Interim Report

PRELIMINARY DESIGN OF A SUSTAINABLE SHORELINE AT THE HUDSON SHORES PARK IN THE CITY OF WATERVLIET, NY

DECEMBER 22, 2017

Prepared for:

New England Interstate Water Pollution Control Commission

Prepared by:

Gomez and Sullivan Engineers

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LIST OF ABBREVIATIONS

GIS  Geographic Information Systems
GPS  Global Positioning System
Gomez and Sullivan  Gomez and Sullivan Engineers, D.P.C.
NEIWPC  New England Interstate Water Pollution Control Commission
NOAA  National Oceanic and Atmospheric Administration
NYHOPS  New York Harbor Observing and Prediction System
NYSDEC  New York State Department of Environmental Conservation
QAPP  Quality Assurance Project Plan
QA/QC  Quality Assurance/Quality Control
USGS  United States Geological Survey
1 PROBLEM DEFINITION/BACKGROUND

The City of Watervliet, New York has long sought to develop recreational facilities and waterfront access for its citizens. In 2004, the City launched its Local Waterfront Revitalization Program, which focuses on protection and wise use of the City’s estuaries. In 2009, the City took the Climate Smart Communities Pledge and created a Climate Action Plan to improve climate resilience. To help implement their pledge goals, the City has partnered with the New England Interstate Water Pollution Control Commission (NEIWPCC), and the New York State Department of Environmental Conservation’s (NYSDEC) Hudson River Estuary Program and Hudson River National Estuarine Research Reserve and Sustainable Shorelines Project to fund engineering designs for a “sustainable shoreline” demonstration project at Hudson Shores Park. The ideal sustainable shoreline improvements will resist erosion, improve habitat value for native flora and fauna, and be resilient in the face of climate change, while also enhancing safe public access to the river.

The Hudson River Estuary Program’s mission is to help people enjoy, protect, and revitalize the Hudson River estuary. To advance this mission, the Program released the 2015-2020 Hudson River Estuary Action Agenda, with a focus on benefits that people receive from healthy ecosystems and priority targets for each benefit. Implementation of this sustainable shoreline project will contribute to Benefit #2 (Resilient Communities), Target #2, which states that tributary streams and floodplains that are conserved, re-vegetated, and restored through natural solutions will absorb and slow floodwaters, mitigate erosions, and support the health of the Hudson River estuary. Managing for these ecosystem services reduces vulnerability to climate change and allows for sustainable human resource use. The proposed project will enhance the diversity of native vegetation, encourage natural filtration of floodwaters, and include shoreline features that will resist erosion by tides and extreme weather. This project will also contribute to Benefit 3 (Vital Estuary Ecosystem), Target #1, which seeks to increase the quantity and quality of nature-based shorelines. Additionally, Benefit #6 (Education, River Access, Recreation and Inspiration), Target #3 (Access) will be addressed by incorporating accessibility to the park for people of all abilities into the Sustainable Shoreline design. Features of the park will encourage citizens to connect with the river and may include educational components, recreation amenities, and fishing locations. This design project will also meet the NYSDEC’s Sustainable Shorelines Project objectives to characterize estuary and shoreline conditions; determine ecological, engineering, and economic trade-offs of shoreline management options; and demonstrate innovative shorelines and best management practices.

1.1 Goals and Objectives

The project is located within Hudson Shores Park which is situated along the Hudson River and adjacent to Interstate 787 in the City of Watervliet. This park was constructed in 1975. The 9-acre park has a 1400-foot-long shoreline and houses a pavilion, picnic area, trail, boat house, kayak launch, and seasonal restaurant on a floating barge. The steep shoreline is lined with native and invasive vegetation. Some areas are protected by rip-rap. The only formal access to the shoreline is the kayak launch.

The goal of this project is to work with project partners to design an ecologically enhanced, engineered shoreline treatment for Hudson Shores Park that resists erosion, enhances accessibility for all citizens, and improves natural habitat value for native plants, fish, and wildlife. The objectives are to: 1) design resilient shoreline features that will resist erosion and adapt to rising sea levels; 2) design Americans with Disabilities Act (ADA)-accessible features for passive and active recreation, and 3) reduce invasive plant species while increasing the native plant species richness and native wildlife habitat.
2 EXISTING SITE CONDITIONS

2.1 Existing Information Review

Existing geographic information systems (GIS) data were collected from reliable sources and used to create a base map used for the ecological and general site assessment and to inform the project design. Supporting GIS data are gathered in a project-specific geodatabase. Table 2.1-1 lists the sources for these data. Figure 2.1-1 shows the base map used for the site assessment.

Table 2.1-1. Existing GIS Data Used to Inform Design

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
<th>Data Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Watervliet</td>
<td>2-foot LiDAR contour lines</td>
<td>1998</td>
</tr>
<tr>
<td>NYS GIS Clearinghouse – Albany County</td>
<td>2-foot LiDAR contour lines</td>
<td>2008</td>
</tr>
<tr>
<td>NYS GIS Clearinghouse – Albany County</td>
<td>1-foot resolution orthoimagery</td>
<td>2014</td>
</tr>
<tr>
<td>NYS GIS Clearinghouse</td>
<td>Streets</td>
<td>2017</td>
</tr>
<tr>
<td>USGS National Hydrography Dataset</td>
<td>Water bodies and channels</td>
<td>2017</td>
</tr>
<tr>
<td>New York Department of State</td>
<td>Coastal Zone Boundary</td>
<td>2017</td>
</tr>
</tbody>
</table>

National Wetlands Inventory data and NYSDEC wetlands data were reviewed; however neither dataset showed wetlands present within Hudson Shores Park.

Weston & Sampson is in the process of compiling a list of plant species successfully used for similar habitat enhancement plantings and the ecological requirements, such as spacing, sunlight tolerances, depth of planting, and appropriate planting depths and flooding regimes, for these species. These data, in the form of published reports for reference, planting lists, planting plans, and specification documents, will be stored in the project directory and will be available to all staff throughout the project.

Gomez and Sullivan requested New York State Heritage Program (NYSHP) for information regarding the presence of rare, threatened, or endangered (RTE) species at the project site in July 2017. NYSHP responded on July 21, 2017 and October 17, 2017 (C. Lutz, personal communication, July 21, 2017 and October 17, 2017) (Appendix A). The species documented in the vicinity of the project are shown on Table 2.1-2. The only botanical RTE species was green rock-cress (Boechera missouriensis). The record for this species was from 1960, prior to the construction of Interstate 787 along the Hudson River. Construction of the Interstate 787 significantly changes the riparian and shoreline habitat in Watervliet and Troy and the habitat for green rock-cress was likely lost.

