HUDSON RIVER HABITAT RESTORATION

ECOSYSTEM RESTORATION
DRAFT INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT

Appendix E:
Cost Engineering

U.S. ARMY CORPS OF ENGINEERS
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Contents

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Attachments

Attachment A – Abbreviated Risk Analysis

Acronyms and Abbreviations

ALT	Alternative
AOP	Aquatic Organism Passage
ARA	Abbreviated Risk Analysis
HRHR	Hudson River Habitat Restoration
MCACES	Micro-Computer Aided Cost Estimating System
OMRR&R	Operation, Maintenance, Repair, Replacement, and Rehabilitation
PED	Preconstruction Engineering and Design
USACE	United States Army Corps of Engineer

Chapter 1: Introduction

This Appendix presents cost estimates that have been assembled for proposed restoration at the final array of sites evaluated as part of the Hudson River Habitat Restoration (HRHR) project. A site-specific discussion regarding cost, schedule ad risk is included within this appendix. What follows is a discussion regarding the methodology used to develop the cost estimate package for each of the six sites: Binnen Kill, Schodack Island, Henry Hudson Park, Charles Rider Park, Rondout Creek, and Moodna Creek (Table 1-1).

Table 1-1: Cost Estimate Packages

Cost Estimate Package	Eco-Restoration Type	Site Name and Alternative
Binnen Kill	Mosaic Habitat: Wetlands and Side Channels; Wetland restoration and invasive species management, Creation of waterways	Binnen Kill North Alternative 1
		Binnen Kill North Alternative 1
		Binnen Kill North Alternative 1
		Binnen Kill North Alternative 1
		Binnen Kill South Alternative 1
		Binnen Kill South Alternative 2
Schodack Island	Mosaic Habitat: Wetlands and Side Channels; Wetland restoration and invasive species management, Creation of waterways	Schodack Island North Alternative 1
		Schodack Island North Alternative 2
		Schodack Island South Alternative 1
		Schodack Island South Alternative 2
		Schodack Island South Pocket Wetlands
Henry Hudson Park	Shoreline Restoration; Wetland Restoration and shoreline stabilization	Henry Hudson Alternative 1
		Henry Hudson Alternative 2
Charles Rider Park	Shoreline Restoration; Wetland Restoration and shoreline stabilization	Charles Rider Alternative 1
Moodna Creek	Aquatic Organism Passage; Dam Removal, Dam Breaching/Notching, Fishway, Fish Ladder	Moodna AOP1 Alternative 1 – Barrier Removal
		Moodna AOP1 Alternative 2 – Rock Ramp
		Moodna AOP2 Alternative 1 – Dam Removal
		Moodna AOP2 Alternative 2 – Fishway
		Moodna AOP3 Alternative 1 – Dam Removal
		Moodna AOP3 Alternative 2 – Dam Breach
Rondout Creek	Aquatic Organism Passage; Dam Removal, Dam Breaching/Notching, Fishway, Fish Ladder	Rondout Creek Alternative 1 – Fishway
		Rondout Creek Alternative 2 – Dam Removal
		Rondout Creek Alternative 3 – Dam Notching

Each cost package is composed of the following items:

1) Binnen Kill costs and contingencies for four alternatives for the northern component and two alternatives for the southern component.
2) Schodack Island costs and contingencies for two alternatives each for two components, North and South, as well as a single alternative for the Pocket Wetlands component.
3) Henry Hudson Park costs and contingencies for two alternatives for one site.
4) Charles Rider Park costs and contingencies for a single alternative for one site.
5) Moodna Creek costs and contingencies for two alternatives each for three aquatic organism passage (AOP) barriers.
6) Rondout Creek costs and contingencies for three alternatives for a single site.

For all sites, the following cost accounts apply:

Price Levels: Costs were presented as current year (2019) dollar values without escalation. The preliminary cost estimates presented are First Costs only.

Real Estate (Account 01): Site-specific real estate costs were developed for each component/site. Fee title and temporary easements will be acquired (no permanent easements will be acquired) per ER 1105-2-100 Sec. 3-5(b)(9) and ER 405-1-12. Real estate costs include land acquisition and incidental (i.e., appraisals, land surveys, title services, etc.) costs. Details related to the real estate costs can be found in the Real Estate Plan (Appendix I).

Cultural Resource Surveys and Mitigation (Account 18): In accordance with the National Environmental Policy Act and the National Historic Preservation Act (54 USC 306108) federal agencies are to avoid, preserve, protect, minimize or compensate for impacts to National Register of Historic Places eligible or listed sites where an undertaking will result in adverse effect to the resource. Cultural Resources mitigation costs were developed for each alternative at each site in the final array in accordance with ER 1105-2-100. Survey and mitigation estimates include archaeological investigations, architectural surveys, and data recovery. Estimates were developed using existing information and assumptions about the level of mitigation required at each site depending on the scale of the undertaking proposed in each alternative as well as the presence of historic properties and potential for buried archaeological sites within a given area, refer to the Cultural Resources Appendix G5 for a detailed discussion of potential cultural resources impacts at each site.

Planning Engineering and Design (Account 30): Planning, Engineering and Design account includes costs for the Pre-construction Engineering and Design (PED) Phase and engineering support during construction. Costs were developed for each site specific alternative including costs related to regulatory compliance, field data collection, and preparation of design plans, documentation, and specifications for all alternatives and engineering support during construction through project completion. It includes all the in-

house labor based upon work-hour requirements, material and facility costs, travel, and overhead. In some cases, a default of 29.5 percent of construction costs were used.

Construction Management (Account 31): Costs were developed for all construction management activities from pre-award requirements through final contract closeout. This cost includes in-house labor based upon work-hour requirements, materials, facility costs, support contracts, travel, and overhead. The cost was developed based on input from the construction division in accordance with Civil Works Breakdown Structure and includes, but is not limited to, anticipated items such as the salaries of the resident engineer and staff, surveyors, inspectors, drafters, clerical, and custodial personnel; operation, maintenance, and fixed charges for transportation and for other field equipment; field supplies; construction management, general construction supervision; and project office administration, distributive cost of area office, and general overhead charged to the project. If the construction management cost for an alternative was less than 14.5 percent of the construction and implementation cost, the default 14.5 percent cost was used.

