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# Suffolk County Peconic Estuary Program Conceptual Habitat Restoration Designs

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Meetinghouse Creek (Site MH-2)  
Main Road Wetland Construction  
Aquebogue, Town of Riverhead

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Prepared For:



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## 1 EXECUTIVE SUMMARY

The Meetinghouse Creek (MH-2) Main Road Wetland Construction project was one of forty-one (41) priority habitat restoration projects identified in the 2017 PEP Habitat Restoration Plan by the Peconic Estuary Program (PEP) Habitat Restoration Workgroup. Meetinghouse Creek is listed as an impaired waterbody on the NYSDEC Division of Water Priority Waterbodies Lists due to low dissolved oxygen concentrations caused by excessive nutrient levels originating from agricultural runoff, stormwater/urban runoff, municipal discharges, and boat pollution. The upstream (northern) limit of the surface waters of Meetinghouse Creek is located on a 2.61 acre parcel owned by the Town of Riverhead. This Main Road wetland consists of a 1.5 acre *Phragmites* marsh surrounded by a narrow fringe of forested wetland. A small, low-gradient stream is located at the downstream end of the *Phragmites* marsh, which conveys water into a small (0.15 acre) pond. Immediately downstream of the Main Road wetland is the Crescent Duck Farm. The tidal reaches of Meetinghouse Creek are located approximately 4,400 feet downstream of the Main Road wetland.

A 5.6-acre watershed consisting of residential, commercial, and agricultural lands bordering Church Lane and Route 25 contributes stormwater to the Main Road wetland. The stormwater from this contributing area discharges from Church Lane and Route 25 to the Main Road wetland through a 24-inch reinforced concrete pipe.

This study recommends the construction of a 1.2 acre stormwater wetland to manage the runoff generated by the 90% rainfall event in the 5.6 acre contributing area of the Main Road. Stormwater wetlands are utilized for water quality and water quantity controls. As stormwater flows through the wetland, pollutants such as nutrients, pathogens, sediments, and metals are removed through settling and biological uptake, reducing sedimentation and improving water quality in downstream wetlands and surface waters. The conceptual plans developed during this study provide for a wetland that complies with requirements of the NYS Stormwater Management Design Manual for water quality volume and water quantity (extreme flood control). The stormwater wetland includes approximately 20,000 SF of meandering zones of low and high freshwater marsh to treat the required water quality volume; deep-water forebay and micropool zones; a 2.5 foot tall earthen berm to provide extreme flood control; maintenance access; and an emergency spillway to allow for stormwater in excess of the 100-year event to flow to the downstream wetlands. This study also provides recommendations for maintenance practices in order to realize the ecological objectives of the proposed stormwater wetland. Feasibility level costs and other considerations, such as design constraints and regulatory permitting requirements, are included to inform the final design of construction plans and specifications.

## 2 EXISTING CONDITIONS

### 2.1 Existing Ecological Conditions

The Main Road (MH-2) wetland is largely located on a 2.61 acre parcel (SCTM#: 600-67-2-26.1) owned by the Town of Riverhead. This wetland is the upstream (northern) limit of Meetinghouse Creek. The Main Road wetland is regulated by the New York State Department of Environmental Conservation (NYSDEC) under the New York State Freshwater Wetlands Act (Article 24). The Main Road wetland consists of a 1.5 acre *Phragmites* marsh surrounded by a narrow fringe of forested wetland. A small, low-gradient stream is located at the downstream (southern) end of the *Phragmites* marsh, which conveys water into a small (0.15 acre) pond. Immediately downstream of the Main Road wetland is the Crescent Duck Farm. Meetinghouse Creek is tidally-influenced approximately 4,400 feet downstream of the Main Road wetland.

Meetinghouse Creek is listed as an impaired waterbody on the NYSDEC Division of Water Priority Waterbodies Lists from 2002 and 2014, which catalogues surface waters with known or suspected water quality problems. Impacts and pollution sources for Meetinghouse Creek identified by the NYSDEC are low dissolved oxygen concentrations caused by excessive nutrient levels originating from agricultural runoff, stormwater/urban runoff, municipal discharges, and boat pollution (Horsley Whitten Group, 2006).

Approximately 0.5 acres of *Phragmites* marsh is located on the subject property. The marsh is a dense monoculture of tall *Phragmites* reeds with limited native plant diversity. Herbaceous plants present at low density within the *Phragmites* marsh include bitter dock (*Rumex obtusifolius*) and various sedges (*Carex* sp.), smartweeds (*Polygonum* sp.), and ferns. The *Phragmites* marsh is bordered by a narrow forested wetland dominated by red maple (*Acer rubrum*) with an understory comprised of *Phragmites australis*, shrub honeysuckle (*Lonicera* sp.), sensitive fern (*Onoclea sensibilis*), soft rush (*Juncus effusus*), various sedges, and occasional skunk cabbage (*Symplocarpus feotidus*). The landward limits of the freshwater wetland located on the subject property, and the boundary between the *Phragmites* marsh and the forested wetland, are shown on Figure 1 (*Draft Ecological Communities Map*). A complete list of the plant species observed during field investigations in November 2018 is provided in Appendix A.

Surface waters drain from the on-site *Phragmites* marsh through a small headwater stream located at the southwestern corner of the marsh, as well as a drainage ditch located slightly to its east, to a small pond. The stream channel, drainage ditch, and pond are relics from a larger man-made (or manipulated) pond present at the site in 1962 (Figure 2). The small stream runs through marshy stands of watercress (*Nasturtium officinale*).



Figure 1: Ecological Communities Map for Main Road wetland



Figure 2: 1962 Aerial Imagery of Main Road wetland and Crescent Duck Farm to the south.

