Dominant class: PSS1E – Palustrine scrub-shrub, broad-leaved deciduous, seasonally saturated/flooded.

Other classes present: PEM1/2E – Palustrine emergent, seasonally saturated/flooded.

General Description: Wetland A is located in a narrow valley between the gravel walking trail and eastern parcel boundary. The margins of the wetland are comprised of a thick shrubby tangle of invasive and native shrubs. Evidence of historic and current filling along the wetland boundary is apparent. Due to the dense shrub growth and past land disturbances, the boundary between wetland and upland has been partially obscured. Hydrology within the wetland flows generally to the west toward Capisic Pond. A culvert located on the downslope side of the wetland along the walking trail appears to channel hydrology from wetland A into Capisic Pond (known herein as wetland F). Water was observed impounded against the fill extensions from the gravel trail.

Dominant Vegetation: Trees: Black willow (*Salix nigra*)

Shrubs: Speckled alder (*Alnus incana var. rugosa*), silky dogwood (*Cornus amomum*), withe-rod (*Viburnum nudum* var. *cassinoides*), and bush honeysuckle.

Herbs: Broadleaf cattail (*Typha latifolia*), woolgrass (*Scirpus cyperinus*), broadleaf arrowhead (*Sagittaria latifolia*), purple loosestrife, and white turtlehead (*Chelone glabra*).

Soils and Hydrology: Indicators of wetland hydrology are ponded surface water (flooded to approximately 6” in August 2012), saturation of the soil to the surface, water-stained leaves within the shrub-dominated portions of the wetland, and drainage patterns throughout the wetland.

Soils within wetland A are lacking an A-horizon (*i.e.* topsoil). This layer may have been removed during dredging or other site work in the past. The B-horizon (subsoil) consists of a gleyed matrix with redoximorphic features. Gleyed matrices are soils with a blue-green color and are indicative of prolonged saturation.

Wetlands of Special Significance: This wetland meets the Maine NRPA definition of a Wetland of Special Significance (WSS) due to the fact that is located entirely within a FEMA 100-year floodzone and contains Significant Wildlife Habitat (IWWH).

Functional Assessment: Wetland A provides or has the potential to provide the following functions and values: groundwater recharge/discharge, floodflow alteration, sediment/toxicant retention, nutrient removal, production export, sediment and shoreline stabilization and wildlife habitat. The capacity for the resource to provide these functions has been reduced due to its position within a developed landscape.

The principal function served by wetland A is floodflow alteration. Wetland A is found within in a narrow valley, it has a constricted outlet, it has dense shrub and herbaceous vegetation, and it has a broad, flat

topography; these features enable the wetland to store significant amounts of floodwater and runoff from the surrounding landscape. Additionally, much of the surrounding area near wetland A consists of impervious and semi-impervious surfaces (roads, houses, yards, driveways, etc.). During rain events, large amounts of runoff flow into the wetland, both overland and from stormwater outlets. The makeup of wetland A allows it to slow floodwaters, giving them time to infiltrate into the soil.

3.4.2 Wetland B

Cowardin Classification: Dominant class: PEM2/1E (Palustrine emergent, seasonally saturated/flooded).

Other classes present: PFO1E (Palustrine forested, broad-leaved deciduous, seasonally saturated/flooded).

General Description: Wetland B is located along the east side of the trail near the trailhead abutting Macy Street. Flow within the wetland tends to the south toward a culvert. The culvert appears to flow toward the pond, but an outlet could not be found (the culvert may drain into the City's stormwater conveyance system that runs under the park trail).

Dominant Vegetation: Trees: Red maple (*Acer rubrum*).

Shrubs: White meadowsweet (*Spiraea alba var. latifolia*).

Herbs: Flat-top goldentop (*Euthamia graminifolia*), jewelweed (*Impatiens capensis*), woolgrass, multiflora rose (*Rosa multiflora*), sensitive fern (*Onoclea sensibilis*), swamp rose (*Rosa palustris*), parasol whitetop (*Doellingeria umbellata*), and giant goldenrod (*Solidago gigantea*).

Soils and Hydrology: Soils within wetland B consist of a thick, dark, A-horizon underlain by a B-horizon with a depleted matrix within 10 inches of the mineral soil surface. Hydrology observed at the time of delineation was limited, but included water-stained leaves and drainage patterns. An inlet culvert was noted in the lowest portion of the wetland, near the park trailhead. An outlet into the pond could not be found. It is possible that the wetland is being drained into the stormwater system that runs along the park trail.

Wetlands of Special Significance: Based on field observations and office review of existing data, this wetland does meet any of the Maine NRPA criteria to be defined as a WSS.

Functional Assessment: Wetland B provides or has the potential to provide the following functions and values: groundwater recharge/discharge, floodflow alteration, sediment/toxicant retention, nutrient removal, and wildlife habitat. While the wetland has the capacity to provide the above-listed functions, none of these functions can be considered principal, as the resource's ability to provide these functions is limited by the size of the wetland and by development of the wetland and the surrounding landscape.

3.4.3 Wetland C

Cowardin Classification: Dominant class: PEM2/1E – Palustrine emergent, seasonally saturated/flooded.

General Description: Wetland C is a small, isolated wetland located along a grassy side trail of the park near the eastern property boundary and slightly south of wetland A. Wetland C appears to have been created by disturbance. Over time, the compaction of the soil in the small depression has caused extended periods of surface water ponding, saturating the soil and favoring hydrophytic vegetation to colonize the small basin.

Vegetation: Trees: None observed

Shrubs: None observed

Herbs: Flat-top goldentop (*Euthamia graminifolia*), purple loosestrife, woolgrass, and New York aster (*Symphyotrichum novi-belgii*).

Soils and Hydrology: Soils in wetland C consist of a thick, dark A-horizon with redoximorphic features underlain by a B-horizon with a depleted matrix. The A-horizon was very compact and overlies a dense, impervious layer of silty-clay. Evidence of hydrology consists of standing water (approximately three inches deep at the time of survey) and saturation to the soil surface.

Wetlands of Special Significance: This wetland is a small, isolated and potentially manmade feature, but due to the fact that it is contains Significant Wildlife Habitat (IWWH,) the wetland is considered WSS.

Functional Assessment: Wetland C provides or has the potential to provide the following functions and values: groundwater recharge/discharge and wildlife habitat. However, due to its small size and location next to the trail, no principal functions or values were identified for the resource.

3.4.4 Wetland D

Cowardin Classification: Dominant class: PEM2/1E – Palustrine emergent, seasonally saturated/flooded.

Other classes present: PSS1E – Palustrine scrub-shrub, broad-leaved deciduous, seasonally saturated/flooded.

General Description: Wetland D is a mixed herbaceous and shrub wetland located along the eastern boundary of the site, just south of Rockland Avenue. The wetland is located just south of Stream 1, that begins at the Rockland Avenue stormwater discharge site.

Vegetation: Trees: None observed

Shrubs: Silky dogwood, withe-rod and tamarack (*Larix laricina*).