Monitoring: Monitoring costs are required by ER 1105-2-100 Sec. 3-5.b. (8). Implementation Guidance issued August 31, 2009 for Section 2039 of Water Resource Development Act (WRDA) 2007 (as amended by Section 1161 of WRDA 2016) directs the Secretary of the Army to ensure, when conducting a feasibility study for a project (or component of a project) under the U.S. Army Corps of Engineers (USACE) ecosystem restoration mission that the decision document include a monitoring plan to measure the success of the ecosystem restoration. Monitoring the success of a restoration project can be complex as restored wetlands can take a myriad of growing seasons to reach dynamic equilibrium conditions; therefore, the initial monitoring period of five years will ensure the site is on a trajectory toward ecological success. A detailed breakdown of the monitoring efforts required for each project site is provided in the Monitoring and Adaptive Management Plan (Appendix H).

Adaptive Management: Section 2039 of WRDA 2007 directs USACE to develop an adaptive management plan for all ecosystem restoration projects. A detailed breakdown of the assumed adaptive management efforts required for each project site is provided in the Monitoring and Adaptive Management Plan (Appendix H).

Construction Contingencies: As stated in ER 1110-2-1302, the goal in contingency development is to identify the uncertainty associated with an item of work or task to an acceptable degree of confidence. Consideration must be given to the detail available at each stage of planning, design or construction for which a cost estimate is being prepared. Contingency may vary throughout the cost estimate and could constitute a significant portion of the overall costs when data or design details are unavailable.

An Abbreviated Risk Analysis (ARA) was completed for the entire project with specific feature of work categories, such as wetland restoration or riparian restoration, for risk evaluation based on the risk elements (Attachment A). Final contingency development and assessment of the potential for cost growth is included in the cost estimate. To develop the Total Project First Cost, contingencies developed in the Abbreviated Risk

Analysis (ARA) were applied. The construction contingencies developed per ARA for each site is shown in Table 1-2.

Table 1-2: Construction Contingency Factors used for Each Site

Cost Estimate Package	Construction Contingency Factor
1. Binnen Kill North Alt 1	23%
2. Binnen Kill North Alt 2	25%
3. Binnen Kill North Alt 3	22%
4. Binnen Kill North Alt 4	25%
5. Binnen Kill South Alt 1	26%
6. Binnen Kill South Alt 2	26%
7. Schodack Island North Alt 1	26%
8. Schodack Island North Alt 2	26%
9. Schodack Island South Alt 1	26%
10. Schodack Island South Alt 2	26%
11. Schodack Island Pocket Wetlands	25%
12. Henry Hudson Park Alt 1	25%
13. Henry Hudson Park Alt 2	35%
14. Charles Rider Park	25%
15. Moodna Creek AOP#1 (Utility Crossing) – Removal	18%
16. Moodna Creek AOP#1 (Utility Crossing) – Fishway	35%
17. Moodna Creek AOP#2 (Firth Cliff Dam) – Removal	18%
18. Moodna Creek AOP#2 (Firth Cliff Dam) – Fishway	35%
19. Moodna Creek AOP#3 (Orr's Mill Dam) – Removal	18%
20. Moodna Creek AOP#3 (Orr's Mill Dam) – Breach	19%
21. Rondout Creek Eddyville Dam – Fishway	35%
22. Rondout Creek Eddyville Dam – Removal	18%
23. Rondout Creek Eddyville Dam – Notch	19%

A similar ARA approach was used for 18 - Cultural Resource Preservation, 30 - Planning, Engineering and Design (PED), and 31 - Construction Management. Cultural Resource contingency was calculated for three general project types: Aquatic Organism Passage (AOP) – Removal/Breach; AOP – Fishways; and Wetland Restoration/Side Channel/Shoreline Restoration which have 32 percent, 12 percent, and 10 percent contingencies, respectively. Contingency values for PED and Construction Management were 29 percent and 24 percent respectively.

Chapter 2: Existing Information and Proposed Actions

The project area is bounded by the Governor Mario M. Cuomo Bridge (former Tappan Zee Bridge) (South) and the Troy Lock and Dam (North) and generally encompasses 125 miles of Hudson River as well as the immediate tributaries and land east and west of the Hudson River between these two boundaries. Within this project area, six restoration sites were selected including:

- Binnen Kill
- Schodack Island
- Charles Rider Park
- Henry Hudson Park
- Rondout Creek – Eddyville Dam
- Moodna Creek including three AOP barriers: AOP#1 (Utility Crossing); AOP#2 (Firth Cliff Dam); and AOP#3 (Orr's Mill Dam)

The Binnen Kill site is located on the west shore of the Hudson River on the borders of the Towns of Bethlehem and Coeymans, New York and encompasses approximately 1,000 acres of publicly and privately-owned lands. The eastern edge of the site originally included islands that were separated from the historic shoreline by side channels in the 1800's but that are now contiguous with the site due to infilling. The Binnen Kill proper is a tidal freshwater tributary that is surrounded by a complex of tidal wetlands, upland forests, non-tidal swamps, and farmland. Proposed actions at the site consist of the restoration of wetlands and hydrological connections through the creation of side channels.

Schodack Island project site is part of the Schodack Island State Park that sits off the eastern shore of the Hudson River just south of Albany. Approximately seven miles of Hudson River and Schodack Creek shoreline bound the 1,052-acre park. The park has been designated a State Estuary, and a portion of the park shelters a Bird Conservation Area that is home to bald eagles, cerulean warblers, and blue herons. Eight miles of multi-use trails wind through a variety of ecological communities. In addition, the park has 66 campsites for use, an improved bike trail, volleyball nets, horseshoe pit, and a kayak/canoe launch. Interpretive signage highlights the park's historic and environmental significance. Proposed actions at the site consist of the restoration of wetlands and hydrological connections through the creation of side channels.

Henry Hudson Park is located on the west shore of the Hudson River and is bisected by the Vloman Kill. The park encompasses approximately 64.2 acres of public open space owned by the Town of Bethlehem. The Hudson River shoreline consists of a dilapidated timber cribbing structure, which has either partially or completely failed along the majority of the structure. Proposed actions at the site focus on shoreline restoration and consist of shoreline stabilization using living shoreline techniques including the establishment of tidal wetlands.

Charles Rider Park is located on the west shore of the Hudson River and encompasses approximately 29.6 acres of public open space owned by the Town of Ulster. The shoreline consists of failed timber cribbing and rock riprap and is largely void of vegetation. Proposed actions at the site focus on shoreline restoration and consist of shoreline stabilization using living shoreline techniques including the establishment of tidal wetlands.

Moodna Creek

AOP#1 (Utility Crossing) is located along Moodna Creek upstream of the Forge Hill Road (Route 74) crossing. A concrete encased decommissioned sewer line crosses Moodna Creek forming a weir that creates a vertical drop of water approximately 2 feet in height during low flows. This sewer line is a potential barrier to AOP, including both migratory and inland resident fish. Proposed actions at the site seek to restore aquatic organism passage by removing the structure or installing a rock ramp.