Gomez and Sullivan contacted the National Marine Fisheries Service (NMFS) over the phone to ask for more information regarding the presence of shortnose sturgeon in the vicinity of the project and spoke with Edith Carson of the protected resources office (E. Carson, personal communication, November 3, 2017). Ms. Carson said that there are shortnose and Atlantic sturgeon in the river adjacent to Hudson
Shores Park. Therefore, any work done below the mean high water elevation would require consultation with NMFS.

**Table 2.1-2. State or Federally Listed Species in the Vicinity of the Project Area**

<table>
<thead>
<tr>
<th>Name</th>
<th>Species</th>
<th>Type</th>
<th>NYS Listing</th>
<th>Federal Listing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shortnose sturgeon</td>
<td><em>Acipenser brevirostrum</em></td>
<td>Animal</td>
<td>Endangered</td>
<td>Endangered</td>
</tr>
<tr>
<td>Cobra clubtail</td>
<td><em>Gomphus vastus</em></td>
<td>Animal</td>
<td>Unlisted</td>
<td>Critically Imperiled in NYS</td>
</tr>
<tr>
<td>Alewife floater</td>
<td><em>Anodonta implicata</em></td>
<td>Animal</td>
<td>Unlisted</td>
<td>Critically Imperiled in NYS</td>
</tr>
<tr>
<td>Green rock-cress</td>
<td><em>Boechera missouriensis</em></td>
<td>Plant</td>
<td>Threatened</td>
<td>Imperiled in NYS</td>
</tr>
</tbody>
</table>
Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park

Figure 2.1-1: Existing GIS Data
Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park

Figure 2.1-1: Existing GIS Data

Legend
- City of Watervliet
- Streets (NYS GIS Clearinghouse)
- 1998 Elevation Contours (W & S)
- 2008 Elevation Contours (NYS GIS Clearinghouse)
- Hudson River (NHD Hydography)
Figure 2.1-1: Existing GIS Data

Legend
- City of Watervliet
- Streets (NYS GIS Clearinghouse)
- 1998 Elevation Contours (W & S)
- 2008 Elevation Contours (NYS GIS Clearinghouse)
- Hudson River (NHD Hydrolography)
Figure 2.1-1: Existing GIS Data

Legend
- City of Watervliet
- Streets (NYS GIS Clearinghouse)
- 1998 Elevation Contours (W & S)
- 2008 Elevation Contours (NYS GIS Clearinghouse)
- Hudson River (NHD Hydrography)

Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park

Map 3
Figure 2.1-1: Existing GIS Data

Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park

Legend

City of Watervliet
Streets (NYS GIS Clearinghouse)
1998 Elevation Contours (W & S)
2008 Elevation Contours (NYS GIS Clearinghouse)
Hudson River (NHD Hydography)
Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park

Figure 2.1-1: Existing GIS Data

Legend
- City of Watervliet
- Streets (NYS GIS Clearinghouse)
- 1998 Elevation Contours (W & S)
- 2008 Elevation Contours (NYS GIS Clearinghouse)
- Hudson River (NHD Hydrography)
2.2 Topographic Survey

A 1-foot interval topographic survey of the shoreline and slope adjacent to the pavilion was conducted. This survey data has been supplemented with existing 2-foot interval LiDAR data for the remainder of the site.

The pavilion section of the site was chosen for the detailed survey since it was determined during the site visit with stakeholders that this area would be a good candidate to provide access to the shore. The topographic survey is presented on sheet V101 of the Preliminary Design drawings in Appendix B.

2.3 Ecological and General Site Conditions

The on-site project kick-off meeting was held on October 20, 2017. The meeting was attended by representatives from NEIWPCC, NYSDEC, NYSDOS, Gomez and Sullivan, and Weston and Sampson. A field evaluation was conducted by Gomez and Sullivan.

The ecological and general site assessment includes the following: general descriptions of the plant communities, GPS point collection for discrete invasive plant species stands, animal sightings, identification of potential wetlands, observations of adjacent aquatic habitats, an evaluation of bank stability and areas in need of shoreline stabilization, and investigation for the presence of rare species’ habitat. GIS data are saved in the project-specific geodatabase. Photographs were taken to support field notes and GPS data.

2.3.1 Plant communities

The plant communities at Hudson Shores Park consists of Riprap/Artificial Shore (Edinger, 2014) as a buffer of trees, shrubs, woody vines, and herbs growing through a mix of rip-rap and soil along the Hudson River and Mowed Lawn (Edinger, 2014) with landscape trees and walking paths. The mowed lawn was largely outside of the project area. These communities are shown in Figure 2.3.1-1. No uncommon native plant communities that will require specific protection from construction and invasive species treatment were observed.
Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park
Figure 2.3.1-1: Plant Communities
Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park
Figure 2.3.1-1: Plant Communities

Legend

Plant Communities
- Mowed Lawn
- Riprap/Artificial Shore
Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park
Figure 2.3.1-1: Plant Communities
Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park

Figure 2.3.1-1: Plant Communities
Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park

Figure 2.3.1-1: Plant Communities

Legend

- Mowed Lawn
- Riprap/Artificial Shore

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC. ©OpenStreetMap contributors, and the GIS User Community.
Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park

Figure 2.3.1-1: Plant Communities
2.3.2 Invasive Plant Species

For the purpose of this report, invasive species will refer to plant species listed on NYSDEC’s 6 NYCRR Part 575 Prohibited and Regulated Invasive Species list (2014) or are listed as invasive by Capital-Mohawk Partnership for Invasive Species Management (Capital-Mohawk PRISM) (Capital-Mohawk PRISM, 2016a) or the New York Department of Transportation (NYSDOT, n.d.). The term “non-native” refers to species that are listed as non-native to New York State in the New York State Flora Atlas (Weldy et al., 2017). Invasive species were wide spread throughout the Hudson Shores Park riparian and shoreline vegetation. Most of these species are not dominant and are not growing in discrete stands. Invasive species Asiatic bittersweet (*Celastrus orbiculatus*), common buckthorn (*Rhamnus cathartica*), and tree of heaven (*Ailanthus altissima*) were dominant plants along the entire shoreline, as shown in Figure 2.3.2.1. They were not growing in monoculture stands. One discrete, monoculture stand of giant knotweed (*Reynoutria sachalinensis*), one discrete, monoculture stand of Canada thistle (*Cirsium arvense*), and three discrete, monoculture stands of phragmites (*Phragmites australis*) were present within the park. Only one of the phragmites stands was within the project area. These stands are shown in Figure 2.3.2.1 and in the photos below. Invasive and non-native species that were observed throughout the shoreline are listed on Table 2.3.2-1.