Herbs: Common rush (*Juncus effusus*), giant goldenrod, parasol whitetop, flat-top goldentop, purple loosestrife, woolgrass, and Pennsylvania smartweed (*Polygonum pennsylvanicum*).

Soils and Hydrology: Soils within wetland D have a dark A-horizon made of gravelly fill material. Below the A-horizon, a hardpan, impervious B-horizon with mixed loamy-silty-clay B-horizon was observed. The B-horizon has a depleted matrix and many redoximorphic features.

Water flowing into the wetland from the northwest tends to back up against the Capisic Pond Park trail, adding to the small wetland's hydrology. Hydrologic indicators include periodic standing water in some of the lower areas of the wetland and a generally high water table (presumably perched on the hard silty-clay horizon). Additional indicators of wetness include sediment deposits from previous flooding events and surface soil cracks along the park trail.

Wetlands of Special Significance: Wetland D meets the Maine NRPA definition of WSS due to the fact that is located entirely within a FEMA 100-year floodplain and contains Significant Wildlife Habitat (IWWH).

Functional Assessment: Wetland D provides or has the potential to provide the following functions and values: groundwater recharge/discharge, floodflow alteration, sediment/toxicant retention, nutrient removal, production export, and sediment and shoreline stabilization. Several of the functions and values are being provided, but the capacity for the resource to provide those functions is limited due to its size, location and the surrounding, developed landscape. While the wetland has the capacity to provide the above-listed functions, the principal function served by wetland D is floodflow alteration.

Wetland D slopes gradually toward Capisic Pond, and slows and holds some stormwater runoff prior to it entering the pond. Additionally, the wetland appears to receive some overflow from the Rockland Avenue outfall during periods of high runoff. During these events, large amounts of runoff flow into the wetland, both overland and from the stormwater outlet. The makeup of wetland A allows it to slow floodwaters, giving them time to infiltrate the topsoil.

3.4.5 Wetland E

Cowardin Classification: Dominant class: PEM1/2E – Palustrine emergent, seasonally saturated/flooded.

Other classes present: PSS1E – Palustrine scrub-shrub, broad-leaved deciduous, seasonally saturated/flooded.

General Description: Wetland E is located in a narrow valley on the east side of the trail – only a small portion of the wetland is located within the study area. Wetland E is very similar to Wetland A. Drainage patterns were noted throughout the wetland and water is being impounded along the park trail. A culvert was observed along the trail; the culvert appears to drain floodwater water from wetland E and outlets into the wetland associated with Capisic Pond (Wetland F).

Vegetation: *Trees:* None observed

Shrubs: Black willow

Herbs: Purple loosestrife, jewelweed, swamp rose, common rush, beggar's tick (*Bidens frondosa*), fringed sedge (*Carex crinita*), New York aster, and New England aster (*Symphyotrichum novae-angliae*).

Soils and Hydrology: The topsoil in wetland E consists of a thin, silt-loam A-horizon underlain by a silty-clay B-horizon with a depleted matrix and redoximorphic features. Evidence of hydrology includes surface water and soil saturation to the surface.

Wetlands of Special Significance: Wetland E meets the Maine NRPA definition of a WSS because it is located entirely within a FEMA 100-year floodplain and contains Significant Wildlife Habitat (IWWH).

Functional Assessment: Wetland E provides or has the potential to provide the following functions and values: groundwater recharge/discharge, floodflow alteration, sediment/toxicant retention, nutrient removal, production export, sediment and shoreline stabilization and wildlife habitat. Several of the functions and values are being provided, but the capacity for the resource to provide those functions is limited due to its small size, its location and its developed surroundings. The principal function served by wetland E is floodflow alteration.

Wetland E is in a similar landscape position as Wetland A. It is has a broad basin located adjacent to the gravel trail. Water is impounded along the trail. The standing water slowly infiltrates the soil, attenuating runoff during periods of heavy storm flows.

3.4.6 Wetland F

Cowardin Classification: Dominant class: PEM1/2E – Palustrine emergent, seasonally saturated/flooded.

Other classes present: PUB – Palustrine unconsolidated bottom; PSS1E – Palustrine scrub-shrub, broad-leaved deciduous, seasonally saturated/flooded.

General Description: Wetland F includes Capisic Pond and its associated riparian wetlands. It covers approximately 10 acres of the study area. In general, Wetland F consists of a dammed, freshwater pond immediately bordered by treed uplands and emergent floodplain wetlands. A few shrubby wetland swales drain into the pond from the west. The wetland is bordered by some of the cleared grasslands and trails of the park to the east and suburban homes and lawns to the west. Wetland F is fed by Capisic Brook from the northwest. Capisic Brook has a narrow, mostly herbaceous floodplain near the northwestern end of the park before it drains into the pond.

The original Capisic Pond dam was constructed on Capisic Brook in the 1600s to power a grist and saw mill. Eventually, in the middle of the 20th century, the City of Portland began managing the dam as a component of its combined sewer/stormwater system. The City rebuilt the dam in its current location on the south side of Capisic Street in 1954. The most recent dam reconstructions, in 1996 and again in 2001, lowered the outlet in order to reduce stormwater flooding issues upstream in the Capisic Brook watershed.

Capisic Pond was last dredged in the 1950s. Over the years, as expansion of impervious surface from development has increased runoff into Capisic Brook, sediments have built up in the pond. The sedimentation, combined with the lower water elevation afforded by the dam lowering efforts of 1996 and 2001, has reduced the water level in the pond. The shallow, turbid water favors the growth of cattails, which outcompete most other species in these types of habitats. A review of historic aerial

photographs has shown a decrease in the open water component of the park over the last few decades, with the largest cattail expansion taking place within the last 10-15 years (see Figure 5) .

Figure 5. 2001 aerial imagery (top) compared with a 2009 image (bottom) indicates expansive growth of cattails around the pond margins and interior.

Vegetation: *Trees:* American elm *(Ulmus americana).*

Shrubs: Withe-rod, bush honeysuckle and silky dogwood.

Herbs: broadleaf cattail, narrowleaf cattail (*Typha angustifolia*), jewelweed, common duckweed (*Lemna minor*), broadleaf arrowhead, wild cucumber (*Echinocystis lobata*), variegated yellow pond-lily (*Nuphar lutea*), American white waterlily (*Nymphaea odorata*), pickerelweed (*Pontederia cordata*), floating pondweed (*Potamogeton natans*), and coontail species (*Ceratophyllum sp.*).

Soils and Hydrology: Soil within the open water portion of Wetland F consists of deep mucky silt and clay. Soil within the herbaceous plant-dominated portions of Wetland F consist a thick organic soils (also known as histosols).

Evidence of hydrology in Wetland F include surface water approximately four inches in depth, a high water table, saturation to the soil surface, sediment deposits, drift deposits ("wrack"), water-stained leaves, and drainage patterns.

Wetlands of Special Significance: Wetland F meets the criteria of a WSS due to the fact that is located entirely within a FEMA 100-year floodplain, contains greater than 20,000 square feet of open water or

emergent marsh vegetation, and contains significant wildlife habitat (moderate value IWWH as described in the NRPA). Additionally, all wetlands located within 25-feet of Capisic Brook are considered WSS.