As shown in Figure 2, the uplands surrounding the Main Road wetland were largely cleared or non-forested in 1962. Successional forests have developed on these uplands since the 1960s. The successional forests dominated by Norway maple (*Acer platanoides*), sycamore maple (*Acer pseudoplatanus*), bird cherry (*Prunus avium*), autumn olive (*Elaeagnus umbellata*), privet (*Ligustrum sp.*), Asiatic bittersweet (*Celastrus orbiculatus*), Alleghany blackberry (*Rubus allegheniensis*), multiflora rose (*Rosa multiflora*), rough-stemmed goldenrod (*Solidago rugosa*), and garlic mustard (*Alliaria petiolata*). The upland portions of the subject property comprised of these successional forests total approximately 1.4 acres.

## 2.2 Stormwater Infrastructure tributary to the Main Road Wetland

A 5.6-acre watershed consisting of residential, commercial, and agricultural lands bordering Church Lane and Route 25 contributes stormwater to the Main Road wetland (Horsley Whitten Group, 2006). An 18-inch perforated corrugated metal pipe conveys stormwater collected from catch basins on Church Lane to the Main Road wetland. Construction plans from 1989 for the Church Lane stormwater drainage system provided by the Town of Riverhead can be found in Appendix B. A 24-inch pipe conveys stormwater collected from catch basins on Route 25 to the Main Road wetland. All catch basins within approximately 200 feet of the Main Road wetland were located (and elevations recorded) and are identified on Figure 1. A 24-inch reinforced concrete pipe housed within a concrete headwall discharges stormwater from the Church Lane and Route 25 stormwater infrastructure to the Main Road wetland (Figure 3).



Figure 3: Stormwater Outfall at Main Road Wetland

## 2.3 Endangered and Threatened Species

Consultation with the New York Natural Heritage Program indicated that there are no known records of current or historical occurrences of endangered, threatened, rare, or special concern species at the Main Road wetland (NYSDEC NHP, 2018).

### **3 PREVIOUS RECOMMENDATIONS FOR STORMWATER MANAGEMENT AND WATER QUALITY IMPROVEMENT AT MEETINGHOUSE CREEK AND MAIN ROAD WETLAND**

The Meetinghouse Creek Watershed Management Plan (Horsley Whitten Group, 2006) identifies opportunities to improve management of sources of stormwater-derived pollutants to Meetinghouse Creek by providing recommendations to prevent pollution and implement appropriate stormwater best management practices (BMPs) in key locations in the Meetinghouse Creek watershed. At the MH-2 location, the Watershed Management Plan (Horsley Whitten Group, 2006) recommended 1) the construction of a sediment forebay (0.05 acres) to prevent the existing wetland from sedimentation, 2) retrofitting the existing outlet structure with a flow-splitting device to direct the water quality volume into the sediment forebay and allow flow from larger storms to directly enter the wetland, and 3) installing an additional stormwater sewer to capture runoff from a frequently flooded section of the Church Lane area.

The sediment forebay recommended by Horsely Whitten Group would slow incoming stormwater from up to a 1.2 inch rainfall event and settle suspended solids to prevent these sediments from being deposited in the *Phragmites*-dominated wetland. It should be noted that the current 2015 New York State Stormwater Design Manual (NYSDEC, January 2015a) now requires treatment of a 1.5 inch rainfall event. Sediments accumulated in the forebay would need to be monitored and removed annually to prevent the forebay from filling resulting in sediment discharge to the existing marsh.

The Town of Riverhead recommended the construction of a larger 0.6 acre stormwater management wetland featuring a sediment forebay, low and high marsh zones, 2 to 4 foot deep micropool, and downstream embankment with a stabilized outfall to prevent sedimentation of the existing wetland and improve water quality.

The site's wetlands are regulated by the NYSDEC (freshwater wetland # MH-2). The NYSDEC typically requires that any proposed sediment forebay or stormwater management wetland must be located landward of the wetland boundary of any NYSDEC-regulated freshwater wetland in order to comply with the objective of Article 24 (Freshwater Wetlands Act) of the New York State Environmental Conservation Law. Specifically, Article 24 aims to "preserve, protect and conserve freshwater wetlands and the benefits derived therefrom, to prevent the despoliation and destruction of freshwater wetlands". In addition, the 2015 New York State Stormwater Design Manual typically requires that stormwater management practices are not located in jurisdictional wetlands.

Due to the standard NYSDEC restrictions described above, our project team developed an initial schematic design (Figure 4) in which a 0.45 acre stormwater wetland was located adjacent to the *Phragmites* marsh.



Figure 4: Preliminary Schematic Design for Main Road Stormwater Wetland.

## 4 CONCEPTUAL DESIGN FOR 1.2 ACRE STORMWATER MANAGEMENT WETLAND

Meetinghouse Creek is listed as an impaired waterbody under the 2015 New York State Waterbody Inventory List, with known pollutants including low dissolved oxygen, nutrients (nitrogen), algal/plant growth (brown tide, rust tide); urban/storm runoff, agricultural runoff from duck farms, and residential sanitary systems (NYSDEC, 2015b). Stormwater wetlands provide water quality and water quantity controls. As stormwater flows through the wetland, pollutants such as nutrients, pathogens, sediments, and metals are removed through settling and biological uptake.

A conceptual plan (Appendix C) was developed for a 1.2 acre stormwater wetland in accordance with the NYS Stormwater Management Design Manual (NYSSMDM, 2015a) for the 5.6 acre contributing area of the Main Road wetland with ~60% impervious surfaces. The size and percent of impervious surfaces of the contributing area was previously identified in the Meetinghouse Creek Watershed Management Plan (Horsley Whitten Group, 2006).

The stormwater management wetland at the subject property was designed to comply with requirements of the NYSSMDM for water quality volume (WQv) and water quantity (Extreme Flood Control, 100-year rainfall event). Preliminary calculations of the water quality volume and

extreme flood control, based on the watershed area and impervious surface coverage, formed the basis for the conceptual stormwater wetland design. Conceptual design is based on treatment and detention of stormwater generated by the 100-year rainfall ('extreme flood'), in order to prevent increased discharge rates to downstream reaches of Meetinghouse Creek. It should be noted that, while the 100-year extreme flood control requirement is not applicable to sites that discharge directly to tidal waters, due to this site's position in the upper reach of the Meetinghouse Creek watershed, the 100-year extreme flood control requirement cannot be waived. The need to provide extreme flood control for the 100-year storm volume has greatly increased the wetland area needed to comply with the 2015 NYSSMDM compared to the 0.6 acre wetland previously recommended by the Town of Riverhead.