This project will be focused on only part of the Hudson Shores Park riparian and shoreline area. The size and location of the focus areas allow for project goals to be met within budget and timeline limitations. Therefore efficient and effective treatment of invasive plants should only focus on the species that are growing in discrete stands, giant knotweed, Canada thistle, and phragmites. All three of these species are considered Tier 3 by Capital-Mohawk PRISM. This means that these species are, “likely too widespread for eradication, but low enough abundance to think about regional containment.” The management strategy throughout the Capital-Mohawk PRISM region is to, “to slow the spread since many surrounding regions could be at risk if left unattended management goal for these species is to contain their spread.” (Capital-Mohawk PRISM, 2016b)

Containment of the invasive species that are growing continuously throughout the site is not feasible for this project. These species would quickly reestablish in the project area following treatment as they are present throughout the vegetation adjacent to the project site.

<table>
<thead>
<tr>
<th>Common name</th>
<th>Species</th>
<th>Status</th>
<th>Capital-Mohawk Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asiatic bittersweet</td>
<td><em>Celastrus orbiculatus</em></td>
<td>non-native, invasive</td>
<td>Tier 3 (Containment)</td>
</tr>
<tr>
<td>bittersweet nightshade</td>
<td><em>Solanum dulcamara</em></td>
<td>non-native</td>
<td>not ranked</td>
</tr>
<tr>
<td>black alder</td>
<td><em>Alnus glutinosa</em></td>
<td>non-native</td>
<td>not ranked</td>
</tr>
<tr>
<td>broad-leaf dock</td>
<td><em>Rumex obtusifolius</em></td>
<td>non-native</td>
<td>not ranked</td>
</tr>
<tr>
<td><strong>Canada thistle</strong></td>
<td><em>Cirsium arvense</em></td>
<td>non-native, invasive</td>
<td>Tier 3 (Containment)</td>
</tr>
<tr>
<td>garlic mustard</td>
<td><em>Alliaria petiolata</em></td>
<td>non-native, invasive</td>
<td>Tier 3 (Containment)</td>
</tr>
<tr>
<td>honey locust</td>
<td><em>Gleditsia triacanthos</em></td>
<td>non-native</td>
<td></td>
</tr>
<tr>
<td>giant knotweed</td>
<td><em>Reynoutria sachalinensis</em></td>
<td>non-native, invasive</td>
<td>Tier 3 (Containment)</td>
</tr>
<tr>
<td>mugwort</td>
<td><em>Artemesia vulgaris</em></td>
<td>non-native, invasive</td>
<td>Tier 3 (Containment)</td>
</tr>
<tr>
<td>multiflora rose</td>
<td><em>Rosa multiflora</em></td>
<td>non-native, invasive</td>
<td>Tier 3 (Containment)</td>
</tr>
<tr>
<td>Norway maple</td>
<td><em>Acer platanoides</em></td>
<td>non-native, invasive</td>
<td>Tier 3 (Containment)</td>
</tr>
<tr>
<td><strong>Phragmites</strong></td>
<td><em>Phragmites australis</em></td>
<td>non-native, invasive</td>
<td>Tier 3 (Containment)</td>
</tr>
<tr>
<td>purple loosestrife</td>
<td><em>Lythrum salicaria</em></td>
<td>non-native, invasive</td>
<td>Tier 3 (Containment)</td>
</tr>
<tr>
<td>teasel</td>
<td><em>Dipsacus lacinatus</em></td>
<td>non-native, invasive</td>
<td>Tier 3 (Containment)</td>
</tr>
<tr>
<td>Common name</td>
<td>Species</td>
<td>Status</td>
<td>Capital-Mohawk Rank</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------</td>
<td>-------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>tree of heaven</td>
<td><em>Ailanthus altissima</em></td>
<td>non-native, invasive</td>
<td>Tier 3 (Containment)</td>
</tr>
<tr>
<td>yellow iris*</td>
<td><em>Iris pseudoacorus</em></td>
<td>non-native, invasive</td>
<td></td>
</tr>
</tbody>
</table>

Target species are indicated in bold font.

* Plants could not be identified to species due to phenology. Assumed to be yellow iris.
Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park

Figure 2.3.2-1: Invasive Plant Species Stands
Legend

- Erosion or steep slope

Continuous Invasive Species Stands (Approximate boundaries drawn in the office)
- Asiatic bittersweet, common buckthorn, and tree of heaven

Discrete Invasive Species Stands (Boundaries mapped with GPS unit in the field)
- Canada thistle
- knotweed
- phragmites

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community
Legend
- Erosion or steep slope

Continuous Invasive Species Stands (Approximate boundaries drawn in the office)
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Discrete Invasive Species Stands (Boundaries mapped with GPS unit in the field)
- Canada thistle
- knotweed
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Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park
Figure 2.3.2-1: Invasive Plant Species Stands

Map 2

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

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Path: P:\01952\GIS\maps\Existing_Conditions_Report\Existing_Conditions_Invasive_Species_Grid.mxd
Legend

- Erosion or steep slope

Continuous Invasive Species Stands (Approximate boundaries drawn in the office)
- Asiatic bittersweet, common buckthorn, and tree of heaven

Discrete Invasive Species Stands (Boundaries mapped with GPS unit in the field)
- Canada thistle
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Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park
Figure 2.3.2-1: Invasive Plant Species Stands
Legend
- Erosion or steep slope
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  - Phragmites

Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park
Figure 2.3.2-1: Invasive Plant Species Stands
Legend

- Erosion or steep slope

Continuous Invasive Species Stands (Approximate boundaries drawn in the office)
- Asiatic bittersweet, common buckthorn, and tree of heaven

Discrete Invasive Species Stands (Boundaries mapped with GPS unit in the field)
- Canada thistle
- knotweed
- phragmites

Preliminary Design of a Sustainable Shoreline at the Hudson Shores Park
Figure 2.3.2-1: Invasive Plant Species Stands
Figure 2.3.2-2. Knotweed Stand Near Hudson Shores Park Kayak Launch

Figure 2.3.2-3. Thistle Stand Near Hudson Shores Park Boat House
2.3.3 Animal Sighting

No animals or animal signs were observed during the ecological and general site assessment.