Functional Assessment: Wetland F contains Capisic Brook and Capisic Pond. Historic alteration of the surrounding land has significantly altered the natural stream and surrounding wetland resources (*e.g.* creating the pond, clearing the riparian forests, sedimentation, *etc.*). One recent (*i.e.* within the last decade) but major change has been the growth of a cattail monoculture along the pond margins and into the pond center. The expansion of cattails has affected the functionality of the pond, effectively reducing the open water component and increasing the emergent wetland area. However, Capisic Pond and its surrounding wetland are still large, diverse and unique enough to provide important functions and values within the surrounding watershed. Wetland F provides or has the potential to provide the following functions and values: groundwater recharge/discharge, floodflow alteration, fish and shellfish habitat, sediment/toxicant retention, nutrient removal, production export, sediment and shoreline stabilization, wildlife habitat, recreation, educational/scientific value, uniqueness/heritage, and visual quality/aesthetics. Principal functions and values served by wetland F include sediment/toxicant retention, wildlife habitat, recreation, and uniqueness/heritage. These functions and values will be discussed below.

Sediment/Toxicant Retention: Sediment runs to the pond from stormwater outfalls and in runoff from surrounding developed and impervious surfaces. The pond can receive sediment and other pollutants from surface runoff and retain the materials in thick emergent marsh vegetation and allow materials to precipitate in the slow moving water of the pond.

Wildlife Habitat: The pond and its surrounding wetlands provide an important habitat island within an otherwise developed landscape. The wetland provides food, shelter, refugia, and breeding habitat for a variety of wildlife (see Appendix C).

Recreational Value: The pond is bordered on the east by a half-mile hiking trail and is encompassed by city-owned lands designating the area as a park. The trails provide access through the habitats within the park and are used for hiking, biking, bird-watching, dog walking, and “morning strolls”. The trails are included within a large, citywide trail system and are managed by Portland Trails (www.trails.org). Additionally, the pond itself has been traditionally used for ice skating.

Uniqueness/Heritage Value: The pond’s long history and relevance to Portland’s early development is well-documented. Historic use of the pond dates back as far as the late 1600s. The dam site was originally used as a gristmill and sawmill built at the falls of Capisic Brook (near the existing dam structure). Of more recent uniqueness value, Capisic Pond remains the largest freshwater pond in the city.

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APPENDIX A

PHOTOGRAPHIC RECORD

(All photos taken July-August, 2012 by Boyle Associates.)

	Description: Looking north-northwest from Capisic Street bridge at Capisic Pond (**Wetland F**).
	Description: Looking southeast from park trail at herbaceous-dominated, lower elevations of **Wetland A**.
	Description: Looking south across PFO/PEM area of **Wetland B** near trailhead by Macy Street.

	Description: Looking east at isolated emergent plant-dominated **Wetland C** from grassy side trail.
	Description: Looking east at **Wetland D** from main trail.
	Description: Looking southeast at **Wetland D** from main trail near bridge over Rockland Avenue outfall.

	Description: Looking east at **Wetland E** from main trail.
	Description: Looking northwest at **Wetland F** from southern, open water portion of Capisic Pond.
	Description: Looking northeast over cattail-dominated section of **Wetland F** from large blown down white pine on west side of pond.

	Description: Looking south across **Wetland F** from blown down pine on west side of pond.
	Description: Looking east at Rockland Avenue outfall and start of **Stream 1**.
	Description: Looking west at **Stream 1** from timber bridge along gravel trail.

	Description: Looking south along Capisic Brook (**Stream 2**) from the north-central portion of **Wetland F**.
	Description: Looking northwest at Capisic Brook (**Stream 2**) under Lucas Street.
	Description: Looking south at Capisic Brook **(Stream 2)** near Lucas Street.

	Description: Look north at the weir dam on the south side of Capisic Street.
	Description: Capisic Brook, below the weir dam, spills over granite outcrops and into a deep-walled granite valley.
	Description: Concrete diversion chamber below weir dam.

	Description: Looking north within former pond area of **Wetland F**. Near complete cattail encroachment has occurred through the central portion of pond.
	Description: Capisic Pond Park trailhead.
	Description: Young snapping turtle found crossing Macy Street.

APPENDIX B

LIST OF PLANT SPECIES OBSERVED (2012)

Family	Scientific name	Common Name	Noxious or invasive
Aceraceae	*Acer rubrum*	red maple	
Aceraceae	*Acer negundo*	boxelder	
Aceraceae	*Acer saccharinum*	silver maple	
Aceraceae	*Acer platanoides*	Norway maple	X
Adoxaceae	*Sambucus nigra*	black elderberry	
Alismataceae	*Sagittaria latifolia*	common arrowhead	
Anacardiaceae	*Rhus typhina*	staghorn sumac	
Apiaceae	*Daucus carota*	Queen Anne's lace	
Asclepiadaceae	*Asclepias syriaca*	common milkweed	
Asteraceae	*Symphyotrichum novae-angliae*	New England aster	
Asteraceae	*Euthamia graminifolia*	flat-top goldenrod	
Asteraceae	*Solidago gigantea*	giant goldenrod	
Asteraceae	*Solidago rugosa*	wrinkleleaf goldenrod	
Asteraceae	*Doellingeria umbellata*	parasol whitetop	
Asteraceae	*Hieracium sp.*	hawkweed	
Asteraceae	*Achillea millefolium*	yarrow	
Asteraceae	*Arctium sp.*	burdock	
Asteraceae	*Bidens frondosa*	devil's beggartick	
Asteraceae	*Helianthus tuberosa*	Jerusalum artichoke	
Asteraceae	*Ambrosia sp.*	ragweed	
Asteraceae	*Rudbeckia hirta*	blackeyed Susan	
Asteraceae	*Cirsium vulgare*	bull thistle	
Asteraceae	*Cirsium arvense*	Canada thistle	X
Asteraceae	*Taraxacum officinale*	dandelion	
Asteraceae	*Cichorium intybus*	chicory	
Asteraceae	*Centaurea sp.*	knapweed	
Balsaminaceae	*Impatiens capensis*	jewelweed	
Balsaminaceae	*Impatiens glandulifera*	ornamental jewelweed	X
Betulaceae	*Alnus incana var. rugosa*	speckled alder	
Campanulaceae	*Campanula rotundifolia*	bluebell bellflower	
Caprifoliaceae	*Viburnum nudum var. cassinoides*	withe-rod	
Caprifoliaceae	*Viburnum dentatum*	southern arrowwood	
Caprifoliaceae	*Viburnum opulus var. americanum*	highbush cranberry	
Caprifoliaceae	*Lonicera sp.*	honeysuckle	X
Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	X
Celastraceae	*Euonymus alatus*	burningbush	X
Ceratophyllaceae	*Ceratophyllum demersum*	coon’s tail	
Cornaceae	*Cornus amomum*	silky dogwood	
Cornaceae	*Cornus racemosa*	gray dogwood	