AOP#2 (Firth Cliff Dam) is located along Moodna Creek adjacent to the former textile manufacturing factory historically known as Firth Carpet Company. The factory was previously demolished but the nine-foot high dam remains, acting as a barrier to AOP. Proposed actions at the site seek to restore aquatic organism passage by removing the structure or installing a technical fishway.

AOP#3 (Orr's Mill Dam) is located along Moodna Creek upstream of the Route 32 crossing. The 10-foot high dam is in poor condition and a barrier to AOP. Normal river flow passes under the spillway suggesting the structure is substantially undermined. Proposed actions at the site seek to restore aquatic organism passage by removing or breaching the structure.

The Eddyville Dam is located on Rondout Creek, on the boundary between the Towns of Esopus and Ulster. The 12-foot high dam sits on a bedrock ledge and is the current head of tide. Proposed actions at the site will seek to restore aquatic organism passage by removing or breaching the structure, or installing a technical fishway.

Chapter 3: Construction Sequencing and Item Descriptions

3.1 Construction Sequencing

Project sites and associated alternatives for the HRHR project were separated into one of three categories according to the type of restoration work proposed, as shown in Table 3-1. Accordingly, the restoration type dictated the construction sequencing associated with design implementation. The construction sequencing played a crucial role in developing the construction cost estimates for each alternative.

Table 3-1: Proposed Restoration Types and Associated Sites

Restoration Type	Primary Restoration Measures/Techniques	Site Name
Mosaic Habitat: Wetlands and Side Channels	Wetland restoration and invasive species management, Creation of waterways	Binnen Kill
		Schodack Island
Shoreline Restoration	Wetland Restoration and shoreline stabilization	Henry Hudson Park
		Charles Rider Park
Tributary Connections	Dam Removal, Dam Breaching/Notching, Fishway, Fish Ladder	Moodna Creek – AOP #1
		Moodna Creek – AOP #2
		Moodna Creek – AOP #3
		Rondout Creek- Eddyville Dam

3.1.1 Mosaic Habitat – Construction Sequencing

The general construction sequence for the mosaic habitat restoration sites will be as follows:

1. Mobilization
2. Installation of soil erosion and sediment control features
3. Installation/modification of temporary work access road(s) and crossings, where applicable
4. Site clearing, including removal of existing vegetation and invasive species treatment, where applicable
5. Installation of water control features, where applicable
6. Earthwork; including excavation, grading, and import of select amended soils, where applicable
7. Installation of site amenities; including removing or modification of existing aquatic organism passage (AOP) crossings, floodplain connections, and/or culverts.
8. Installation of herbivory fencing
9. Installation of plants and seed
10. Demobilization

For alternatives that include installation or modifications to aquatic organism passage crossings, floodplain connections, and/or culverts, it was assumed this activity would occur after the bulk of earthwork efforts. Therefore, a temporary crossing(s) was priced to account for the assumed sequencing. Note that construction items may be constructed simultaneously depending on project phasing and construction crews. Also, it was assumed that if more than one component at a project site (e.g. Schodack Island north

and south) were chosen to be implemented, then the construction would occur independent of one another.

3.1.2 Shoreline Restoration – Construction Sequencing

The general construction sequence for the shoreline restoration sites will be as follows:

1. Mobilization
2. Installation of soil erosion and sediment control features
3. Installation/modification of temporary work access road(s)
4. Site clearing, including removal of existing vegetation and invasive species treatment, where applicable
5. Installation of water control features, where applicable
6. Earthwork; including excavation, grading, and import of select amended soils, where applicable
7. Installation of shoreline stabilization structures, where applicable; includes the import of soil and bank stabilization boulders
8. Installation of herbivory fencing
9. Installation of plants and seed
11. Demobilization

A combination of wet excavation and dewatering is essential at the shoreline restoration sites. Water control structures should be installed before earthwork activities begin and wet excavation shall be utilized as necessary moving forward. For the purpose of cost estimating, shoreline excavation was assumed to be wet as a conservative measure; however, depending on the success of the water control structures, the excavation may be partly dry. Note that construction items may be constructed simultaneously depending on project phasing and construction crews.

3.1.3 Tributary Connections/Aquatic Organism Passage – Construction Sequencing

The general construction sequence for Aquatic Organism Passage restoration sites will be as follows:

1. Mobilization
2. Installation of soil erosion and sediment control features
3. Installation of temporary work access road(s)
4. Site clearing, including removal of existing vegetation, where applicable
5. Installation of water control features
6. Installation of in-water access ramps and pads
7. Demolition of barrier, including excavation and export of material, as applicable
8. Installation of in-stream structures, including import and transport of boulders and fishways, as applicable
9. Stabilization of banks and surrounding areas, as necessary
10. Demobilization

It was assumed that in-stream fish passage or stabilization structures would be constructed after the removal or modification to the barrier at the project site when water surface elevations are shallow enough to drive equipment directly in the stream, eliminating the need for in-stream construction access pads.

3.2 Item Descriptions

Micro-Computer Aided Cost Estimating System (MCACES), Second Generation (MII), version 4.4 was used to generate general construction, monitoring, and adaptive management costs. Costs included items such as mobilization, demobilization, construction of temporary access roads, soil erosion and sediment controls, planting, and construction for site specific features, among other items described below.

Two master files were created with an identical list of items but varied in the labor costs associated with the items. Labor costs vary by generalized area and thus varied among the sites as follows; Henry Hudson Park, Binnen Kill, and Schodack Island all shared a master file while Moodna Creek, Rondout Creek, and Charles Rider Park shared a separate master file. Below is a comprehensive list of the individual cost items.

Mobilization and Demobilization: Mobilization of the site includes the establishment of support facilities within the construction staging area, as well as the mobilization of support facilities (e.g. office trailers, storage trailers, small tools, etc.) and heavy equipment for construction operations. Connecting electric power and telephone service to the trailers is also completed under this item. Demobilization includes removal of support facilities from the site, as well as the demobilization of heavy equipment. This cost was estimated at 3 percent of the total general construction cost.

Temporary Work Access Road: There are up to five temporary work access road features used to develop costs; stabilized construction entrances, access road – reinforcement, access road – wetland matting, construction access ramp, and construction access pad (in water). The number and length of temporary work access roads vary by site based on site geometry and conditions, but the general materials and installation are similar. Project sites that require additional access features were addressed in a separate line item. The five temporary work access road features are as follows:

- **Stabilized construction entrance** assumes an 8-inch gravel depth with exclusive surfacing. These shall be installed in accordance with the governing soil erosion and sediment control agency.
- **Access road – reinforcement** assumes a 4-inch gravel depth with exclusive surfacing in areas that already have an existing temporary road which only needs reinforcement.
- **Access road – wetland matting** assumes temporary ramps of ¾-inch plywood on 2-inch by 10-inch joists and 16-inch on center in the wetland or other vegetated areas that will be excavated as part of the project or will be restored to vegetation post construction.