The 1.2 acre stormwater wetland includes approximately 20,000 SF of meandering zones of low and high freshwater marsh to treat the required WQ<sub>v</sub>. A 755 SF rip-rap lined sediment forebay (4 feet deep) is located between the existing culvert outfall and the wetland in order to allow sediments to settle out and to be periodically removed. A similarly sized (850 SF) rip-rap lined micropool is located at the downstream end of the treatment wetland. In order to provide extreme flood control, the stormwater wetland is surrounded by a 2.5 foot tall earthen berm having a 1:3 slope. On the east side of the wetland, the berm has a 12' wide access road with precast concrete grass pavers at the entrance and on the top of the berm adjacent to the forebay and micropool for maintenance equipment. To the west of the wetland and discharge outfall, no maintenance road is necessary and the top of the berm is only 6 feet wide. On the northern side of the proposed wetland, the 2.5 ft tall earthen berm will again have a 1:3 side slope leading down to the wetland. However, a northern side slope is not likely necessary due to the change in existing grade. On the north side of the access road, the 7.5 ft wide area shown will meet existing grade. The conceptual plan also provides a rip-rap pad at the outfall of the stormwater wetland to prevent scouring and erosion of sediment. An emergency spillway is required and sited on the southwest corner of the wetland to allow for waters in excess of the 100-year event to flow over the earthen berm in a rip-rap reinforced channel to the downstream wetlands.

In addition to water quality and water quantity requirements, the recommended conceptual stormwater management wetland complies with the following requirements for stormwater wetland design (NYSDEC, 2015a):

- Flowpaths through wetland should be maximized and the flowpath shall have a minimum length to relative width ratio of 2:1.
- The surface area of the entire stormwater wetland shall be at least one percent of the contributing drainage area (e.g. recommended wetland is 21% of contributing area).
- A minimum of 35% of the total surface area (in this case of the portion of the wetland to accommodate the WQ<sub>v</sub>) can have a depth of six inches or less, and at least 65% of the total surface area shall be shallower than 18 inches. In this wetland, 46% is less than six inches and 92% is less than 18 inches.
- At least 25% of the WQ<sub>v</sub> shall be in deepwater zones with a depth greater than four feet and outlet micropool must accommodate at least 10% of the WQ<sub>v</sub>.
- A vegetated buffer extends 25 feet outward from the maximum water surface elevation.

As stated in the previous section, the NYSDEC Stormwater Management Design Manual typically requires that stormwater management practices are not sited in NYSDEC-regulated freshwater wetlands. However, Kevin Jennings (NYSDEC Region 1, Bureau of Habitat Manager) indicated in a meeting on April 5, 2019 that the NYSDEC Bureau of Habitat would consider allowing a stormwater wetland to be located within the existing *Phragmites* marsh at the Main Road site due to the current impaired condition of the wetland (i.e. infestation with *Phragmites australis*) provided that 1) the recommended design will result in an increase in total freshwater wetland area on the site; 2) the recommended design will result in greater ecological habitat quality and function due to increased species diversity, reduced *Phragmites* cover, and increased habitat diversity; and 3) the recommended design will result in more effective removal and reduction of transport of sediments and pollutants to downstream reaches of Meetinghouse Creek.

The conceptual stormwater wetland meets these conditions for potential approval by the NYSDEC. The area of freshwater wetlands on the subject property is increasing from 1.0 acres (with 0.5 acres of *Phragmites* monocultural marsh) to 1.2 acres. The ecological habitat quality will increase greatly due to increased species and habitat diversity. The recommended stormwater wetland will consist of deep water stands of tall emergent grasses and deepwater broad-leaved emergents, such as broad-leaved cattail, soft-stemmed bulrush, and pickerelweed, i.e. the 10,000 SF low marsh zone; a 10,000 SF high marsh zone with shallow water depths and shorter emergent grass species, such as soft rush, tussock sedge, lurid sedge, and various wetland wildflowers; and 33,000 SF of shrub swamp consisting of dense plantings of native wetland shrubs (highbush blueberry, black chokeberry, sweet pepperbush) and small trees (alders and young red maple). The diversity of plant species and the differences in habitat characteristics (i.e. deep versus shallow water; open and grassy versus sheltered and woody) will provide habitat for a wide variety of wildlife. In addition, the dense shading at ground level produced by the woody shrubs and trees will provide long-term resistance to growth and infestation with *Phragmites australis*. Lastly, as described above, the conceptual design is consistent with the 2015 NYS Stormwater Management Design Manual; accordingly, the wetland should provide expected water quality benefits including the removal of nutrients, pathogens, and sediments through settling and biological uptake.

## 5 MAINTENANCE

Following the 2015 NYS Stormwater Management Design Manual, the following maintenance practices are recommended:

- The principal outflow shall be equipped with a removable trash rack, and generally accessible from dry land and cleaned annually or as needed.
- Sediment removal in the forebay shall occur every five to six years or after 50% of total forebay capacity has been lost.
- All safety elements should be inspected and maintained on an annual basis, unless prior inspections indicate more frequent maintenance is required.

In order to realize the ecological objectives of the proposed project, *Phragmites australis* present adjacent to the recommended stormwater management wetland must be managed using selective herbicide application. In addition, pre-construction herbicide application is recommended to minimize colonization and spread of *Phragmites* in the constructed wetland from rhizomes remaining below the limit of excavation. Periodic herbicide application (every 2 to 4 years) will likely be necessary to avoid re-establishment of *Phragmites* within the constructed wetland.