Family	Scientific name	Common Name	Noxious or invasive
Cucurbitaceae	*Echinocystis lobata*	wild cucumber	
Cupressaceae	*Juniperus communis*	common juniper	
Cyperaceae	*Scirpus cyperinus*	woolgrass	
Dryopteridaceae	*Onoclea sensibilis*	sensitive fern	
Fabaceae	*Lupinus sp.*	lupine	
Fabaceae	*Lotus corniculatus*	bird's-foot trefoil	X
Fabaceae	*Robinia pseudoacacia*	black locust	X
Fabaceae	*Vicia cracca*	cow vetch	
Fabaceae	*Securigera varia*	crown vetch	X
Fabaceae	*Trifolium pratense*	red clover	
Fabaceae	*Trifolium repens*	white clover	
Fagaceae	*Quercus rubra*	northern red oak	
Juncaceae	*Juncus effusus*	common rush	
Lamiaceae	*Monarda fistulosa*	wild bergamot	
Liliaceae	*Asparagus officinalis*	asparagus	X
Lythraceae	*Lythrum salicaria*	purple loosestrife	X
Onagraceae	*Oenothera sp.*	evening primrose	
Pinaceae	*Picea pungens*	blue spruce	
Pinaceae	*Pinus sylvestris*	Scots pine	
Pinaceae	*Picea rubens*	red spruce	
Pinaceae	*Pinus strobus*	white pine	
Pinaceae	*Larix laricina*	larch	
Plantaginaceae	*Plantago major*	plantain	
Poaceae	*Digitaria sp.*	crabgrass	
Poaceae	*Panicum virgatum*	switchgrass	
Poaceae	*Dactylis glomeratus*	orchard grass	
Poaceae	*Schizachyrium scoparium*	little bluestem	
Poaceae	*Lolium perenne*	perennial ryegrass	
Poaceae	*Echinochloa sp.*	barnyard grass	
Poaceae	*Phleum pratense*	timothy	
Poaceae	*Elymus viginicus*	Virginia wild rye	
Poaceae	*Dichanthelium clandestinum*	Deertongue grass	
Poaceae	*Phalaris arundinacea*	reedcanary grass	X
Polygonaceae	*Polygonum sagittatum*	arrowleaf tearthumb	
Polygonaceae	*Rumex crispus*	curly dock	
Polygonaceae	*Polygonum cuspidatum*	Japanese knotweed	
Polygonaceae	*Polygonum pennsylvanicum*	Pennsylvania smartweed	
Primulaceae	*Lysimachia terrestris*	swamp candle	
Ranunculaceae	*Ranunculus sp.*	buttercup	

Family	Scientific name	Common Name	Noxious or invasive
Ranunculaceae	*Thalictrum sp.*	meadow-rue	
Rhamnaceae	*Rhamnus cathartica*	common buckthorn	X
Rhamnaceae	*Rhamnus frangula*	glossy buckthorn	X
Rosaceae	*Rosa palustris*	swamp rose	
Rosaceae	*Amelanchier canadensis*	Canadian serviceberry	
Rosaceae	*Photinia melanocarpa*	black chokeberry	
Rosaceae	*Prunus nigra*	Canadian plum	
Rosaceae	*Crataegus sp.*	hawthorn	
Rosaceae	*Rosa multiflora*	multiflora rose	X
Rosaceae	*Rubus hispidus*	bristly dewberry	
Rosaceae	*Rubus allegheniensis*	Allegheny blackberry	
Rosaceae	*Malus sp.*	crabapple	
Rubiaceae	*Cephalanthus occidentalis*	common buttonbush	
Salicaceae	*Salix discolor*	pussy willow	
Salicaceae	*Salix nigra*	black willow	
Salicaceae	*Populus tremuloides*	quaking aspen	
Scrophulariaceae	*Chelone glabra*	white turtlehead	
Tiliaceae	*Tilia americana*	basswood	
Typhaceae	*Typha latifolia*	broadleaf cattail	X
Typhaceae	*Typha angustifolia*	narrowleaf cattail	X
Ulmaceae	*Ulmus americana*	American elm	
Verbenaceae	*Verbena hastata*	Swamp verbena	
Vitaceae	*Vitis sp.*	wild grape vine	

APPENDIX C

ANIMAL SPECIES LIST

BIRDS			
Common name	**Species name**	**Field observed**	**E-bird sighting***
Alder flycatcher	*Empidonax alnorum*		X
American black duck	*Anas rubripes*	X	X
American coot	*Fulica americana*		X
American crow	*Corvus brachyhychos*	X	X
American goldfinch	*Spinus tristis*	X	X
American kestrel	*Falco sparverius*		X
American redstart	*Setophaga ruticilla*	X	X
American robin	*Turdus migratorius*	X	X
American tree sparrow	*Spizella arborea*		X
American wigeon	*Anas americana*		X
American woodcock	*Scolopax minor*	X	X
Baltimore oriole	*Icterus galbula*		X
Bank swallow	*Riparia riparia*		X
Barn swallow	*Hirundo rustica*		X
Belted kingfisher	*Magaceryle alcyon*	X	X
Black-and-white warbler	*Mniotilta varia*		X
Blackburnian warbler	*Dendroica fusca*		X
Black-capped chickadee	*Poecile atricapillus*	X	X
Black-crowned night heron	*Nyticorax nyticorax*	X	X
Blackpoll warbler	*Dendroica striata*		X
Black-throated blue warbler	*Drendroica caerulescens*		X
Black-throated green warbler	*Dendroica virens*		X
Blue Jay	*Cyanocitta cristata*	X	X
Blue-gray gnatcatcher	*Polioptila caerulea*		X
Blue-headed vireo	*Vireo solitarius*		X
Bobolink	*Dolichonyx oryzivorus*		X
Bohemian waxwing	*Bombycilla garrulus*		X
Broad-winged hawk	*Buteo platypterus*	X	X
Brown thrasher	*Toxostoma rufum*		X
Brown-headed cowbird	*Molothrus ater*		X
Canada goose	*Branta canadensis*		X
Canada warbler	*Wilsonia canadensis*		X
Cape May warbler	*Dendroica tigrina*		X
Northern cardinal	*Cardinalis cardinalis*	X	X
Carolina wren	*Thryothorus ludovicianus*		X
Cedar waxwing	*Bombycilla cedrorum*	X	X
Chestnut-sided warbler	*Dendroica pensylvanica*	X	X
Chimney swift	*Chaetura pelagica*		X