- **Construction access ramp** will be used to access a stream from the bank and assumes riprap and rock lining of broken stone (50-pound average), includes dumping of the rock.
- **Construction access pad (in water)** assumes the same as the construction access ramp, but with a crew output of 75% (versus 100%) to account for in-water work.

Clearing Site: Clearing and grubbing of the site includes removing vegetation for the creation of temporary access roads and for restoration purposes. Clearing the site will also include the felling, chipping, and stump removal of existing trees that are within excavation and grading zones, and clearing trash on site.

For cost estimating purposes, debris from clearing operations, including vegetation or trash, will be removed from the site and disposed of at a licensed disposal or recycling facility in accordance with all federal, state, and city laws and regulations.

Traffic Control: Traffic control includes detour signs for adjacent roads and parking lots in the project site's vicinity.

Soil Erosion and Sediment Control: Soil erosion and sediment control devices include silt fence and turbidity barriers. These will be furnished and installed at the commencement of site operations and maintained throughout the construction period. Devices will be installed per the approved soil erosion and sediment control plan and maintained accordingly. Silt fencing was proposed at all sites in need of grading and excavation and turbidity barriers were assumed to be required at all sites in need of in-water work, including work occurring adjacent to the water's edge.

Survey Stakeout: Survey stakeout was assumed to be required for grading and/or excavation areas.

Water Control Structures: Water control structures include dewatering pumps, sump holes, and cofferdams. All sump holes were assumed to be 15-feet in height, and all dewatering pumps were assumed to be pumping 8-hours per day, with an assumed 2-hours of attendance by an onsite worker. Cofferdams are necessary for areas directly adjacent to the water where construction would be occurring and need to remain dewatered. Cofferdams were assumed to be 6-feet in height to account for the tidal range.

Field Office and Amenities: A field office was assumed for the duration of each project. In addition to the field office, a toilet, storage box, office equipment, bills associated with the field house, and a project sign were included in the cost estimate.

Herbicide Treatment: Clearing the site will involve the application of herbicide to help in the eradication of existing vegetation, specifically invasive plant species, where necessary. The herbicide will be applied from the ground using spray equipment mounted on all-terrain vehicles. It was assumed that a 5 percent mix of herbicide and water are used at an application rate of 50 gallons/acre.

Herbivory Fencing: This item includes both deer fencing and goose fencing. Deer fence was priced based on the cost of chain link fence, as this would be a comparable cost to deer fence. The crew output efficiency for deer fence installation was reduced by half in forested areas and areas requiring significant travel from the primary site access.

Goose fencing is separated into three categories; Goose fence – Area, Goose fence – Area-Shoreline, and Temporary fencing.

- **Goose fence – Area** and **Goose fence – Area-Shoreline** vary in the location where the goose fencing is installed. If the project site is located along the water's edge, like Henry Hudson Park, then the shoreline goose fence was proposed. Otherwise, traditional goose fencing was used. Both goose fence area items include stakes, twine, and ribbons with the main costing difference being the work output as installation of shoreline goose fencing is assumed to take longer.
- **Temporary fencing** was priced along the water's edge of sites where goose fence is proposed but deer fence is not. The cost of temporary fencing was assumed to be equivalent to the cost of construction fence. Sites, or areas of sites, where deer fence was proposed, it was assumed that deer fencing was sufficient to prevent goose access along the water's edge.

Plantings: This item includes plugs, trees and shrubs, and seeding. Plugs, trees, and shrub material and installation costs were derived from actual costs from a regional wetland and floodplain restoration project. It was assumed plugs would be planted 3-feet on-center in tidal and emergent wetland communities. Tree and shrub species would be planted 8-feet on center in forested wetland and riparian vegetation communities. Seeding is based on total area and includes both soil preparation and seeding with equipment. Soil preparation involves mulching and oat straw 1-inch deep with the use of a power mulcher. Seeding with equipment involves fine grading, and lime, fertilizer, and seed.

Vegetative Matting and Coir Log: This item includes vegetative matting and coir logs. Vegetative matting is composed of tobacco netting, jute mesh, or rolled straw double net blanket fabric and was used for the shoreline stabilization sites as a bank stabilization method. The 12-inch coir log was assumed to require the same crew and effort as silt fencing and uses 2x2x24-inch hardwood survey stakes to secure the coir logs in place.

Earthwork: Earthwork includes both wet and dry excavation, as well as grading. Wet excavation will occur in the creation of channels and tidal wetland communities, as well as for the installation of shoreline stabilization structures. Wet excavation may be used in addition to dewatering at certain sites along the shoreline or in shallow wetland areas. Wet excavation will likely require the use of specialized equipment outfitted for work in wet soils and/or the adaptation of standard construction equipment and construction methods for work on soft soils. Equipment may include: hydraulic excavators outfitted with long reach booms; low ground pressure off-road hauling equipment; low ground pressure dozers; low ground pressure utility vehicles; and the use of crane mats to

support excavators and to assist them in moving across wet areas of the site. Dry excavation will occur in all other areas requiring excavation and will not require as many specialized pieces of equipment, therefore resulting in less expensive costs. At this phase, it is assumed that the site's earthwork volume is balanced and all excavated materials will remain on site. Loading and on site hauling costs were included in all excavation items.

Grading costs were dependent on the volume and area of the grading extent. Sites with large open areas and excavation volumes in excess of 15,000 square yards require rough grading and were suitable for a dozer. Sites with smaller areas and excavation volumes less than 15,000 square yards were assumed to require technical grading, therefore a skid steer and smaller equipment were specified.

Demolition: Demolition items were used for sites with barrier or bulkhead removal, notching, or fishway creation. AOP alternatives that required demolition such as a fishway, notching, or barrier removal assumed that the concrete would be reused onsite for stabilization. Demolition at other sites such as bulkhead removal at Henry Hudson Park assumed costs for concrete demolition, excavation and loading, and disposal.

Side Channel Crossing: This item consists of a box culvert, floodplain culvert(s), earthwork, and accessory components associated with the culverts and crossing. Box culverts were assumed to be 10-feet high with a 12-foot span, a 1-foot concrete thickness, and prefabricated in 8-foot sections. The box culvert item includes compaction, backfill, excavation, headwalls, wingwalls, a crane crew, mobilization and demobilization of the crane crew, a guard rail, guard rail posts, a base coarse drainage layer, and the concrete box culvert. Many of the elements associated with the box culvert were sized based off the existing berm elevation, culvert top elevation and invert, and 3:1 side slopes. Wingwalls were assumed to be triangular concrete sheets with a height of 12-feet and a width of 10-feet, which was used to calculate a total square footage of wall face. In addition, a temporary bridge was priced for intermediate stages, where necessary.