2.3.4 Potential Wetlands

No potential wetlands other than the Hudson River were observed at Hudson Shores Park. Gomez and Sullivan staff confirmed this during the field assessment using the definitions and the guidelines in the 1987 Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0) (USACE, 2012). Soil samples were not taken.

2.3.5 Observations of Adjacent Aquatic Habitats

No emergent aquatic vegetation was growing within the project area.

2.3.6 Evaluation of Bank stability and Areas in Need of Shoreline Stabilization

GPS points were collected along the shoreline in areas where the shoreline appeared moderately unstable or unstable. These points are shown in Figure 2.3.6-1 and Appendix C.

2.3.7 Investigation for the Presence of Rare Species’ Habitat

The field crew assessed the entire shoreline for natural rock slopes that could provide habitat for green rockcress (Boechera missouriensis). No appropriate habitat was observed on the site. No investigations were done for RTE fish species.
3 PRELIMINARY PLANS

3.1 Land Use Areas

Based on a combination of stakeholder input and sound engineering judgement, four distinct usage areas have been identified for the site. The opportunities for improvements and enhancements for these areas are discussed below, from the north to the south end of the site.

Environmental Resource Area – This area begins at the north end of the park and extends to approximately the north end of the pavilion. The proposed work plan will leave this area untouched as the shoreline and embankment appear stable. Although invasive species, particularly Asiatic Bittersweet, Common Buckthorn, and Tree of Heaven, are present, the area is not utilized and therefore is not a priority for improvement.

Lawn and Viewshed Area – This highly used area includes the existing pavilion and extends to the northern gangway entrance to the seasonal barge and will be treated for invasive species. As much as possible, the existing slope will be cut back to provide a more gradual embankment, which will be finished with boulder gardens planted with native shrubs, vines and perennials. Additionally, a proposed stonedust pathway and stone staircase with a wooden railing will provide access to the shoreline in this area.

Forest Area - This area is between the north gangway and the bridge overpass and will also be left untouched. The shoreline and embankment appear stable. Although invasive species are present in this area, there are multiple stands of native vegetation which would likely be harmed by regrading. It is not utilized, aside from elevated gangways to access the existing seasonal barge, and therefore does not lend itself well to improvement.

Boat and Fishing Recreation Area – This area is between the bridge overpass and the south end of the park. The non-motorized boat launch and fishing pier is located in this section. In addition to other invasive species in this vicinity, there is a large stand of knotweed that is proposed to be removed. Staked native vegetation and vegetated rip-rap will replace the removed invasive species. Additionally, the existing paved walking path will be extended to the entrance of the pier to provide ADA access.

In all areas where invasive species are to be removed, the construction contract will require two additional years of follow-up treatment and plantings maintenance to help to ensure control of the vegetation.

3.2 Preliminary Plans, Cost Estimate, and Renderings

Preliminary design plans and selected site renderings are located in Appendix B. The preliminary cost estimate for the work described above is currently $486,000. This includes a 25% contingency allowance and an additional 10% for construction management.

As described in Section 3.1, in order to provide a project meeting the requirements of the City, only specific areas of the site were selected for improvements. The lawn and viewshed area containing the pavilion is a popular area within the park. The vegetation on the embankment including invasive species is cut back on a yearly basis by City personnel. Trimmings are disposed of on site, in a remote area at the southern tip of the park. There are currently several steep, uneven social paths from the top of the embankment to the shoreline. By regrading the slope to a less steep, more stable embankment and providing a designated access path to the shore, several main goals will be accomplished. First, in the process of regrading, the invasive species present in this area will be removed, disposed of properly and replaced with new native low-growing plantings that will enhance and preserve the viewshed. Overall, the proposed project will reduce the vegetation maintenance required by the City and the additional potential spread of invasive species will be lessened since stockpiling of the clippings will be unnecessary.
Providing a single designated access point to the shore will allow for a safer solution for people to reach the shore and serve to reduce erosion potential elsewhere on the embankment caused by multiple bare footpaths.

The boat and fishing recreation area was selected as a second focus point since it is also a highly used area within the park. The addition of a smooth surface path connecting the existing walkway to the dock will provide greater access to a range of patrons. Removal of invasive species and replacement with native plants in the southern portion of the shoreline will provide a showcase area within the park. It will offer an opportunity for the City to determine whether removal of invasive species throughout the remainder of the park offers an achievable and economically beneficial solution for reducing maintenance and increasing the environmental character of the park.

4 FINDINGS AND RESPONSES TO REGULATORY ISSUES

A pre-application meeting was held on December 21st at the Watervliet City Hall. Attendees included representatives from the City, US Army Corps of Engineers (USACE), the NYS Department of Environmental Conservation (NYSDEC) and the NYS Department of State (NYSDOS).

A review of plans was conducted and questions and concerns from the Stakeholders were discussed. The major issues that were raised are addressed below.

1. Will native trees remain on site? *The project aims to retain the large trees uphill of the work areas and as many native trees on the slopes as feasible. Existing willows along the shoreline will also be preserved.*

2. Will submerged aquatic vegetation (SAV) be introduced as part of the project? *Given the combination of rocky and generally inorganic soils within and below the tidal zone elevations and the presence of ice scour along the shoreline, it is not recommended that SAVs be installed.*

3. What is the mean high water elevation? *Using data from the NOAA Tides & Currents Datums and preliminary conversations with the USACE, it was determined that 3.4ft is considered the mean high water elevation. We will follow up with USACE to confirm that this is accurate.*

4. In the cobbles and rip-rap areas near the kayak boat launch there is limited void space. How will plantings be incorporated? *It is anticipated that hand work will be required to open the voids where plantings and soils will be installed to provide adequate space for establishment.*

5. The sea-level rise projections should be shown in the plans and any measures required to protect the project elements should be incorporated. *The expected seal level elevations will be included in the revised plans.*

6. Provide more detail regarding the steps of the stairs and the steepness of the regraded slope. *Cross sections of the proposed steps and slope will be provided in the revised plans.*

7. Will additional stone be brought in to construct the boulder gardens near the stairs? *It is anticipated that the existing rip-rap and stone currently onsite will be adequate to be relocated and utilized for the construction of the proposed boulder gardens. These structures will help to reduce water runoff down the slope and provide additional stability to the embankment.*

8. Consider using a more porous material for the path connecting the walkway to the dock. *Options other than typical asphalt will be investigated.*
9. How will construction affect the accessibility of the park to the public? During the actual construction, such as paving and regrading, the adjacent sites may require closure to the public. However, it is expected that these will be small timeframes, only a few days at a time. Ideally it will be possible to schedule construction prior to or after times of increased usage, such as early spring or late fall. Parking is not expected to be impacted given the size of the exiting lots. The construction period will depend on the contractor’s schedule.