*Phragmites* management in the areas adjacent to the constructed wetland should be completed as follows:

- Herbicides shall be applied between August 15 and October 1 in the prior to stormwater wetland construction. Two herbicide treatments are anticipated (Year 1 and Year 2).
- Herbicides shall not be applied directly or indirectly to native vegetation.
- All herbicide applications shall be applied by back-pack sprayer, wickstick, or other controlled means to prevent damage to desirable planted vegetation or native vegetation.
- Herbicide application to weeds and invasive plants shall not be to the point of runoff of herbicide from the plant.
- Herbicides shall be applied thoroughly, with assurance that recommended rates of the correct chemicals are used at proper times in the prescribed manner, for the complete eradication of invasive vegetation.
- Mixing and usage of herbicides shall be conducted in accordance with manufacturer's specifications.
- All back-spraying of herbicides shall be done at times when wind does not exceed a velocity of 8 miles per hour. Herbicides should not be applied if air temperature is less than 50°F or rain is expected within the next 6 hours.
- Herbicides shall be applied by a New York State certified herbicide applicator.
- All herbicides shall be applied in accordance with the manufacturer's instructions, NYSDEC regulations and permits issued for the project. All pesticide labeling must be followed in reference to any restrictions to being utilized near shorelines, wetlands, and standing water.

In accordance with the NYSSMDM, an Operation and Maintenance (O & M) Plan must be developed during the construction design and permitting phase of this project. The O & M plan shall describe the operation practices and maintenance protocols for the living and structural components of the stormwater management, including (1) wetland monitoring and maintenance procedures, and (2) periodic herbicide application that will be used to ensure the long-term survivorship of the planted native vegetation and prevent re-colonization of the site by *Phragmites australis* or other invasive plants.

## **6 ENVIRONMENTAL PERMITTING REQUIREMENTS FOR THE MAIN ROAD STORMWATER MANAGEMENT WETLAND**

The recommended construction of the 1.2 acre stormwater management wetland at this site will require the following environmental permits:

- United States Army Corps of Engineers:
  - Section 404 of Clean Water Act, Section 10 of Rivers and Harbors Act

- New York State Department of Environmental Conservation:
  - Article 24 (Freshwater Wetlands)
  - Article 15 (Protection of Waters)
  - SPDES General Permit for Stormwater Discharges from Construction Activity
- New York State Department of Transportation
- Town of Riverhead:
  - Conservation Advisory Council Review under Section 107 (Tidal and Freshwater Wetlands) of Town Code
  - Building Construction

## 7 CONSTRUCTION COSTS

Costs here are concept level estimates to provide approximate values for project planning purposes (Table 1). Actual design and construction costs will vary following a more detailed data collection effort and ensuing design. A detailed account of costs is provided in Appendix D. These costs have been based on knowledge of similar projects and construction components. A contingency was added to each estimate to provide the range noted below. Due to the high design and construction costs associated with the the 1.2 acre stormwater management wetland, Alternatives A and B have been identified to reduce project costs. Under these alternatives, the reduced construction scope is accompanied by reduced environmental benefits of the stormwater management system. Costs for the alternatives do not take into account any necessary repair or replacement of the existing culvert or Main Road drainage infrastructure.

Under Alternative A, the height of the containment berm has been reduced from 2.5 feet to 0.5 feet. This reduction in containment berm height prevents the wetland from detaining and treating the water quantity associated with the 100-year rainfall ('extreme flood') event. The 1.2 acre stormwater wetland would still include approximately 20,000 SF of meandering zones of low and high freshwater marsh and the required micropool and forebay to treat the calculated WQ<sub>v</sub>. Accordingly, the stormwater management wetland would still be expected to provide water quality improvement benefits such as the removal of nutrients, pathogens, and sediments through settling and biological uptake. However, the Alternative A wetland would not comply with the water quantity requirements of the NYSSMDM (NYSDEC, 2015a), as it would not provide flood protection benefits to downstream reaches of Meetinghouse Creek during extreme flood events and the constructed stormwater wetland would be expected to result in increased discharge rates to those downstream reaches. Alternative A would also require individual review and approval from the NYSDEC Division of Water.

Under Alternative B, only the large rip-rap lined sediment forebay would be constructed at the end of the existing culvert outfall along with the associated maintenance access to periodically remove accumulated sediments. This sediment forebay could be designed to accommodate 10% of the WQ<sub>v</sub>. This alternative does not include the recommended 1.2-acre wetland and would not be expected to provide the ecological benefits associated with the native stormwater wetland and *Phragmites* management. The sediment forebay would remove sediments, hydrocarbons, and fecal coliform effectively but would be less effective at removing nutrients and metals (Horsley Whitten Group, 2006).

Table 1: Conceptual Plan Construction Costs

Restoration Action	Design Cost	Construction Cost	Notes
1.2 acre Stormwater Wetland	\$154K	\$530K	<ul style="list-style-type: none"> <li>- 20,000 SF of high and low marsh zones and 33,050 SF shrub swamp and associated herbaceous and upland plantings.</li> <li>- Assumes 2.5-ft perimeter berm to provide storage for 100-year storm event and associated fill.</li> <li>- Assumes traffic control costs; erosion and sediment control, mobilization and demobilization costs</li> <li>- Assumes precast concrete grass pavers installed on 40 LF entrance road and adjacent to forebay and micropool (840 SF total)</li> <li>- Assumes herbicide application to control <i>Phragmites</i></li> <li>- Cost includes construction contingency and cost escalation</li> </ul>
<b>Alternative A:</b> 1.2 acre Stormwater Wetlands for WQ <sub>v</sub> Volume only	\$128K	\$440K	<ul style="list-style-type: none"> <li>- 20,000 SF of high and low marsh zones and 33,050 SF shrub swamp and associated herbaceous and upland plantings.</li> <li>- Assumes 0.5-ft perimeter berm and associated fill to provide storage for WQ<sub>v</sub> but not 100-year storm event.</li> <li>- Assumes traffic control costs; erosion and sediment control, mobilization and demobilization costs</li> <li>- Assumes precast concrete grass pavers installed only on entrance road and adjacent to forebay and micropool</li> <li>- Assumes herbicide application to control <i>Phragmites</i></li> <li>- Cost includes construction contingency and cost escalation</li> </ul>
<b>Alternative B:</b> Sediment Forebay only	\$25K	\$80K	<ul style="list-style-type: none"> <li>- Assumes construction of only sediment forebay to accommodate 10% of WQ<sub>v</sub> and maintenance access</li> </ul>

## 8 LITERATURE CITED

Horsley Witten Group. 2006. Meetinghouse Creek Watershed Management Plan. Prepared for Peconic Estuary Program and Suffolk County Department of Public Health Services. 164 pgs.