BIRDS			
Common name	**Species name**	**Field observed**	**E-bird sighting***
Chipping sparrow	*Spizella passerina*		X
Cliff swallow	*Petrochelidon pyrrhonota*		X
Common grackle	*Quiscalus quiscalus*	X	X
Common loon	*Gavia immer*		X
Common yellowthroat	*Geothlypis trichas*	X	X
Cooper's hawk	*Accipiter cooperii*		X
Dark-eyed junco	*Junco hyemalis*		X
Double-crested cormorant	*Phalacrocorax auritus*	X	X
Downy woodpecker	*Picoides pubescens*		X
Eastern bluebird	*Sialis sialis*		X
Eastern kingbird	*Tyrannus tyrannus*		X
Eastern phoebe	*Sayornis phoebe*		X
Eastern towhee	*Pipilo erythrophthalmus*		X
Eastern wood-pewee	*Contopus virens*		X
European starling	*Sturnus vulgaris*	X	X
Gadwall	*Anas strepera*		X
Gray catbird	*Dumetella carolinensis*	X	X
Great black-backed gull	*Larus marinus*		X
Great blue heron	*Ardea herodias*	X	X
Great crested flycatcher	*Myiarchus crinitus*		X
Great egret	*Ardea alba*	X	X
Greater yellowlegs	*Tringa melanoleuca*		X
Green heron	*Butorides virescens*	X	X
Hairy woodpecker	*Picoides villosus*		X
Hermit thrush	*Catharus guttatus*		X
Herring gull	*Larus argentatus*	X	X
Hooded merganser	*Lophodytes cucullatus*		X
House finch	*Carpodacus mexicanus*	X	X
House sparrow	*Passer domesticus*		X
House wren	*Troglodytes aedon*		X
Lark sparrow	*Chondestes grammacus*		X
Least flycatcher	*Empidonax minimus*		X
Least sandpiper	*Calidris minutilla*		X
Lincoln's sparrow	*Melospiza lincolnii*		X
Magnolia warbler	*Dendroica magnolia*		X
Mallard	*Anas platyrhynchos*	X	X
Merlin	*Falco columbarius*		X
Mourning dove	*Zenaida macroura*	X	X

BIRDS			
Common name	**Species name**	**Field observed**	**E-bird sighting***
Mourning warbler	*Oporornis philadelphia*		X
Nashville warbler	*Oreothlypis ruficapilla*		X
Northern flicker	*Colaptes auratus*		X
Northern mockingbird	*Mimus polyglottos*		X
Northern parula	*Parula americana*	X	X
Northern rough-winged swallow	*Stelgidopteryx serripennis*		X
Northern waterthrush	*Parkesia noveboracensis*		X
Orchard oriole	*Icterus spurius*		X
Osprey	*Pandion haliaetus*		X
Ovenbird	*Seiurus aurocapilla*		X
Palm warbler	*Dendroica palmarum*		X
Pied-billed grebe	*Podilymbus podiceps*		X
Pileated woodpecker	*Dryocopus pileatus*		X
Pine siskin	*Spinus pinus*		X
Pine warbler	*Dendroica pinus*		X
Prairie warbler	*Dendroica discolor*		X
Purple finch	*Carpodacus purpureus*		X
Red-bellied woodpecker	*Melanerpes carolinus*		X
Red-breasted nuthatch	*Sitta canadensis*		X
Red-eyed vireo	*Vireo olivaceus*		X
Redhead	*Aythya americana*		X
Red-tailed hawk	*Buteo jamaicensis*	X	X
Red-winged blackbird	*Agelaius phoeniceus*	X	X
Ring-billed gull	*Larus delawarensis*		X
Ring-necked duck	*Aythya collaris*		X
Rock pigeon	*Columba livia*	X	X
Rose-breasted grosbeak	*Pheucticus ludovicianus*		X
Ruby-crowned kinglet	*Regulus calendula*	X	X
Ruby-throated hummingbird	*Archilochus colubris*	X	X
Ruddy duck	*Oxyura jamaicensis*		X
Rusty blackbird	*Euphagus carolinus*		X
Savannah sparrow	*Passerculus sandwichensis*		X
Scarlet tanager	*Piranga olivacea*		X
Sharp-shinned hawk	*Accipiter striatus*		X
Solitary sandpiper	*Tringa solitaria*	X	X
Song sparrow	*Melospiza melodia*	X	X
Sora	*Porzana carolina*		X
Spotted sandpiper	*Actitis macularius*		X

BIRDS			
Common name	**Species name**	**Field observed**	**E-bird sighting***
Swamp sparrow	*Melospiza georgiana*		X
Tennessee warbler	*Oreothlypis peregrina*		X
Tree swallow	*Tachycineata bicolor*		X
Tufted titmouse	*Baeolophus bicolor*		X
Turkey vulture	*Cathartes aura*	X	X
Veery	*Catharus fuscescens*		X
Virginia rail	*Rallus limicola*		X
Warbling vireo	*Vireo gilvus*		X
White-breasted nuthatch	*Sitta carolinensis*	X	X
White-crowned sparrow	*Zonotrichia leucophrys*		X
White-throated sparrow	*Zonotrichia albicollis*		X
Willow flycatcher	*Empidonax traillii*		X
Wilson's snipe	*Gallinago delicata*		X
Wilson's warbler	*Wilsonia pusilla*		X
Wood duck	*Aix sponsa*	X	X
Wood thrush	*Hylocichla mustelina*		X
Yellow warbler	*Dendroica petechia*		X
Yellow-bellied flycatcher	*Empidonax flaviventris*		X
Yellow-rumped warbler	*Dendroica coronata*		X

*Source: eBird. 2012. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Available: http://www.ebird.org. (Accessed: September 16th, 2012). Search Criteria: first sightings Capisic Pond, 1997-2012

OTHER WILDLIFE	
Common name	**Species name**
American red squirrel	*Tamiasciurus hudsonicus*
Eastern gray squirrel	*Sciurus griseus*
Eastern chipmunk	*Tamias striatus*
White-tailed deer	*Odocoileus virginianus*
Coyote	*Canis latrans*
Common raccoon	*Procyon lotor*
Green frog	*Rana clamitans*
Bull frog	*Rana catasbeiana*
Common snapping turtle	*Chelydra serpentina*
Painted turtle	*Chrysemys picta*
fish	multiple (un-id'ed)
Chinese mystery snail	*Bellamya chinensis*
White-footed mouse	*Peromyscus leucopus*
Common garter snake	*Thamnophis sirtalis*

APPENDIX B: ROCKLAND AVENUE OUTFALL DESIGN CALCULATIONS

WOODARD &CURRAN
COMMITMENT & INTEGRITY
DRIVE RESULTS
41 HUTCHINS DRIVE
PORTLAND, MAINE 04102
TEL.(207)774-2112

CLIENT	CITY OF PORTLAND		
PROJECT	ROCKLAND AVE OUTFALL		
	DISCHARGE ESTIMATE		
DESIGNED BY	AEA	DATE	10/11/2012
CHECKED BY		DATE	
PROJECT NO.	225672.15	SHEET NO.	1