10. How will the contractor treat invasive species? Prior to construction, the contractor will submit means and methods for approval by the City. The contract will include the requirement of two additional years of invasive species treatment and plant maintenance by the contractor.

11. Will construction require machinery to be operated in the water? The work will be completed in the dry.

12. How should permitting proceed? Forms and required documentation should be completed as much as feasible. It is understood that modification may be required in the case that the plans change. Permits may need to be renewed if the construction does not occur within the timeframes indicated by the specific permits, however this is not expected to be a laborious or time-consuming process.

13. The NYSDEC stated that the stream classification will impact the permits required. If the river is a class C, then their jurisdiction is mean high water. If it is a class B then the NYSDEC has jurisdiction of the streambanks.

14. The USACE stated that if all work, including installation of erosion control measures, will be completed above mean high water they do not have jurisdiction. If requested, they are willing to document this finding with a letter.

15. The NYS DOS stated that if no Federal permits are required, then they will only need to conduct a State level coastal consistency review.

16. The USACE and the NYSDEC indicated that they would like to visit the project site to further understand the project and confirm permitting requirements. Gomez and Sullivan will arrange a meeting at the site with the agencies in January.

It is currently presumed that the proposed shoreline stabilization measures along the western shore of the Hudson River will have minimal environmental permitting implications as they are located above the mean high water. Permitting or authorization may be limited to the NYSDEC and the NYSDEC.

5 REFERENCES


New York State Department of Environmental Protection. (2014). 6 NYCRR Part 575 Prohibited and Regulated Invasive Species.


APPENDIX A: NEW YORK NATURAL HERITAGE PROGRAM AND IPaC DOCUMENTS
Dear Erin,

Thank you for contacting us. Many of our historical records, such as the record for Green rock-cress (*Boechera missouriensis*), have limited information about the site location and/or distribution of the species observation. These records pre-date 1979 and their continued presence at the site is unknown. They tend to be mapped with low accuracy and over broader areas, simply because exact locational data was not provided when the observation was documented.

When I reviewed the map and EO (element occurrence), the directions to this record are listed as "Watervliet; west side" and encompasses the entire project site and more. I wish I had more details about the observation; but they don’t seem to exist in the database.

If you are looking for more specific information about the site it might be worth contacting the Region 4 office, the phone number is included on our report. Additionally, you might be interested in our conservation guide on Green rock-cress: [http://www.acris.nynhp.org/guide.php?id=8886](http://www.acris.nynhp.org/guide.php?id=8886) which includes conservation and management practices for this species.

If you have any additional questions, please feel free to contact me.

Sincerely,

Colleen Lutz

Assistant Biologist
NY Natural Heritage Program
625 Broadway, 5th Floor
Albany, NY 12233-4757
www.nynhp.org
518-402-8913

*The New York Natural Heritage Program is a partnership between the New York State Department of Environmental Conservation and the State University of New York College of Environmental Science and Forestry.*
Hello Colleen,

We are working as environmental and engineering consultants for a “Sustainable Shorelines” demonstration project at the Hudson Shores Park in the City of Watervliet. The purpose of the project is to create a shoreline treatment that resists erosion, enhances accessibility and recreational use, and improves habitat value.

I am contacting you in regard to the Natural Heritage data request we submitted in June and your response dated July 21, 2017. When we last reached out to you, we were pursuing this work. We now have a contract in place with New England Interstate Water Pollution Control Commission and NYSDEC. We understand that there is a rare plant, green water-cress (*Boechera missouriensis*) in the vicinity of the project site. Are there more specific location data available for this species within Watervliet? If so, can Natural Heritage share these data with Gomez and Sullivan or with our client, New England Interstate Water Pollution Control Commission and NYSDEC?

Sincerely,

Erin Redding  
Certified Ecologist (Ecological Society of America)  
Gomez and Sullivan Engineers, D.P.C.  
1961 Wehrle Dr.  
Suite 12  
Williamsville, NY 14221  
716-250-4960  
erredding@gomezandsullivan.com

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GSE CONFIDENTIALITY NOTICE: This email and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you are not the intended recipient, please do not read or review the content and/or metadata and do not disseminate, distribute or copy this communication. Anyone who receives this message in error should notify the sender (eredding@gomezandsullivan.com) immediately by return e-mail and delete it from his or her computer.
APPENDIX B: PRELIMINARY DESIGN DRAWINGS
PRELIMINARY DESIGN OF A SUSTAINABLE SHORELINE
AT THE HUDSON SHORES PARK IN CITY OF WATERVLIET, NY

PREPARED FOR:

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION
650 SUFFOLK STREET
SUITE 410
LOWELL, MA 01854

DRAWINGS - PRELIMINARY 30% DESIGN

NOT TO BE USED FOR CONSTRUCTION

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DIG-SAFE
CONTRACTOR SHALL CALL DIG-SAFE CALL CENTER AT 1-888-344-7233 AT LEAST 72 HOURS PRIOR TO STARTING ANY EXCAVATION. SATURDAYS, SUNDAYS, AND LEGAL HOLIDAYS ARE NOT TO BE INCLUDED IN THE REQUIRED 72 HOUR NOTICE.
3. The Contractor shall conduct appropriate inspections to protect the water. The Contractor shall follow the New York State Department of Environmental Conservation’s regulations on the use of herbicides for weed control and shall consult with the City of Waterford before using any herbicides.

4. The Contractor shall submit a Health and Safety Plan detailing the health and safety procedures which will apply during the term of the contract. The Health and Safety Plan will be reviewed by and accepted by the City.

5. The Contractor shall hold daily safety meetings before the start of work.

6. It is the responsibility of the Contractor to fulfill all requirements of the contract and all amendments thereto, including the New York State Department of Transportation’s Engineering Office of Lighting Standards for highway work, and subcontractor agreements.

7. The Contractor shall submit a proposal for the proposed project to the City. The proposal shall include the following:

   a. The proposed work scope and schedule.
   b. The estimated cost of the project.
   c. The qualifications of the Contractor.
   d. The proposed plan and specifications.