New York State Department of Environmental Conservation. 2015a. New York State Stormwater Management Design Manual. New York State Department of Environmental Conservation. Albany, NY. January 2015. 578 pgs.

New York State Department of Environmental Conservation. 2015b. Waterbody Inventory/ Priority Waterbodies List (WI/PWL). Peconic River/Bays Watershed (0203020205). Meetinghouse Creek, Terrys Creek and tributaries. New York State Department of Environmental Conservation. Albany, NY. [http://www.dec.ny.gov/docs/water\\_pdf/wiatllisprpb.pdf](http://www.dec.ny.gov/docs/water_pdf/wiatllisprpb.pdf)



## **Appendix A – Plant Species List for Main Road Wetland Project Site**



## Appendix A – Plant Species List for Main Road Wetland Project Site<sup>1</sup>

### Plant Species Observed in Uplands

Common Name	Scientific Name
Sycamore Maple	<i>Acer pseudoplatanus</i>
Privet	<i>Ligustrum</i> ssp.
Heath Aster	<i>Symphotrichum ericoides</i>
Multiflora Rose	<i>Rosa multiflora</i>
Norway Maple	<i>Acer platanoides</i>
Mugwort	<i>Artemisia vulgaris</i>
Shrub Honeysuckle	<i>Lonicera</i> sp.
Rough-leaved Goldenrod	<i>Solidago rugosa</i>
Field Garlic	<i>Allium vineale</i>
Garlic Mustard	<i>Alliaria petiolata</i>
Black Walnut	<i>Juglans nigra</i>
Japanese Black Pine	<i>Pinus thunbergii</i>
Asiatic Bittersweet	<i>Celastrus orbiculatus</i>
Allegheny Blackberry	<i>Rubus allegheniensis</i>
Autumn Olive	<i>Elaeagnus umbellata</i>
Scarlet Oak	<i>Quercus coccinea</i>
Black Locust	<i>Robinia pseudoacacia</i>
Eastern Red Cedar	<i>Juniperus virginiana</i>
Black Cherry	<i>Prunus serotina</i>
Sweetgum	<i>Liquidambar styraciflua</i>
English Ivy	<i>Hedera helix</i> ssp. <i>helix</i>
White Pine	<i>Pinus strobus</i>
Bird Cherry	<i>Prunus avium</i>
Dodder	<i>Cuscuta</i> ssp.
Catbriar	<i>Smlilax glauca</i>
Sassafras	<i>Sassafras albidum</i>
Gray Birch	<i>Betula populifolia</i>