The floodplain culverts consist of piping, end sections, gaskets, backfill, compaction, excavating, and a base coarse drainage layer. The floodplain culverts were assumed to be 48-inch x 76-inch concrete elliptical pipe design, or 60-inch diameter circular pipe equivalent.

Rock and Soil Import: This item group consists of 12-inch riprap, select amended soil, 36-inch bank stabilization boulders, and riverstone.

- **12-inch riprap** will be used to reinforce shoreline stabilization and conservatively includes grouting in the cost.
- **Select amended soil** is specified to promote vegetative growth and uptake of seed and plantings. The select amended soil includes a volume of material as well as an area of topsoil placement and grading to account for laying the material.

- **36-inch bank stabilization boulders** are used as shoreline stabilization, bank stabilization, and fishway passage elements. These boulders were priced as 300-pound average stone including dumping onsite.
- **Riverstone** was proposed in the base of the side channel crossing box culverts to mimic a natural channel bottom. The riverstone consists of round river stone aggregate and 18-inch riprap spread across the culvert base.

Cribbing: Concrete cribbing, as proposed in Henry Hudson Park Alternative 2, was priced as concrete seawalls/precast concrete bulkheads.

Fishway Structure: One of two fishway types was specified for the AOP fishway alternatives; Alaskan Steeppass or Denil. The cost was based on project experience and fisheries experts from various government entities.

Chapter 4: Operation, Maintenance, Repair, Replacement, and Rehabilitation

Costs were developed for activities associated with operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) efforts for 10 years after construction completion and monitoring activities. This account also includes in-house labor based upon work-hour requirements, material and facility costs, travel, and overhead. The OMRR&R is based on 0.5 percent of the construction cost along with professional judgment (Table 4-1).

Table 4-1: OMRR&R Costs (TSP highlighted in green)

Site Name and Alternative	Cost
Binnen Kill North Alternative 1	$118,211
Binnen Kill North Alternative 2	$148,049
Binnen Kill North Alternative 3	$111,326
Binnen Kill North Alternative 4	$145,896
Binnen Kill South Alternative 1	$77,552
Binnen Kill South Alternative 2	$85,556
Schodack Island North Alternative 1	$45,836
Schodack Island North Alternative 2	$73,638
Schodack Island South Alternative 1	$21,062
Schodack Island South Alternative 2	$30,278
Schodack Island Pocket Wetlands	$30,727
Henry Hudson Park Alternative 1	$29,783
Henry Hudson Park Alternative 2	$59,173
Charles Rider Park Alternative 1	$9,830
Moodna Creek AOP1 Alternative 1 – Barrier Removal	$5,000*
Moodna Creek AOP1 Alternative 2 – Rock Ramp	$5,000*
Moodna Creek AOP2 Alternative 1 – Dam Removal	$7,664
Moodna Creek AOP2 Alternative 2 – Fishway	$25,000*
Moodna Creek AOP3 Alternative 1 – Dam Removal	$9,523
Moodna Creek AOP3 Alternative 2 – Dam Breach	$10,000*
Rondout Creek Alternative 1 – Fishway	$25,000*
Rondout Creek Alternative 2 – Dam Removal	$8,429
Rondout Creek Alternative 3 – Dam Notching	$12,882

*Professional judgment was used to estimate this cost based on information provided in the Monitoring and Adaptive Management Plan

Chapter 5: Total First Costs

The first costs for each project site on each alternatives were calculated based on the approach discussed in chapter 1 for individual planning region and its applicability to the site. The first cost table for each HRHR alternative are summarized below in Table 5-1 through 5-23. These costs were utilized to determine the Tentatively Selected Plan (TSP)

through the Cost Effectiveness/Incremental Cost Analysis (CE/ICA). The TSP alternative costs are identified *** and the Alternative is highlighted in green.

5.1 Total First Costs – Binnen Kill (Tentatively Selected Plan [TSP]

Table 5-1: Binnen Kill North Alternative 1

Binnen Kill North Alt 1					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 498,970	25%	$ 124,743	$ 623,713
06 03 Wildlife Facilities and Sanctuaries		$ 19,221,245	23%	$ 4,420,886	$ 23,642,131
18 Cultural Resources		$ 200,000	10%	$ 20,000	$ 220,000
30 Pre-construction Engineering and Design		$ 1,635,000	29%	$ 474,150	$ 2,109,150
31 Construction Management		$ 900,000	24%	$ 216,000	$ 1,116,000
	Sub-Total First Cost				$ 27,710,994
	Monitoring	$ 236,421	NA		$ 236,421
	Adaptive Management	$ 981,139	NA		$ 981,139
Total First Cost					$ 28,928,554

Table 5-2: Binnen Kill North Alternative 2

Binnen Kill North Alt 2					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 647,920	25%	$ 161,980	$ 809,900
06 03 Wildlife Facilities and Sanctuaries		$ 23,687,884	25%	$ 5,921,971	$ 29,609,855
18 Cultural Resources		$ 150,000	10%	$ 15,000	$ 165,000
30 Pre-construction Engineering and Design		$ 1,635,000	29%	$ 474,150	$ 2,109,150
31 Construction Management		$ 1,200,000	24%	$ 288,000	$ 1,488,000
	Sub-Total First Cost				$ 34,181,905
	Monitoring	$ 296,099	NA		$ 296,099
	Adaptive Management	$ 1,241,257	NA		$ 1,241,257
Total First Cost					$ 35,719,261

Table 5-3: Binnen Kill North Alternative 3

Binnen Kill North Alt 3					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 462,600	25%	$ 115,650	$ 578,250
06 03 Wildlife Facilities and Sanctuaries		$ 18,250,144	22%	$ 4,015,032	$ 22,265,176
18 Cultural Resources		$ 250,000	10%	$ 25,000	$ 275,000
30 Pre-construction Engineering and Design		$ 1,585,000	29%	$ 459,650	$ 2,044,650
31 Construction Management		$ 850,000	24%	$ 204,000	$ 1,054,000
	Sub-Total First Cost				$ 26,217,076
	Monitoring	$ 222,652	NA		$ 222,652
	Adaptive Management	$ 957,154	NA		$ 957,154
Total First Cost					$ 27,396,881