8. The Contractor shall provide and work shall be performed in accordance with the New York State Department of Transportation’s requirements for erosion and soil and sediment control.

9. The Contractor shall provide a copy of the approved erosion and sediment control plan, if required by federal, state, or local regulations.

10. The Contractor shall be responsible for the performance and computer of the work and shall notify the city of any changes in the plans or any additional permits required.

11. The Contractor shall not disturb soil in areas outside of those specified on the plans.

12. The Contractor shall not construct any temporary facilities in areas outside of the proposed work areas.

13. The Contractor shall not construct any temporary facilities within two hundred feet of any public rights-of-way.

14. Should hazardous/unsuitable materials be encountered, the Contractor shall stop work immediately and notify the City. The Contractor shall be responsible for the proper disposal of all materials and equipment.

15. The Contractor shall submit a proposal for the proposed project to the City. The proposal shall include the following:

   a. The proposed work scope and schedule.
   b. The estimated cost of the project.
   c. The qualifications of the Contractor.
   d. The proposed plan and specifications.

16. The Contractor shall provide and work shall be performed in accordance with the New York State Department of Transportation’s requirements for erosion and soil and sediment control.

17. Elevation are shown in North American Vertical Datum 88.

18. The Hudson River Park portion of the survey is in Zone AE, an area subject to inundation by the 100-year flood with the base flood elevation of 3.0 feet.

19. Erosion and sediment control measures shall be used to minimize the impact of the project on the environment.

20. All equipment shall be cleaned using water prior to and after use. The Contractor shall be responsible for the proper disposal of all materials and equipment.

21. The Contractor shall prevent the transport of invasive plant material to and from the site. Equipment, vehicles, personal gear, and supplies shall be checked before leaving the site.

22. Access to the site will be coordinated with the City. The use of vehicles on the site will follow established procedures.

23. Only vehicles authorized to enter the site will be used in the fill operations on the site. No unauthorized vehicles will be allowed on the site.

24. All temporary structures shall be set up and operated in accordance with the New York State Department of Health and the City’s regulations.

25. If excavated materials are to be hauled, the material shall be stabilized prior to being removed from the site. The Contractor shall be responsible for the proper disposal of all materials and equipment.

26. Temporary stockpiling of excavated materials on approved designated area is acceptable. Stockpiles shall be placed, graded, and protected for surface run-off control. All excavated materials shall be correctly classified and labeled according to the New York State Department of Environmental Conservation regulations.

27. The Contractor shall not construct any temporary facilities within two hundred feet of any public rights-of-way.

28. The Contractor shall be responsible for the proper disposal of all materials and equipment.

29. The Contractor shall submit a proposal for the proposed project to the City. The proposal shall include the following:

   a. The proposed work scope and schedule.
   b. The estimated cost of the project.
   c. The qualifications of the Contractor.
   d. The proposed plan and specifications.

30. The Contractor shall provide and work shall be performed in accordance with the New York State Department of Transportation’s requirements for erosion and soil and sediment control.
EXISTING CONDITIONS

V101

HUDSON SHORES PARK SUSTAINABLE SHORELINE DESIGN

PRELIMINARY
30% DESIGN
NOTE FOR CONSTRUCTION

30% DESIGN
NOT FOR CONSTRUCTION

GENERAL SURVEY NOTES:
1. UNDERGROUND UTILITY LOCATIONS SHOWN HEREON ARE BASED ON UTILITY EVIDENCE VISIBLE AT GROUND SURFACE AND RECORD DRAWINGS AND ARE SUBJECT TO FIELD VERIFICATION BY EXCAVATION. UTILITIES SHOWN DO NOT PURPORT TO CONSTITUTE OR REPRESENT ALL UTILITIES LOCATED UPON OR ADJACENT TO THE SURVEYED PREMISES.
2. SURVEY PERFORMED BY WESTON & SAMPSON PE, LS, LA, PC IN NOVEMBER 2017.
3. CONTOURS AND ELEVATIONS SHOWN ON NAVD88 VERTICAL DATUM BASED ON GPS OBSERVATIONS.
4. NORTH ORIENTATION IS TRUE NORTH BASED ON GPS OBSERVATIONS TAKEN AT THE TIME OF THE FIELD SURVEY. MAPPING PREPARED ON PACER CROOK PLANE COORDINATE SYSTEM NEW YORK EAST ZONE.
5. MAPPING OUTSIDE OF SURVEYED AREA IS PROVISO MAPS BY OTHERS.

www.gomezandsullivan.com
DEMOLITION PLAN

HUDSON SHORES PARK SUSTAINABLE SHORELINE DESIGN
PRELIMINARY 30% DESIGN
NOT FOR CONSTRUCTION

AREA OF REGRADED AND ACCESS IMPROVEMENTS

ACCESS IMPROVEMENTS AND REMOVAL OF INVASIVE SPECIES WITHIN RIPRAPP

Williamsville, NY    Utica, NY    Albany, NY    Henniker, NH
www.gomezandsullivan.com

CHJ/JSW
INVASIVE SPECIES REMOVAL

HUDSON SHORES PARK SUSTAINABLE SHORELINE DESIGN

4. CONTRACTORS SHALL UTILIZE SPECIFIC TREATMENT METHODS FOR EACH TARGET SPECIES. VARIOUS METHODS MAY NEED TO BE EMPLOYED FOR EACH SPECIES AS WELL. LOW VOLUME FOLIAR TREATMENT: A LOW VOLUME HERBICIDE MIXTURE APPLIED TO STANDS OR HERBACEOUS PLANTS USING LOW VOLUME APPlicATION. CONTRACTORS SHALL PROVIDE HOURLY/TOTAL TREATMENT REPORTS TO THE OWNER.

5. ALL CUT HERBACEOUS OR SUCKERING INVASIVE PLANT MATERIALS, SEEDS, BERRIES, AND RHIZOMES SHALL BE DISPOSED OF PROPERLY AT AN APPROVED FACILITY OFF-SITE. CONTRACTORS ARE ENCOURAGED TO PROVIDE RECOMMENDATIONS FOR OTHER TREATMENT METHODS. E.G., HAND PULLING, HAND WICKERING.

6. THE CONTRACTOR MUST INFORM THE CITY'S AUTHORIZED REPRESENTATIVE OF ITS INTENDED SCHEDULE AT ALL TIMES. WHILE IT IS RECOGNIZED THAT RAIN, WIND, AND OTHER WEATHER VARIABLes MAY CAUSE SCHEDULES TO BE ADJUSTED, THE CONTRACTOR MUST INFORM THE CITY'S AUTHORIZED REPRESENTATIVE OF ITS INTENDED SCHEDULE ONE WEEK IN ADVANCE.