Storm Drain Pipe Capacity Calculation

Percent Full	Flow Rate (gpd)	Flow Rate (cfs)	Velocity (fps)	Wetted Perimeter	Hydraulic Radius (feet)	Flow Area (sq. ft.)
0	0	0	0	0	0	0
1	53,082	0.082	2.470	1.002	0.033	0.033
2	236,864	0.366	3.909	1.419	0.066	0.094
3	566,670	0.876	5.106	1.741	0.099	0.172
4	1,050,299	1.624	6.166	2.014	0.131	0.263
5	1,692,574	2.618	7.132	2.255	0.163	0.367
10	7,358,705	11.381	11.138	3.218	0.318	1.022
15	17,133,105	26.499	14.348	3.977	0.464	1.847
20	30,865,844	47.739	17.076	4.636	0.603	2.796
25	48,281,323	74.674	19.453	5.236	0.733	3.839
30	69,023,684	106.755	21.548	5.796	0.855	4.954
35	92,677,151	143.339	23.404	6.331	0.967	6.125
40	118,776,470	183.705	25.048	6.847	1.071	7.334
45	146,812,201	227.067	26.497	7.353	1.165	8.570
50	176,232,614	272.570	27.764	7.854	1.250	9.817
55	206,442,735	319.294	28.855	8.355	1.324	11.065
60	236,800,310	366.246	29.774	8.861	1.388	12.301
65	266,607,667	412.348	30.521	9.377	1.441	13.510
70	295,097,162	456.411	31.089	9.912	1.481	14.681
75	321,405,177	497.100	31.469	10.472	1.508	15.796
80	344,523,088	532.856	31.643	11.071	1.521	16.839
85	363,194,419	561.734	31.579	11.731	1.516	17.788
90	375,656,504	581.008	31.215	12.490	1.490	18.613
95	378,729,015	585.760	30.401	13.453	1.432	19.268
100	352,465,701	545.140	27.764	15.708	1.250	19.635

25-yr Storm Flow (CFS)	241
Diam. (in)	60
Manning n	0.011
Slope(ft/ft)	0.0312

WOODARD & CURRAN
41 HUTCHINS DRIVE
PORTLAND, MAINE 04102
TEL. (207) 774-2112
FAX (207) 774-6635

CLIENT City of Portland
PROJECT Rockland Ave. Outfall Design
DESIGNED BY AEA DATE 10-11-12
CHECKED BY DATE
PROJECT NO. 225672.15 SHEET NO. 1 OF 1

Maine DEP Wetpond Sizing Criteria

* Per Chapter 4 of Volume III of the Maine Stormwater BMP Manual

① Channel Protection Volume (CPV) = 1" × Impervious + 0.4" × Pervious

Areas (From HydroCAD):

Impervious (ac)	Pervious (ac)
7.113	47.265
6.124	25.862
10.09	20.050
4.682	25.307
28.009 ac = 1,220,072 SF	118.484 ac = 5,161,163 SF

$CPV = \frac{1}{12}'(1,220,072\ SF) + 0.4/12'(5,161,163\ SF) = \underline{273,711\ CF}$

② Permanent Pool Volume (PPV) = 1.5" × Impervious + 0.6" × Pervious

$PPV = 1.5/12'(1,220,072\ SF) + 0.6/12'(5,161,163\ SF) = \underline{410,567\ CF}$
(9.43 ac)

WetPond that can be Provided @ Rockland Outfall

PPV (from HydroCAD based on preliminary Permanent Pool Elev. = 34.83 w/ 2:1 Embankments, NOT to exceed 10 VF) = 132,154 CF (3.03 ac)

Percentage of Maine DEP Requirement = $\boxed{32\%}$

Mean Permanent Pool Depth $\overset{?}{\geq} 3'$ = $\frac{\text{Pond Volume}}{\text{Surface Area}}$ @ 1' below Permanent Pool

$\frac{113,711\ CF}{17,947\ SF} = \underline{6.34'}$ ✓ OK

APPENDIX C: PROJECT OPINION OF COST

COMMITMENT & INTEGRITY
DRIVE RESULTS
WOODARD & CURRAN
41 HUTCHINS DRIVE
PORTLAND, MAINE 04102
TEL.(207)774-2112

CLIENT	City of Portland		
PROJECT	Capisic Pond Enhancement Plan - Phase II		
EST. BY	JB	DATE	11/9/2012
CHECKED BY	DAS	DATE	11/13/2012
PROJECT NO.	225672.15		

Capisic Pond Enhancement Plan - Phase II:
Engineer's Opinion of Probable Construction Cost at 30% Design

Rockland Ave. Outfall Construction	$230,000
Pond Enhancement	$1,550,000
SubTotal	**$1,780,000**
Permitting & Final Design (6% of Construction)	$107,000
Construction Administration (8% of Construction)	$143,000
SubTotal	**$250,000**
Project Contingency (20% of Project Cost)	**$406,000**
Total Project	**$2,436,000**

DRAFT

Note:

1 Estimate Based on 30% Preliminary Design Report Figures dated November 2012

2 Detailed project cost estimate presented in "30% Design Opinion of Project Cost" prepared by Woodard & Curran, dated 11/9/2012

DRAFT

30% Design Opinion of Project Cost

Capisic Pond Management Plan

Woodard & Curran
41 Hutchins Drive
Portland, Maine 04102

WOODARD &CURRAN

Date: 11/9/2012
Time: 7:51 AM
Project No.: 225672

		Labor	Material	Equipment	Subcontract	Temp Matl	Equip Rental	Other	Totals
Direct costs	%								
Base labor		$472,357	$368,032	$506,021	$70,157	$0	$2,760	$0	$1,419,326
Labor burden	0.00%	$0							$0
Labor fringes		$72,710							$72,710
Labor manhours		10,471							
Material sales tax	0.00%		$0						$0
Equipment surcharge	0.00%			$0					$0
Temporary material markup	0.00%					$0			$0
Equipment rental markup	0.00%						$0		$0
Other markup	0.00%							$0	$0
Gross cost		$472,357	$368,032	$506,021	$70,157	$0	$2,760	$0	$1,492,036
General liability insurance	0.65%								$13,195
Builder's risk insurance	0.15%								$3,045
	Overall								
Overhead	0.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	
	$0	$47,236	$36,803	$50,602	$7,016	$0	$276	$0	$141,933
Profit	0.00%	8.00%	8.00%	8.00%	8.00%	8.00%	8.00%	8.00%	
	$0	$37,789	$29,443	$40,482	$5,613	$0	$221	$0	$113,546
Performance bond	$16,946								$16,946
Permitting & Final Design	6.00%								$106,842
Construction Administration	8.00%								$142,456
Total									**$2,030,000**
Project Contingency	20%								$406,000
Project total									**$2,436,000**

Estimate Summary - Capisic Pond Management Plan

Recap - With Taxes and Insurance ,Indirect Costs are Spread

Group 1: Area

Estimator : JBrockington
Project Size : 6.0 ACRES

Description	Quantity	UM	Lab.Total	Mat.Total	Sub.Total	Eqp.Total	Eqp.Rent.Tot	Tot.UnitCost	TotalCost
General Conditions	**1**	**LS**	**148,282.26**	**35,163.12**	**16,745.87**	**21,317.98**		**221,509.224**	**221,509**
Outfall Structure	**1**	**LS**	**49,181.73**	**197,451.39**	**16,163.41**	**19,879.74**	**1,502.05**	**284,178.332**	**284,178**
Pond Remediation	**1**	**LS**	**692,448.76**	**368,258.80**	**81,633.39**	**784,966.92**	**3,004.11**	**1,930,311.981**	**1,930,312**
Total Estimate			**889,912.75**	**600,873.32**	**114,542.67**	**826,164.64**	**4,506.16**		**2,436,000**