Table 5-4: Binnen Kill North Alternative 4 *** TSP

Binnen Kill North Alt 4					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 611,520	25%	$ 152,880	$ 764,400
06 03 Wildlife Facilities and Sanctuaries		$ 23,343,378	25%	$ 5,835,845	$ 29,179,223
18 Cultural Resources		$ 250,000	10%	$ 25,000	$ 275,000
30 Pre-construction Engineering and Design		$ 1,585,000	29%	$ 459,650	$ 2,044,650
31 Construction Management		$ 1,150,000	24%	$ 276,000	$ 1,426,000
	Sub-Total First Cost				$ 33,689,273
	Monitoring	$ 291,792	NA		$ 291,792
	Adaptive Management	$ 1,212,587	NA		$ 1,212,587
Total First Cost					$ 35,193,652

Table 5-5: Binnen Kill South Alternative 1

Binnen Kill South Alt 1					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 30,000	25%	$ 7,500	$ 37,500
06 03 Wildlife Facilities and Sanctuaries		$ 12,309,813	26%	$ 3,200,551	$ 15,510,364
18 Cultural Resources		$ 150,000	10%	$ 15,000	$ 165,000
30 Pre-construction Engineering and Design		$ 1,975,000	29%	$ 572,750	$ 2,547,750
31 Construction Management		$ 900,000	24%	$ 216,000	$ 1,116,000
	Sub-Total First Cost				$ 19,376,614
	Monitoring	$ 195,538	NA		$ 195,538
	Adaptive Management	$ 546,787	NA		$ 546,787
Total First Cost					$ 20,118,939

Table 5-6: Binnen Kill South Alternative 2 *** TSP

Binnen Kill South Alt 2					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 30,000	25%	$ 7,500	$ 37,500
06 03 Wildlife Facilities and Sanctuaries		$ 13,580,358	26%	$ 3,530,893	$ 17,111,251
18 Cultural Resources		$ 200,000	10%	$ 20,000	$ 220,000
30 Pre-construction Engineering and Design		$ 1,975,000	29%	$ 572,750	$ 2,547,750
31 Construction Management		$ 1,200,000	24%	$ 288,000	$ 1,488,000
	Sub-Total First Cost				$ 21,404,501
	Monitoring	$ 217,704	NA		$ 217,704
	Adaptive Management	$ 514,741	NA		$ 514,741
Total First Cost					$ 22,136,946

5.2 First Costs – Schodack Island

Table 5-7: Schodack Island North Alternative 1

Schodack Island Park North Alt 1					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 30,000	25%	$ 7,500	$ 37,500
06 03 Wildlife Facilities and Sanctuaries		$ 7,275,478	26%	$ 1,891,624	$ 9,167,102
18 Cultural Resources		$ 100,000	10%	$ 10,000	$ 110,000
30 Pre-construction Engineering and Design		$ 1,685,000	29%	$ 488,650	$ 2,173,650
31 Construction Management		$ 1,200,000	24%	$ 288,000	$ 1,488,000
	Sub-Total First Cost				$ 12,976,252
	Monitoring	$ 188,428	NA		$ 188,428
	Adaptive Management	$ 292,895	NA		$ 292,895
Total First Cost					$ 13,457,575

Table 5-8: Schodack Island North Alternative 2- *** TSP

Schodack Island Park North Alt 2					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 30,000	25%	$ 7,500	$ 37,500
06 03 Wildlife Facilities and Sanctuaries		$ 11,688,526	26%	$ 3,039,017	$ 14,727,543
18 Cultural Resources		$ 200,000	10%	$ 20,000	$ 220,000
30 Pre-construction Engineering and Design		$ 1,685,000	29%	$ 488,650	$ 2,173,650
31 Construction Management		$ 1,200,000	24%	$ 288,000	$ 1,488,000
	Sub-Total First Cost				$ 18,646,693
	Monitoring	$ 168,278	NA		$ 168,278
	Adaptive Management	$ 441,826	NA		$ 441,826
Total First Cost					$ 19,256,797

Table 5-9: Schodack Island Park South Alternative 1

Schodack Island Park South Alt 1					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 30,000	25%	$ 7,500	$ 37,500
06 03 Wildlife Facilities and Sanctuaries		$ 3,343,207	26%	$ 869,234	$ 4,212,441
18 Cultural Resources		$ 100,000	10%	$ 10,000	$ 110,000
30 Pre-construction Engineering and Design		$ 1,565,000	29%	$ 453,850	$ 2,018,850
31 Construction Management		$ 900,000	24%	$ 216,000	$ 1,116,000
	Sub-Total First Cost				$ 7,494,791
	Monitoring	$ 195,538	NA		$ 195,538
	Adaptive Management	$ 145,501	NA		$ 145,501
Total First Cost					$ 7,835,830

Table 5-10: Schodack Island Park South Alternative 2

Schodack Island Park South Alt 2					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 30,000	25%	$ 7,500	$ 37,500
06 03 Wildlife Facilities and Sanctuaries		$ 4,806,076	26%	$ 1,249,580	$ 6,055,656
18 Cultural Resources		$ 125,000	10%	$ 12,500	$ 137,500
30 Pre-construction Engineering and Design		$ 1,565,000	29%	$ 453,850	$ 2,018,850
31 Construction Management		$ 900,000	24%	$ 216,000	$ 1,116,000
	Sub-Total First Cost				$ 9,365,506
	Monitoring	$ 168,278	NA		$ 168,278
	Adaptive Management	$ 181,670	NA		$ 181,670
Total First Cost					$ 9,715,453

Table 5-11: Schodack Island Park Pocket Wetlands

Schodack Island Park Pocket Wetlands					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 50,000	25%	$ 12,500	$ 62,500
06 03 Wildlife Facilities and Sanctuaries		$ 4,916,389	25%	$ 1,229,097	$ 6,145,486
18 Cultural Resources		$ 35,000	10%	$ 3,500	$ 38,500
30 Pre-construction Engineering and Design		$ 1,315,000	29%	$ 381,350	$ 1,696,350
31 Construction Management		$ 712,876	24%	$ 171,090	$ 883,967
	Sub-Total First Cost				$ 8,826,803
	Monitoring	$ 61,455	NA		$ 61,455
	Adaptive Management	$ 184,365	NA		$ 184,365
Total First Cost					$ 9,072,622

5.3 First Costs – Henry Hudson Park

Table 5-12: Henry Hudson Alternative 1- ***TSP

Henry Hudson - Alt 1					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 20,000	25%	$ 5,000	$ 25,000
16 Bank Stabilization		$ 4,765,235	25%	$ 1,191,309	$ 5,956,544
18 Cultural Resources		$ 75,000	10%	$ 7,500	$ 82,500
30 Pre-construction Engineering and Design		$ 1,365,000	29%	$ 395,850	$ 1,760,850
31 Construction Management		$ 600,000	24%	$ 144,000	$ 744,000
	Sub-Total First Cost				$ 8,568,894
	Monitoring	$ 125,619	NA		$ 125,619
	Adaptive Management	$ 178,696	NA		$ 178,696
Total First Cost					$ 8,873,209