7. NATIONAL SAFETY DATA SHEETS FOR ALL MATERIALS SUPPLIED TO THE CONTRACTOR SHALL BE POSTED ON-SITE AND REMAIN ACCESSIBLE AT ALL TIMES DURING TREATMENT.

8. THE CONTRACTOR IS RESPONSIBLE FOR SUPPLYING TO THE OWNER, STATE, AND LOCAL REGULATIONS PERTAINING TO THE PURCHASE, TRANSPORT, APPLICATION, AND DISPOSAL OF HERBICIDES. CONTRACTORS SHALL PRODUCE A WRITTEN CONFIRMATION FROM THE MANUFACTURER OF HERBICIDE TO ENSURE THAT DAILY TREATMENTS ARE COMPLETED.

9. MATERIAL SAFETY DATA SHEETS FOR ALL CHEMICALS TO BE USED IN TREATMENT ACTIVITIES. A COPY OF THESE TREATMENT AND MAINTENANCE RECORDS SHALL BE SUBMITTED TO THE CITY IN BOTH HARDCopy AND ELECTRONIC FORMAT (PDF FORMAT) WITHIN 3 WEEKS OF TREATMENT.

10. THE CONTRACTOR IS RESPONSIBLE FOR ADHERING TO ALL FEDERAL, STATE, AND LOCAL REGULATIONS PERTAINING TO THE PURCHASE, TRANSPORT, APPLICATION, AND DISPOSAL OF HERBICIDES. CONTRACTORS ARE RESPONSIBLE FOR SECURING ANY PERMITS REQUIRED FOR THE PURCHASE, TRANSPORT, APPLICATION, AND DISPOSAL OF HERBICIDES. CONTRACTORS ARE RESPONSIBLE FOR SECURING ANY PERMITS REQUIRED FOR THE PURCHASE, TRANSPORT, APPLICATION, AND DISPOSAL OF HERBICIDES.

11. THE PROJECT INVOLVES APPLICATION OF HERBICIDES IN AND ADJACENT TO A STATE-REGULATED WATERWAY AND AS SUCH, THE CONTRACTOR SHALL PROVIDE AND UTILIZE A CUT AND TREAT METHOD. CUT AND TREAT IS CUTTING THE STEM OF THE PLANT, REMOVING THE CUTTINGS AND TREATING THE CUT STEM WITH A HERBICIDE. THIS METHOD MAY BE APPROPRIATE FOR SMALL POPULATIONS THAT ARE VERY CLOSE TO DESIRABLE, NON-TARGET SPECIES. CUT AND TREAT SHALL BE USED TO TREAT WOODY SHRUBS AND TREES. CUTTING THE STEM OF THE PLANT, REMOVING THE CUTTINGS AND TREATING THE CUT STEM WITH A HERBICIDE. THIS METHOD MAY BE APPROPRIATE FOR SMALL POPULATIONS THAT ARE VERY CLOSE TO DESIRABLE, NON-TARGET SPECIES. CUT AND TREAT SHALL BE USED TO TREAT WOODY SHRUBS AND TREES.

12. THE CONTRACTOR SHALL PROTECT THE ENVIRONMENT. THE CONTRACTOR IS RESPONSIBLE TO ASSURE THAT TREATMENT CREWS ABIDE BY ALL APPLICABLE ENVIRONMENTAL REGULATIONS, INCLUDING BUT NOT LIMITED TO FEDERAL, STATE AND LOCAL RULES GOVERNING POLLUTION AND THE PROTECTION OF PLANTS AND ANIMALS.

13. THE HERBICIDE MANUFACTURER'S LABEL SHALL BE WORN FOR ALL HERBICIDE HANDLING AND APPLICATIONS. SPECIFICATIONS FOR MIXING, DILUTION, AND USE, INCLUDING SPECIFIC INSTRUCTIONS FOR TARGET VEGETATION. PERSONAL PROTECTIVE SAFETY EQUIPMENT AS REQUIRED PER GLYPHOSATE-BASED HERBICIDE THAT IS AUTHORIZED FOR USE IN AQUATIC APPLICATIONS AND IN NEW YORK STATE. THE CONTRACTOR SHALL FOLLOW THE MANUFACTURER'S LABEL INSTRUCTIONS FOR MIXING, DILUTION, AND USE, INCLUDING SPECIFIC INSTRUCTIONS FOR TARGET VEGETATION. PERSONAL PROTECTIVE SAFETY EQUIPMENT AS REQUIRED PER GLYPHOSATE-BASED HERBICIDE THAT IS AUTHORIZED FOR USE IN AQUATIC APPLICATIONS AND IN NEW YORK STATE.

14. THE CONTRACTOR SHALL BE ASSURED THAT TREATMENT CREWS ABIDE BY ALL APPLICABLE ENVIRONMENTAL REGULATIONS.

15. CONTRACTORS ARE ENCOURAGED TO PROVIDE RECOMMENDATIONS FOR OTHER TREATMENT METHODS. E.G., HAND PULLING, HAND WICKERING.

16. CUT AND TREAT: CUTTING THE STEM OF THE PLANT, REMOVING THE CUTTINGS AND TREATING THE CUT STEM WITH A HERBICIDE. THIS METHOD MAY BE APPROPRIATE FOR SMALL POPULATIONS THAT ARE VERY CLOSE TO DESIRABLE, NON-TARGET SPECIES. CUT AND TREAT SHALL BE USED TO TREAT WOODY SHRUBS AND TREES. CUTTING THE STEM OF THE PLANT, REMOVING THE CUTTINGS AND TREATING THE CUT STEM WITH A HERBICIDE. THIS METHOD MAY BE APPROPRIATE FOR SMALL POPULATIONS THAT ARE VERY CLOSE TO DESIRABLE, NON-TARGET SPECIES. CUT AND TREAT SHALL BE USED TO TREAT WOODY SHRUBS AND TREES.

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21. THE CONTRACTOR SHALL BE ASSURED THAT TREATMENT CREWS ABIDE BY ALL APPLICABLE ENVIRONMENTAL REGULATIONS.
RPI BOAT HOUSE

MEAN HIGH WATER LINE (ELEVATION 3.4)

STAKED VEGETATION

VEGETATION WITHIN EXISTING RIP RAP

FIBER ROLL SILT PROTECTION, TYP.