Estimate Summary - Capisic Pond Management Plan

Recap - With Taxes and Insurance

Estimator : JBrockington
Project Size : 6.0 ACRES

Group 1: Area
Group 2: Divisions
Group 3: Major ItemCode Groups

Description	Quantity	UM	Lab.Total	Mat.Total	Sub.Total	Eqp.Total	Eqp.Rent.Tot	Tot.UnitCost	TotalCost
General Conditions									
01 - General Conditions									
Administrative requirements			87,128.56	10,187.46	402.00	4,172.39			101,890
Quality requirements					5,000.00				5,000
Temporary facilities and controls			3,237.50	11,349.75	1,116.00	8,884.75			24,588
Execution requirements			456.00		3,738.75				4,195
** Total 01 - General Conditions			90,822.06	21,537.21	10,256.75	13,057.14			135,673
* Total General Conditions	1	LS	90,822.06	21,537.21	10,256.75	13,057.14		135,673.173	135,673
Outfall Structure									
02 - Sitework									
Site preparation			3,915.37	679.25		2,466.36	920.00		7,981
Earthwork			2,898.95	25,522.26		700.07			29,121
Drainage and containment			5,231.69	92,086.90		8,158.94			105,478
Bases, ballasts and pavement			6,120.12	1,399.56		850.86			8,371
Planting			11,957.40	1,249.92	9,900.00				23,107
** Total 02 - Sitework			30,123.54	120,937.89	9,900.00	12,176.23	920.00		174,058
* Total Outfall Structure	1	LS	30,123.54	120,937.89	9,900.00	12,176.23	920.00	174,057.654	174,058
Pond Remediation									
Notes									
Notes									
** Total Notes									
02 - Sitework									
Site preparation			14,238.09	9,324.98		13,409.10	1,840.00		38,812
Earthwork			357,347.05	207,404.76		457,335.46			1,022,087
Bases, ballasts and pavement			5,110.11	2,421.94		8,691.33			16,223
Site improvements and amenities			5,669.78	2,040.00		1,352.00			9,062
Planting			41,756.00	4,364.80	50,000.00				96,121
** Total 02 - Sitework			424,121.03	225,556.48	50,000.00	480,787.89	1,840.00		1,182,305
* Total Pond Remediation	1	LS	424,121.03	225,556.48	50,000.00	480,787.89	1,840.00	1,182,305.393	1,182,305
Total Gross Cost			545,066.63	368,031.58	70,156.75	506,021.26	2,760.00		1,492,036

Estimate Summary - Capisic Pond Management Plan

Detail - With Taxes and Insurance

Estimator : JBrockington
Project Size : 6.0 ACRES

Group 1: Area
Group 2: Divisions
Group 3: Major ItemCode Groups

Description	Quantity	UM	Lab.Total	Mat.Total	Sub.Total	Eqp.Total	Eqp.Rent.Tot	Tot.UnitCost	TotalCost
General Conditions									
01 - General Conditions									
Administrative requirements									
Mobilize/Demobilize	1	LS	1,928.56	937.46		4,172.39		7,038.423	7,038
Project Manager	8	WEEK	23,520.00					2,800.000	23,520
Superintendent	14	WEEK	36,400.00					2,600.000	36,400
Project Engineer	6	WEEK	10,304.00					1,840.000	10,304
Office Manager	8	WEEK	10,752.00					1,280.000	10,752
General Laborer	4	WEEK	4,224.00					1,056.000	4,224
Permit	1	LS		5,000.00				5,000.000	5,000
Purchase drawings	1	LS		2,500.00				2,500.000	2,500
Travel expenses	14	WEEK		1,750.00				125.000	1,750
Progess photographs	3	MO			402.00			134.000	402
***** Total Administrative requirements**			**87,128.56**	**10,187.46**	**402.00**	**4,172.39**			**101,890**
Quality requirements									
Laboratory testing	1	LS			5,000.00			5,000.000	5,000
***** Total Quality requirements**					**5,000.00**				**5,000**
Temporary facilities and controls									
Job telephone	3	MO		1,050.00				350.000	1,050
Electrical energy costs	3	MO		1,350.00	849.00			733.000	2,199
Water usage costs	3	MO		300.00	267.00			189.000	567
Office trailer	3	MO		1,350.00				450.000	1,350
Storage trailer(s)	3	MO		375.00				125.000	375
Temporary toilets	3	MO		1,020.00				340.000	1,020
Water, ice and cups	3	MO		427.50				142.500	428
First aid supplies	3	MO		150.00				50.000	150
Safety supplies	3	MO		456.75				152.250	457
Office supplies	3	MO		250.50				83.500	251
Small tools	3	MO				503.25		167.750	503
Gasoline and lubricating oil	920	GALS		3,220.00				3.500	3,220
Generators	3	MO				3,648.00		1,216.000	3,648
Automobile	2	MO				1,200.00		600.000	1,200
Pick-up truck	3	MO				2,646.00		882.000	2,646
Temporary road	2,500	SQYD	2,962.50	900.00		887.50		1.900	4,750
Job sign	1	EACH	275.00	500.00				775.000	775
***** Total Temporary facilities and controls**			**3,237.50**	**11,349.75**	**1,116.00**	**8,884.75**			**24,588**
Execution requirements									
Job clean up	1,200	SQFT	456.00		300.00			0.630	756
Rubbish removal	210	CUYD			3,438.75			16.375	3,439
***** Total Execution requirements**			**456.00**		**3,738.75**				**4,195**
**** Total 01 - General Conditions**			**90,822.06**	**21,537.21**	**10,256.75**	**13,057.14**			**135,673**
*** Total General Conditions**	**1**	**LS**	**90,822.06**	**21,537.21**	**10,256.75**	**13,057.14**		**135,673.173**	**135,673**