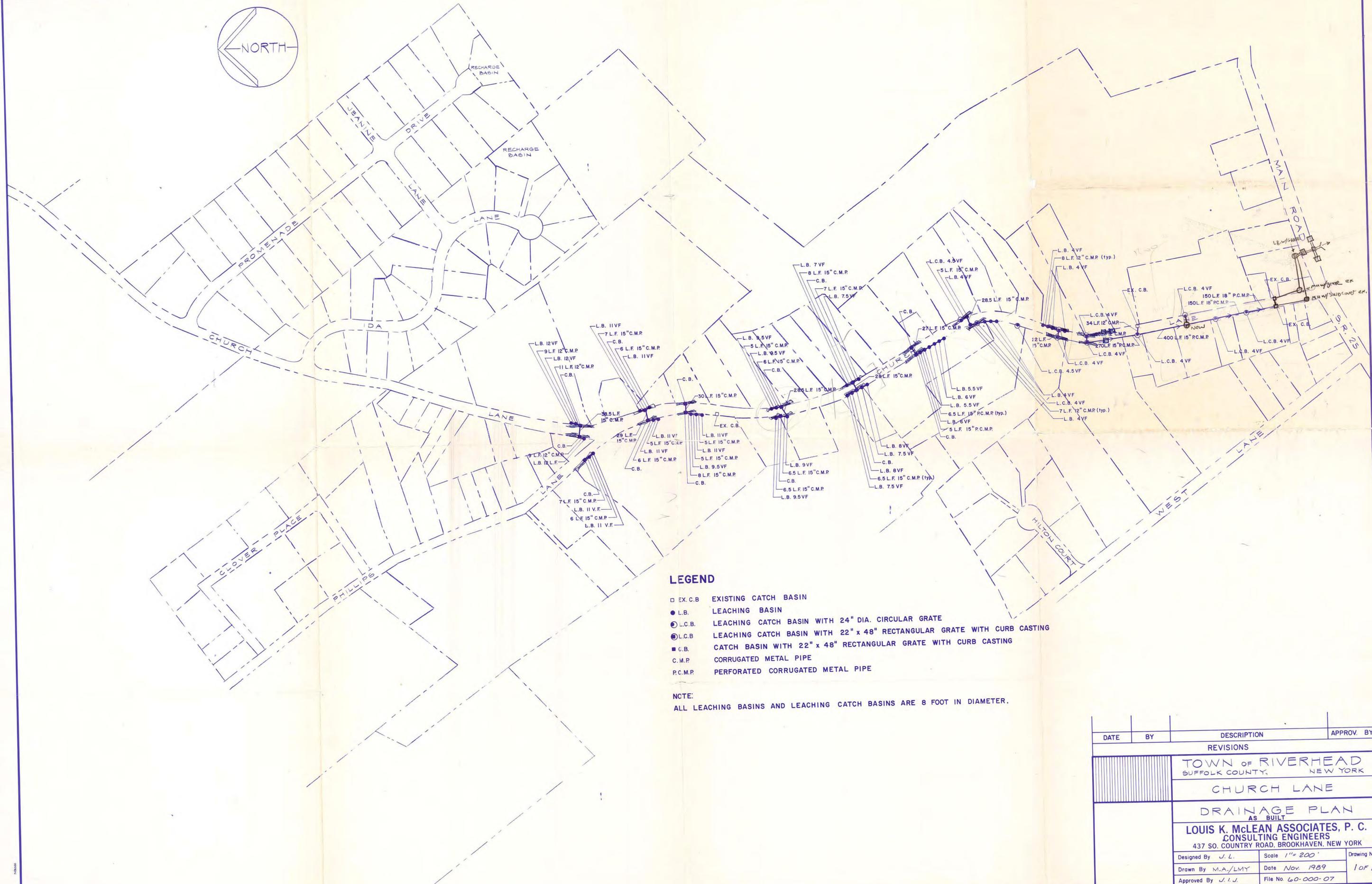
### Plant Species Observed in Wetlands

Common Name	Scientific Name
Red Maple	<i>Acer rubrum</i>
Common Reed	<i>Phragmites australis</i>
Rose-of-Sharon	<i>Hibiscus syriacus</i>
Sensitive Fern	<i>Onoclea sensibilis</i>
Sedge	<i>Carex</i> sp.
Smartweed	<i>Persicaria</i> sp.
Soft Rush	<i>Juncus effusus</i>
Bitter Dock	<i>Rumex obtusifolius</i>
Pin Oak	<i>Quercus palustris</i>
Prickly Dewberry	<i>Rubus flagellaris</i>
American Holly	<i>Ilex opaca</i>
Arrowwood	<i>Viburnum dentatum</i>
Skunk Cabbage	<i>Symplocarpus feotidus</i>
Weeping Willow	<i>Salix babylonica</i>
Common Elderberry	<i>Sambucus canadensis</i>
Water Cress	<i>Nasturtium officinale</i>

<sup>1</sup>Based on field observations on November 11, 2019



## **Appendix B – Church Lane As-Built Drainage Plan (LK McLean Associates, 1989)**



**LEGEND**

- EX. C.B. EXISTING CATCH BASIN
- L.B. LEACHING BASIN
- ⊙ L.C.B. LEACHING CATCH BASIN WITH 24" DIA. CIRCULAR GRATE
- ⊕ L.C.B. LEACHING CATCH BASIN WITH 22" x 48" RECTANGULAR GRATE WITH CURB CASTING
- C.B. CATCH BASIN WITH 22" x 48" RECTANGULAR GRATE WITH CURB CASTING
- C.M.P. CORRUGATED METAL PIPE
- - - P.C.M.P. PERFORATED CORRUGATED METAL PIPE

NOTE:  
ALL LEACHING BASINS AND LEACHING CATCH BASINS ARE 8 FOOT IN DIAMETER.

DATE	BY	DESCRIPTION	APPROV. BY
REVISIONS			
TOWN OF RIVERHEAD SUFFOLK COUNTY, NEW YORK			
CHURCH LANE			
DRAINAGE PLAN AS BUILT			
LOUIS K. McLEAN ASSOCIATES, P. C. CONSULTING ENGINEERS 437 SO. COUNTRY ROAD, BROOKHAVEN, NEW YORK			
Designed By	J. L.	Scale	1" = 200'
Drawn By	M.A./LMY	Date	Nov. 1989
Approved By	J. L.	File No.	60-000-07
		Drawing No.	1 of 1



## **Appendix C – Conceptual Plans for Main Road Stormwater Wetland Construction**



### NOTES LEGEND

- Edge of existing Phragmites
- Existing wetland boundary
- - - Property boundary
- ← Flow

1. Existing storm sewer outfall
2. Guard rail (proposed)
3. Treatment area forebay (rip-rap lined)
4. Treatment area micropool (rip-rap lined)
5. Outlet riser structure with trash grate
6. Spillway pipe (under embankment)
7. Outfall rip-rap pad
8. Existing flow path on private property (no improvements)
9. Emergency spillway (rip-rap lined)
10. Maintenance access entry/egress
11. Potential turn-around

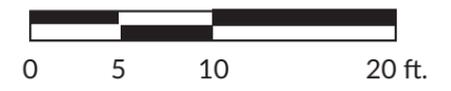
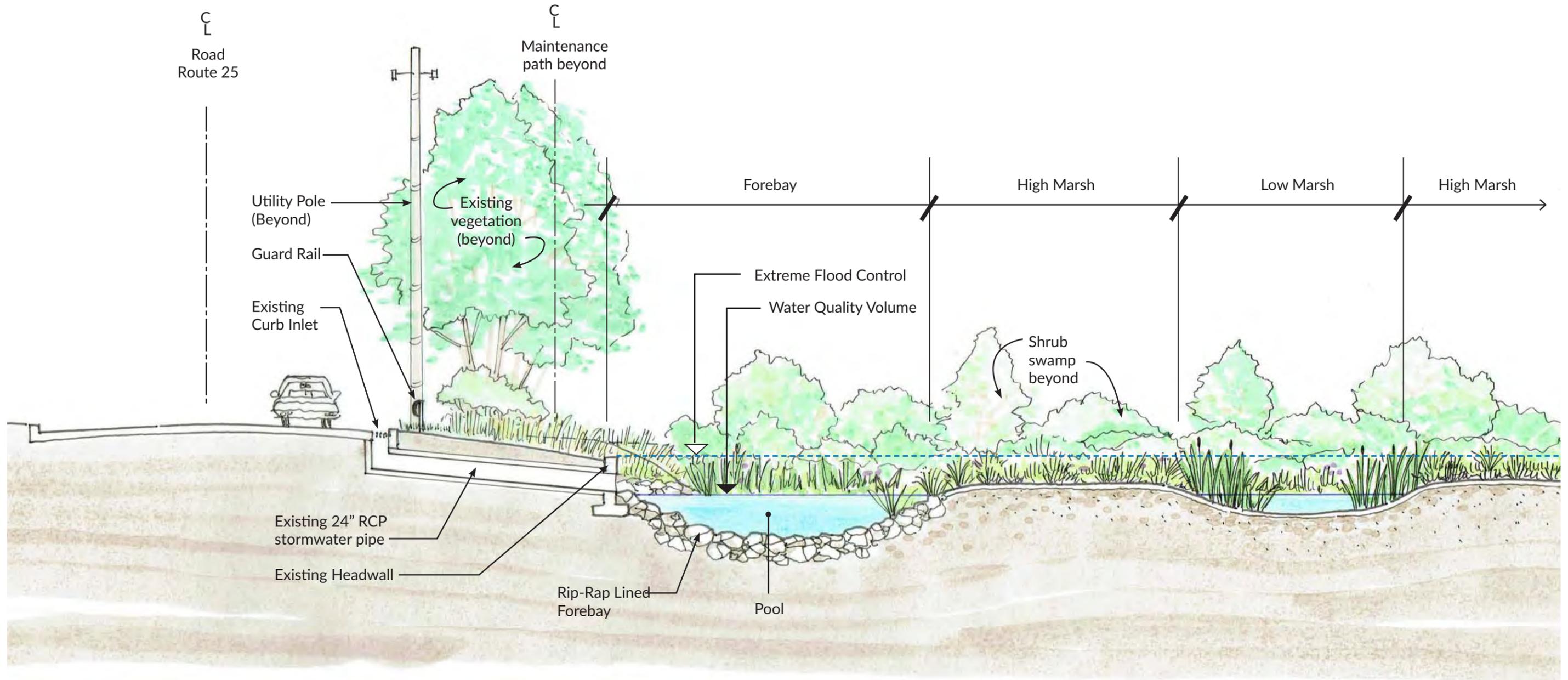
**B1**