Table 5-13: Henry Hudson Alternative 2

Henry Hudson - Alt 2					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 20,000	25%	$ 5,000	$ 25,000
16 Bank Stabilization		$ 8,766,338	35%	$ 3,068,218	$ 11,834,556
18 Cultural Resources		$ 125,000	10%	$ 12,500	$ 137,500
30 Pre-construction Engineering and Design		$ 1,465,000	29%	$ 424,850	$ 1,889,850
31 Construction Management		$ 660,000	24%	$ 158,400	$ 818,400
	Sub-Total First Cost				$ 14,705,306
	Monitoring	$ 161,168	NA		$ 161,168
	Adaptive Management	$ 355,037	NA		$ 355,037
Total First Cost					$ 15,221,511

5.4 First Cost – Charles Rider

Table 5-14: Charles Rider

Charles Rider Alt 1					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 10,000	25%	$ 2,500	$ 12,500
16 Bank Stabilization		$ 1,572,838	25%	$ 393,210	$ 1,966,048
18 Cultural Resources		$ 60,000	10%	$ 6,000	$ 66,000
30 Pre-construction Engineering and Design		$ 765,000	29%	$ 221,850	$ 986,850
31 Construction Management		$ 300,000	24%	$ 72,000	$ 372,000
	Sub-Total First Cost				$ 3,403,398
	Monitoring	$ 123,072	NA		$ 123,072
	Adaptive Management	$ 58,981	NA		$ 58,981
Total First Cost					$ 3,585,451

5.5 Total First Costs – Moodna

Table 5-15: Moodna AOP 1 – Alternative 1 * TSP**

Moodna AOP 1 - Alt 1					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 36,245	25%	$ 9,061	$ 45,306
04 Dams		$ 413,492	18%	$ 74,429	$ 487,921
18 Cultural Resources		$ -	32%	$ 5,458	$ 5,458
30 Pre-construction Engineering and Design		$ 590,000	29%	$ 171,100	$ 761,100
31 Construction Management		$ 250,000	24%	$ 60,000	$ 310,000
	Sub-Total First Cost				$ 1,609,785
	Monitoring	$ 35,550	NA		$ 35,550
	Adaptive Management	$ 50,296	NA		$ 50,296
Total First Cost					$ 1,695,631

Table 5-16: Moodna AOP 1 – Alternative 2

Moodna AOP 1 - Alt 2					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 52,760	25%	$ 13,190	$ 65,950
04 Dams		$ 448,083	35%	$ 156,829	$ 604,912
18 Cultural Resources		$ -	12%	$ 5,019	$ 5,019
30 Pre-construction Engineering and Design		$ 605,000	29%	$ 175,450	$ 780,450
31 Construction Management		$ 250,000	24%	$ 60,000	$ 310,000
	Sub-Total First Cost				$ 1,766,331
	Monitoring	$ 42,659	NA		$ 42,659
	Adaptive Management	$ 49,704	NA		$ 49,704
Total First Cost					$ 1,858,694

Table 5-17: Moodna AOP 2 – Alternative 1 *** TSP

Moodna AOP 2 - Alt 1					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 97,491	25%	$ 24,373	$ 121,864
04 Dams		$ 1,299,003	18%	$ 233,821	$ 1,532,824
18 Cultural Resources		$ 150,000	32%	$ 48,000	$ 198,000
30 Pre-construction Engineering and Design		$ 805,000	29%	$ 233,450	$ 1,038,450
31 Construction Management		$ 500,000	24%	$ 120,000	$ 620,000
	Sub-Total First Cost				$ 3,511,137
	Monitoring	$ 35,550	NA		$ 35,550
	Adaptive Management	$ 75,296	NA		$ 75,296
Total First Cost					$ 3,621,983

Table 5-18: Moodna Creek AOP 2 – Alternative 2

Moodna AOP 2 - Alt 2					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 77,333	25%	$ 19,333	$ 96,666
04 Dams		$ 1,160,364	35%	$ 406,127	$ 1,566,491
18 Cultural Resources		$ 100,000	12%	$ 12,000	$ 112,000
30 Pre-construction Engineering and Design		$ 805,000	29%	$ 233,450	$ 1,038,450
31 Construction Management		$ 500,000	24%	$ 120,000	$ 620,000
	Sub-Total First Cost				$ 3,433,608
	Monitoring	$ 568,793	NA		$ 568,793
	Adaptive Management	$ 46,995	NA		$ 46,995
Total First Cost					$ 4,049,395

Table 5-19: Moodna Creek AOP 3 – Alternative 1

Moodna AOP 3 - Alt 1					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 118,556	25%	$ 29,639	$ 148,195
04 Dams		$ 1,614,030	18%	$ 290,525	$ 1,904,555
18 Cultural Resources		$ 300,000	32%	$ 96,000	$ 396,000
30 Pre-construction Engineering and Design		$ 805,000	29%	$ 233,450	$ 1,038,450
31 Construction Management		$ 500,000	24%	$ 120,000	$ 620,000
	Sub-Total First Cost				$ 4,107,200
	Monitoring	$ 106,649	NA		$ 106,649
	Adaptive Management	$ 66,081	NA		$ 66,081
Total First Cost					$ 4,279,930

Table 5-20: Moodna Creek AOP 3 – Alternative 2 *** TSP

Moodna AOP 3 - Alt 2					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 78,556	25%	$ 19,639	$ 98,195
04 Dams		$ 1,051,294	19%	$ 199,746	$ 1,251,040
18 Cultural Resources		$ 200,000	32%	$ 64,000	$ 264,000
30 Pre-construction Engineering and Design		$ 805,000	29%	$ 233,450	$ 1,038,450
31 Construction Management		$ 500,000	24%	$ 120,000	$ 620,000
	Sub-Total First Cost				$ 3,271,685
	Monitoring	$ 213,297	NA		$ 213,297
	Adaptive Management	$ 190,678	NA		$ 190,678
Total First Cost					$ 3,675,660