Estimate Summary - Capisic Pond Management Plan

Detail - With Taxes and Insurance

Estimator : JBrockington
Project Size : 6.0 ACRES

Group 1: Area
Group 2: Divisions
Group 3: Major ItemCode Groups

Description	Quantity	UM	Lab.Total	Mat.Total	Sub.Total	Eqp.Total	Eqp.Rent.Tot	Tot.UnitCost	TotalCost
Outfall Structure									
02 - Sitework									
Site preparation									
Silt fence w/wire mesh, filter fabric and stakes	500	LNFT	580.00	255.05				1.670	835
Demo existing 60" reinforced concrete pipe	20	LNFT	1,508.00	96.00		1,347.20		147.560	2,951
Remove and reset existing 60" reinforced concrete pipe	6	LNFT	904.80	57.60		808.32		295.120	1,771
6" dewatering header pipe	10	LNFT	579.68	154.62		61.52		79.582	796
6" dewatering sump pump	1	EACH	141.29				920.00	1,061.289	1,061
Sump hole excavation by backhoe	10	CUYD	95.63	19.98		249.32		36.493	365
Sump hole gravel collar	2	EACH	105.97	96.00				100.983	202
***** Total Site preparation**			**3,915.37**	**679.25**		**2,466.36**	**920.00**		**7,981**
Earthwork									
Remove and reset existing outfall	1	EACH	1,326.40	256.00		332.80		1,915.200	1,915
Remove and reset existing bridge	1	EACH	884.27	170.67		221.87		1,276.800	1,277
Rounded river boulders 2' - 4' dia	650	TONS	688.29	25,095.59		145.41		39.891	25,929
***** Total Earthwork**			**2,898.95**	**25,522.26**		**700.07**			**29,121**
Drainage and containment									
Pretreatment stucture - 11.3' wide x 17.3' long x 13.4' high	1	EACH	1,854.96	88,744.00		1,954.00		92,552.960	92,553
Machine excavate stormwater structure	200	CUYD	1,365.68	285.68		3,561.44		26.064	5,213
Backfill stormwater structure w/gravel	135	CUYD	2,011.05	3,057.22		2,643.50		57.124	7,712
Maintenance area (excluded)		****							
***** Total Drainage and containment**			**5,231.69**	**92,086.90**		**8,158.94**			**105,478**
Bases, ballasts and pavement									
Fine grade @ reinforced access area	600	SQFT	143.64	24.30		283.86		0.753	452
Sub base gravel @ reinforced access area	30	CUYD	286.80	722.40		567.00		52.540	1,576
Reinforced access road	600	SQFT	5,689.68	652.86				10.571	6,343
***** Total Bases, ballasts and pavement**			**6,120.12**	**1,399.56**		**850.86**			**8,371**
Planting									
Small trees	22	EACH			9,900.00			450.000	9,900
Seeding w/fertilizer and mulch	12,600	SQFT	11,957.40	1,249.92				1.048	13,207
***** Total Planting**			**11,957.40**	**1,249.92**	**9,900.00**				**23,107**
**** Total 02 - Sitework**			**30,123.54**	**120,937.89**	**9,900.00**	**12,176.23**	**920.00**		**174,058**
*** Total Outfall Structure**	**1**	**LS**	**30,123.54**	**120,937.89**	**9,900.00**	**12,176.23**	**920.00**	**174,057.654**	**174,058**

Detail - With Taxes and Insurance

Estimator : JBrockington
Project Size : 6.0 ACRES

Group 1: Area
Group 2: Divisions
Group 3: Major ItemCode Groups

Description	Quantity	UM	Lab.Total	Mat.Total	Sub.Total	Eqp.Total	Eqp.Rent.Tot	Tot.UnitCost	TotalCost
Pond Remediation									
Notes									
Notes									
Labor cost based on standard wage rates (excludes prevailing wage rates)		****							
Project schedule start Aug 1st and complete October 31st (3 months duration)		****							
***** Total Notes**									
**** Total Notes**									
02 - Sitework									
Site preparation									
Stabilized construction entrance	150	CUYD	300.72	120.00		1,027.52		9.655	1,448
3/4" crushed stone material	150	CUYD		3,750.00				25.000	3,750
Jute mesh	1,789	SQYD	1,254.91	1,681.73				1.642	2,937
Silt fence w/wire mesh, filter fabric and stakes	2,500	LNFT	2,900.00	1,275.25				1.670	4,175
Hay bales (staked)	100	EACH	105.40	1,218.12				13.235	1,324
Maintain erosion control	40	HOUR	1,412.89					35.322	1,413
Clear brush and undergrowth (light)	1	ACRE	3,970.81			8,720.05		9,263.400	12,691
Rough grading	1	ACRE	1,390.35			2,479.70		2,824.857	3,870
24" corrugated mtl coated pipe	24	LNFT	286.92	544.11				34.626	831
6" dewatering header pipe	30	LNFT	1,739.04	463.85		184.56		79.582	2,387
6" dewatering sump pump	2	EACH	282.58				1,840.00	1,061.289	2,123
Sump hole excavation by backhoe	40	CUYD	382.54	79.92		997.27		36.493	1,460
Sump hole gravel collar	4	EACH	211.93	192.00				100.983	404
***** Total Site preparation**			**14,238.09**	**9,324.98**		**13,409.10**	**1,840.00**		**38,812**
Earthwork									
Bank cut	1,193	CUYD	2,850.77	715.56		9,003.84		10.540	12,570
Swamp mats - 8' wide x 14' long	80	EACH		29,200.00				365.000	29,200
Mass excavation - JD 270C LC 60' long reach	13,260	CUYD	175,273.33	54,004.00		232,154.75		34.799	461,432
Haul excavated material w/ watertight sealed trucks 8-10 miles	4,680	CUYD	15,121.55	4,659.41		39,934.44		12.760	59,715
** Licensed landfill disposal (excluded) **		****							
Fill w/ excavated material	8,580	CUYD	112,552.44	48,048.86		175,174.43		39.135	335,776
Fill w/ crushed stone	745	CUYD	40,738.96	18,634.26				79.656	59,373
Class 3 rip-rap 18"	1,386	TONS	2,571.75	42,982.35				32.858	45,554
Woven polypropylene geotextile	4,800	SQYD	8,238.24	9,160.32		1,068.00		3.847	18,467
***** Total Earthwork**			**357,347.05**	**207,404.76**		**457,335.46**			**1,022,087**
Bases, ballasts and pavement									
12" compacted local gravel	556	SQYD	5,110.11	2,421.94		8,691.33		29.202	16,223
** Temporary access road **	556	SQYD							
***** Total Bases, ballasts and pavement**			**5,110.11**	**2,421.94**		**8,691.33**			**16,223**
Site improvements and amenities									

Estimate Summary - Capisic Pond Management Plan

Detail - With Taxes and Insurance

Estimator : JBrockington
Project Size : 6.0 ACRES

Group 1: Area
Group 2: Divisions
Group 3: Major ItemCode Groups

Description	Quantity	UM	Lab.Total	Mat.Total	Sub.Total	Eqp.Total	Eqp.Rent.Tot	Tot.UnitCost	TotalCost
Traffic signs	8	EACH	281.28	1,000.00				160.160	1,281
Street sweeping	130	HOUR	5,388.50	1,040.00		1,352.00		59.850	7,781
***** Total Site improvements and amenities**			**5,669.78**	**2,040.00**		**1,352.00**			**9,062**
Planting									
Wetland enhancement plantings (allowance)	1	LS			50,000.00			50,000.000	50,000
Seeding w/fertilizer and mulch	44,000	SQFT	41,756.00	4,364.80				1.048	46,121
***** Total Planting**			**41,756.00**	**4,364.80**	**50,000.00**				**96,121**
**** Total 02 - Sitework**			**424,121.03**	**225,556.48**	**50,000.00**	**480,787.89**	**1,840.00**		**1,182,305**
*** Total Pond Remediation**	**1**	**LS**	**424,121.03**	**225,556.48**	**50,000.00**	**480,787.89**	**1,840.00**	**1,182,305.393**	**1,182,305**
Total Gross Cost			**545,066.63**	**368,031.58**	**70,156.75**	**506,021.26**	**2,760.00**		**1,492,036**

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