LEGEND:
- FIBER ROLL SILT PROTECTION
- RIP RAP
- STAKED VEGETATION
- VEGETATION IN RIP RAP

MATCH LINE SHEET L103
MATCH LINE SHEET L105

PRELIMINARY 30% DESIGN
NOT FOR CONSTRUCTION

HUDSON SHORES PARK SUSTAINABLE SHORELINE DESIGN

RAM/DBP

PREPARED BY: RAMDBP
ORIG NO: L104

HUDSON RIVER
SCALE:

RPI BOAT HOUSE

www.gomezandsullivan.com

NEW YORK CITY UNIVERSITY
SUNY NEW PEST
GOMEZ AND SULLIVAN

LANDSCAPE PLAN 5

MATCH LINE SHEET L103
PROTECTION OF TREES:

1. Placement of a flush cut mulch to the edge of the roll and trench to facilitate slope treatment. Mulch shall be placed around the trees for 1' radius at the base of each tree. Mulch shall be properly compacted to protect against erosion and washout.

2. The use of erosion control blankets or fabric to hold mulch in place and prevent erosion. The blankets shall be secured with nails or stakes to prevent movement.

3. Careful placement of the blankets to avoid damage to the tree roots. The blankets shall be removed after the tree establishment is complete.

4. Drainage ditches shall be constructed to prevent water from accumulating around the base of the tree. The ditches shall be properly sized and shaped to accommodate the anticipated flow.

5. Regular maintenance of the tree area to promote healthy growth. This includes weeding, fertilization, and regular watering.

LANDSCAPE REPLACEMENT:

1. The replacement of native vegetation with similar species shall be performed as noted on plans. The replacement vegetation shall be native and adapted to the local soil and climate conditions.

2. Soil shall be properly amended to support the new vegetation. This includes the addition of organic matter and the adjustment of pH levels as necessary.

3. Irrigation systems shall be installed to sustain the new vegetation during the establishment phase. The systems shall be designed to provide adequate water to support the new growth.

4. Regular monitoring of the new vegetation shall be performed to ensure healthy growth. This includes checking for pests and diseases and applying appropriate treatments as necessary.
NOTES:
1. STAKES SHALL BE ARRANGED PERPENDICULAR TO THE SLOPE.
2. SPACING SHALL BE BETWEEN TWO TO FOUR STAKES PER 9 SQUARE FEET.
3. EXISTING INVASIVE SPECIES SHALL BE REMOVED PRIOR TO INSTALLATION.
4. EXISTING RUP RAP MAY BE ADJUSTED TO ACCOMMODATE PLANTINGS.
## Conceptual Opinion of Probable Construction Cost

**Project:** Hudson Shores Park Shoreline Stabilization

**Estimate for:** Preliminary (30%) Design

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<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td>$0</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td>$0</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Invasive Species Control Maintenance</td>
<td>2</td>
<td>YR</td>
<td>$1,500</td>
<td>$3,000</td>
</tr>
<tr>
<td>15</td>
<td>Plant Maintenance</td>
<td>1</td>
<td>LS</td>
<td>$15,000</td>
<td>$15,000</td>
</tr>
</tbody>
</table>

**Subtotal Direct Cost** $353,700

**Contingency Allowance (25%)²** $88,425

**Total Direct Cost** $442,000

**Construction Management (10%)³** $44,000

**Total OPCC** $486,000

### Notes:
1. Contractor General Requirements taken as 10% of the remaining itemized costs totaled and rounded to the nearest $100.
2. Contingency Allowance taken as 25%.
3. Rounded to the nearest $1,000.
4. The unit prices are estimated based on a compilation of manufacturer's pricing and similar completed project costs.
## Appendix C: Shoreline Stability Assessment

<table>
<thead>
<tr>
<th>GPS ID</th>
<th>Field Comment</th>
<th>Photo</th>
<th>Shoreline Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Steeper slope with garlic mustard. Trees in this area have been cut.</td>
<td><img src="image1.jpg" alt="Photo" /></td>
<td>Moderately unstable</td>
</tr>
<tr>
<td>11</td>
<td>Steep slope</td>
<td>No photo</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>The slope here is near vertical with cottonwood trees</td>
<td><img src="image2.jpg" alt="Photo" /></td>
<td>Moderately unstable</td>
</tr>
<tr>
<td>GPS ID</td>
<td>Field Comment</td>
<td>Photo</td>
<td>Shoreline Stability</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>29</td>
<td>Steep slope with dumping of concrete, waste from management, and large concrete blocks.</td>
<td><img src="image1.jpg" alt="Photo" /></td>
<td>Moderately unstable</td>
</tr>
<tr>
<td>35</td>
<td>Fallen tree at shoreline. Mulberry tree on the bank is undercut.</td>
<td><img src="image2.jpg" alt="Photo" /></td>
<td>Unstable</td>
</tr>
<tr>
<td>GPS ID</td>
<td>Field Comment</td>
<td>Photo</td>
<td>Shoreline Stability</td>
</tr>
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<td>--------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>36</td>
<td>Eroding slope. Potential for stabilization here.</td>
<td><img src="image1" alt="Photo" /></td>
<td>Moderately unstable</td>
</tr>
<tr>
<td>37</td>
<td>Bank at or above high water is undercut from point 36 to here.</td>
<td><img src="image2" alt="Photo" /></td>
<td>Moderately unstable</td>
</tr>
<tr>
<td>GPS ID</td>
<td>Field Comment</td>
<td>Photo</td>
<td>Shoreline Stability</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------------</td>
<td>-------</td>
<td>---------------------</td>
</tr>
<tr>
<td>42</td>
<td>Undercut cottonwood roots</td>
<td></td>
<td>Moderately unstable</td>
</tr>
<tr>
<td>44</td>
<td>Undercutting and steep slope south of employee gangway</td>
<td></td>
<td>Moderately unstable</td>
</tr>
<tr>
<td>45</td>
<td>Eroding slope</td>
<td></td>
<td>Moderately unstable</td>
</tr>
<tr>
<td>GPS ID</td>
<td>Field Comment</td>
<td>Photo</td>
<td>Shoreline Stability</td>
</tr>
<tr>
<td>--------</td>
<td>----------------</td>
<td>--------------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>46</td>
<td>Eroding slope</td>
<td><img src="image-url" alt="Image" /></td>
<td>Moderately unstable</td>
</tr>
</tbody>
</table>