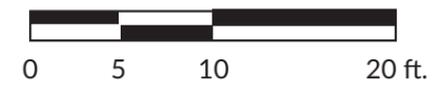
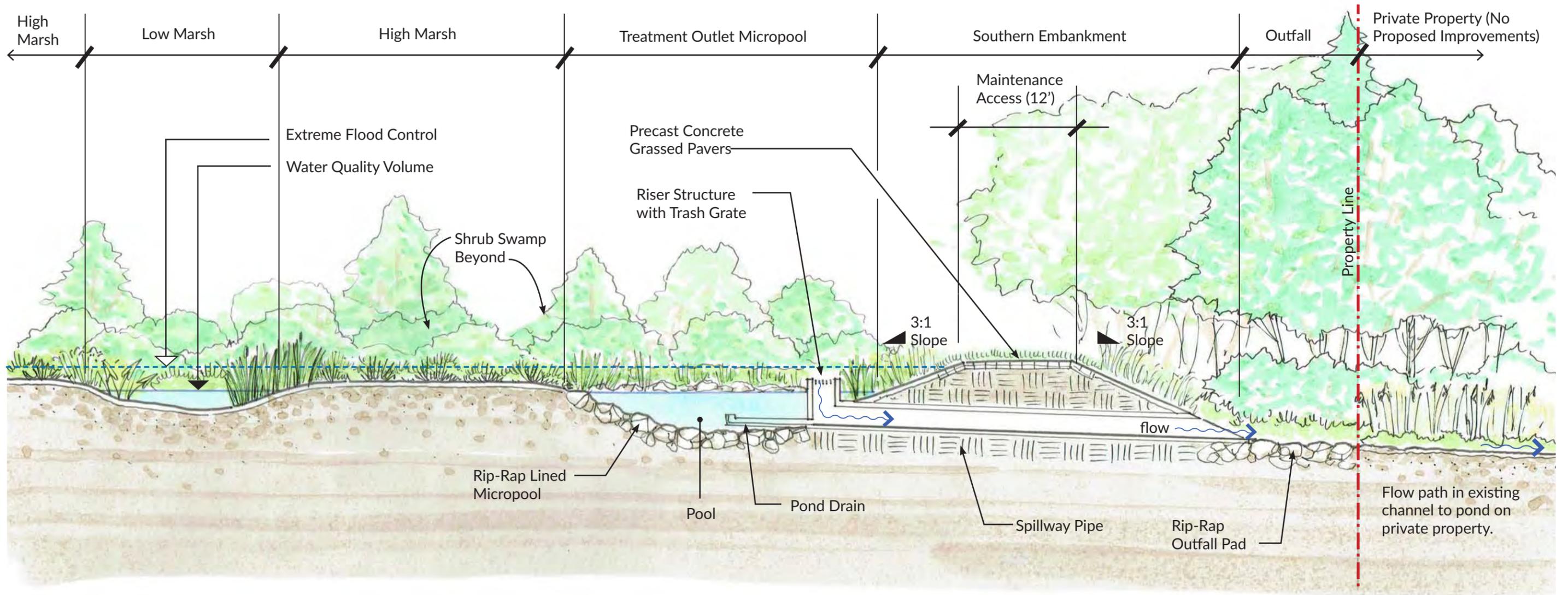
**PECONIC ESTUARY PROGRAM** June 21, 2019

## Conceptual Restoration Plan

Main Road 1.2 acre Stormwater Wetland (Aquebogue, NY)









## **Appendix D – Conceptual Construction Costs**

# Main Road Stormwater Wetland Construction

## Conceptual Design Phase Cost Estimate (1.2 acre Stormwater Wetland)

No.	Bid Item	Unit	Unit Price	Quantity	Subtotal	Notes
1	Mobilization & Demobilization	LS	\$50,000	1	\$50,000	
2	Access & Traffic Control	LS	\$25,000	1	\$25,000	
5	Clearing & Grubbing	LS	\$10,000	1	\$10,000	
6	Guide Railing	LF	\$40	80	\$3,200	
7	Excavation (cut)	CY	\$60	2,500	\$150,000	
8	Import structural fill for embankment	CY	\$65	1,000	\$65,000	
9	Rip Rap	CY	\$100	40	\$4,000	
10	Precast Concrete Grass Pavers	SY	\$115	135	\$15,525	
11	Special Drainage Structure	EA	\$10,000	1	\$10,000	
12	Temp Catch Basin Inserts	EA	\$400	5	\$2,000	
13	Silt Fence	LF	\$5	1,050	\$5,250	
14	Construction Entrance	SY	\$16	75	\$1,200	
15	Wetland Planting- High and Low Marsh	EA	\$3	9,000	\$27,000	
16	Shrub Planting	EA	\$40	1,000	\$40,000	
17	Turbidity Curtain	LF	\$30	40	\$1,200	
16	Utility coordination/relocation	LS	\$10,000	1	\$10,000	
17	Herbicide Treatments	AC	\$8,000	1	\$8,000	2 Herbicide Treatments
18	Seeding	SY	\$3	750	\$2,250	
<b>CONSTRUCTION SUBTOTAL</b>					\$429,700	
<b>20% Construction Contingency</b>					\$86,000	
<b>3% Escalation, assuming 2020 construction</b>					\$15,500	20% of Construction Subtotal
<b>CONSTRUCTION TOTAL with Contingency &amp; Escalation</b>					<b>\$531,200</b>	
<b>PROJECT DELIVERY (design, permitting, construction support)</b>					\$129,000	
<b>20% Project Delivery contingency</b>					\$25,800	
<b>PROJECT DELIVERY TOTAL with Contingency</b>					<b>\$154,800</b>	
<b>GRAND TOTAL with all contingencies</b>					<b>\$686,000</b>	

# Main Road Stormwater Wetland Construction (Alternative A)

## Conceptual Design Phase Cost Estimate

No.	Bid Item	Unit	Unit Price	Quantity	Subtotal	Notes
1	Mobilization & Demobilization	LS	\$50,000	1	\$38,000	
2	Access & Traffic Control	LS	\$25,000	1	\$20,000	
5	Clearing & Grubbing	LS	\$10,000	1	\$10,000	
6	Guide Railing	LF	\$40	80	\$3,200	
7	Excavation (cut)	CY	\$60	2,500	\$150,000	
8	Import structural fill for embankment	CY	\$65	140	\$9,100	
9	Rip Rap	CY	\$100	40	\$4,000	
10	Precast Concrete Grass Pavers	SY	\$115	135	\$15,525	
11	Special Drainage Structure	EA	\$10,000	1	\$10,000	
12	Temp Catch Basin Inserts	EA	\$400	5	\$2,000	
13	Silt Fence	LF	\$5	1,050	\$5,250	
14	Construction Entrance	SY	\$16	75	\$1,200	
15	Wetland Planting- High and Low Marsh	EA	\$3	9,000	\$27,000	
16	Shrub Planting	EA	\$40	1,000	\$40,000	
17	Turbidity Curtain	LF	\$30	40	\$1,200	
16	Utility coordination/relocation	LS	\$10,000	1	\$10,000	
17	Herbicide Treatments	AC	\$8,000	1	\$8,000	2 Herbicide Treatments
18	Seeding	SY	\$3	750	\$2,250	
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$356,800</b>	
<b>20% Construction Contingency</b>					<b>\$71,400</b>	
<b>3% Escalation, assuming 2020 construction</b>					<b>\$12,900</b>	20% of Construction Subtotal
<b>CONSTRUCTION TOTAL with Contingency &amp; Escalation</b>					<b>\$441,100</b>	
<b>PROJECT DELIVERY (design, permitting, construction support)</b>					<b>\$107,100</b>	
<b>20% Project Delivery contingency</b>					<b>\$21,500</b>	
<b>PROJECT DELIVERY TOTAL with Contingency</b>					<b>\$128,600</b>	
<b>GRAND TOTAL with all contingencies</b>					<b>\$569,700</b>	

# Main Road Stormwater Wetland Construction (Alternative B)

## Conceptual Design Phase Cost Estimate

No.	Bid Item	Unit	Unit Price	Quantity	Subtotal	Notes
1	Mobilization & Demobilization	LS	\$50,000	1	\$6,500	
2	Access & Traffic Control	LS	\$25,000	1	\$3,500	
5	Clearing & Grubbing	LS	\$5,000	1	\$5,000	
6	Guide Railing	LF	\$40	80	\$3,200	
7	Excavation (cut)	CY	\$60	100	\$6,000	
8	Import structural fill for embankment	CY	\$65	30	\$1,950	
9	Rip Rap	CY	\$100	15	\$1,500	
10	Precast Concrete Grass Pavers	SY	\$115	135	\$15,525	
11	Special Drainage Structure	EA	\$10,000	0	\$0	
12	Temp Catch Basin Inserts	EA	\$400	5	\$2,000	
13	Silt Fence	LF	\$5	250	\$1,250	
14	Construction Entrance	SY	\$16	75	\$1,200	
15	Wetland Planting- High and Low Marsh	EA	\$3	0	\$0	
16	Tree and Shrub Planting	EA	\$40	100	\$4,000	
17	Turbidity Curtain	LF	\$30	0	\$0	
16	Utility coordination/relocation	LS	\$10,000	1	\$10,000	
17	Herbicide Treatments	AC	\$8,000	0	\$0	2 Herbicide Treatments
18	Seeding	SY	\$3	300	\$900	
<b>CONSTRUCTION SUBTOTAL</b>					\$62,600	
<b>20% Construction Contingency</b>					\$12,600	
<b>3% Escalation, assuming 2020 construction</b>					\$2,300	20% of Construction Subtotal
<b>CONSTRUCTION TOTAL with Contingency &amp; Escalation</b>					<b>\$77,500</b>	
<b>PROJECT DELIVERY (design, permitting, construction support)</b>					\$18,800	
<b>20% Project Delivery contingency</b>					\$3,800	
<b>PROJECT DELIVERY TOTAL with Contingency</b>					<b>\$22,600</b>	
<b>GRAND TOTAL with all contingencies</b>					<b>\$100,100</b>	