5.6 First Costs – Rondout

Table 5-21: Rondout – Alternative 1

Rondout - Alt 1					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 160,000	25%	$ 40,000	$ 200,000
04 Dams		$ 1,282,443	35%	$ 448,855	$ 1,731,298
18 Cultural Resources		$ 125,000	12%	$ 15,000	$ 140,000
30 Pre-construction Engineering and Design		$ 945,000	29%	$ 274,050	$ 1,219,050
31 Construction Management		$ 250,000	24%	$ 60,000	$ 310,000
	Sub-Total First Cost				$ 3,600,348
	Monitoring	$ 568,793	NA		$ 568,793
	Adaptive Management	$ 51,939	NA		$ 51,939
Total First Cost					$ 4,221,080

Table 5-22: Rondout – Alternative 2 ***TSP

Rondout - Alt 2					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 180,000	25%	$ 45,000	$ 225,000
04 Dams		$ 1,428,722	18%	$ 257,170	$ 1,685,892
18 Cultural Resources		$ 250,000	32%	$ 80,000	$ 330,000
30 Pre-construction Engineering and Design		$ 985,000	29%	$ 285,650	$ 1,270,650
31 Construction Management		$ 250,000	24%	$ 60,000	$ 310,000
	Sub-Total First Cost				$ 3,821,542
	Monitoring	$ 35,550	NA		$ 35,550
	Adaptive Management	$ 75,296	NA		$ 75,296
Total First Cost					$ 3,932,388

Table 5-23: Rondout – Alternative 3

Rondout - Alt 3					
Account		Cost	% Contingency	Contingency Cost	Cost w/Contingency
01 Real Estate		$ 82,686	25%	$ 20,672	$ 103,358
04 Dams		$ 2,165,038	19%	$ 411,357	$ 2,576,395
18 Cultural Resources		$ 100,000	32%	$ 32,000	$ 132,000
30 Pre-construction Engineering and Design		$ 985,000	29%	$ 285,650	$ 1,270,650
31 Construction Management		$ 250,000	24%	$ 60,000	$ 310,000
	Sub-Total First Cost				$ 4,392,403
	Monitoring	$ 142,198	NA		$ 142,198
	Adaptive Management	$ 100,069	NA		$ 100,069
Total First Cost					$ 4,634,670

ATTACHMENT A
ABBREVIATED RISK ANALYSIS

Abbreviated Risk Analysis

Project (less than $40M): **HRHR**
Project Development Stage/Alternative: **Feasibility (Recommended Plan)**
Risk Category: **Moderate Risk: Typical Project Construction Ty**

	CWWBS	Feature of Work	% Contingency
	01 LANDS AND DAMAGES	Real Estate	0%
1	16 BANK STABILIZATION	Shoreline Restoration - Riprap	30%
2	16 BANK STABILIZATION	Shoreline Restoration - Cribbing	67%
3	09 01 CHANNELS	Side Channels	30%
4	06 03 WILDLIFE FACILITIES AND SANCTUARIES	Wetland Restoration	30%
5	06 03 WILDLIFE FACILITIES AND SANCTUARIES	Riparian Restoration	30%
6	04 DAMS	AOP - Dam Removal	22%
7	04 DAMS	AOP - Breach	24%
8	04 DAMS	AOP - Fishways	57%
9	08 ROADS, RAILROADS, AND BRIDGES	Culverts	24%
18	18 CULTURAL RESOURCE PRESERVATION	CRP - AOP - Removal/Breach	32%
18	18 CULTURAL RESOURCE PRESERVATION	CRP - AOP - Fishways	12%
18	18 CULTURAL RESOURCE PRESERVATION	CRP - Wetland Restoration/Side Channels/Shoreline Restoration	10%
12	All Other	Remaining Construction Items	14%
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	29%
14	31 CONSTRUCTION MANAGEMENT	Construction Management	24%
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)		

Totals	
Real Estate	0%
Total Construction Estimate	28%
Total Planning, Engineering & Design	29%
Total Construction Management	24%
Total Excluding Real Estate	**28%**

Base
$160k

Construction Contingency												
Site	Alt	Shoreline Restoration - Riprap	Shoreline Restoration - Cribbing	Side Channels	Wetland Restoration	Riparian Restoration	AOP- Dam Removal	AOP - Breach	AOP - Fishways	Culverts	Remaining Construction Items	Construction Contingency (avg. contingency)
Contingency as calculated in the ARA		30%	67%	30%	30%	30%	22%	24%	57%	24%	14%	
Charles Rider Park	1	X			X						X	25%
Henry Hudson Park	1	X			X						X	25%
Henry Hudson Park	2	X	X		X						X	35%
Schodack Island – North	1	X		X	X	X				X	X	26%
Schodack Island – North	2	X		X	X	X				X	X	26%
Schodack Island – South	1	X		X	X	X				X	X	26%
Schodack Island – South	2	X		X	X	X				X	X	26%
Schodack Island – Pocket Wetland	1	X			X						X	25%
Binnen Kill – North	1				X					X	X	23%
Binnen Kill – North	2			X	X					X	X	25%
Binnen Kill – North	3				X						X	22%
Binnen Kill – North	4			X	X						X	25%
Binnen Kill – South	1			X	X	X				X	X	26%
Binnen Kill – South	2			X	X	X				X	X	26%
Rondout Creek - Eddyville Dam -Fishway	1								X		X	35%
Rondout Creek - Eddyville Dam -Removal	2						X				X	18%
Rondout Creek - Eddyville Dam - Notch	3							X			X	19%
Moodna Creek – AOP1 (Utility Crossing)-Removal	1						X				X	18%
Moodna Creek – AOP1 (Utility Crossing)-Fishway	2								X		X	35%
Moodna Creek – AOP2 (Firth Cliff Dam)- Removal	1						X				X	18%
Moodna Creek – AOP2 (Firth Cliff Dam)-Fishway	2								X		X	35%
Moodna Creek – AOP3 (Orr's Mill Dam) - Removal	1						X				X	18%
Moodna Creek – AOP3 (Orr's Mill Dam) - Breach	2							X			X	19%

HRHR Entire Project

Feasibility (Recommended Plan)
Abbreviated Risk Analysis
Meeting Date: 20-Nov-18

Risk Level

	Negligible	Marginal	Moderate	Significant	Critical
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3

Risk Register

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Management & Scope Growth				Maximum Project Growth		75%
PS-1	Shoreline Restoration - Riprap	Potential for additional stablization	The impact will be marginal considing the length of shoreline in concept. Adjust to the area or scope is possible	Marginal	Possible	1
PS-2	Shoreline Restoration - Cribbing	scope adjustment	additional length and/or type of cribbing	Marginal	Likely	2
PS-3	Side Channels	scope adjustment	likely adjustment to the channel configuration and elevations. Geotechnical data needs to be collected but is not anticpated to have any appreciable impact	Marginal	Possible	1
PS-4	Wetland Restoration	scope adjustment	likely adjustment to the configuration and elevations	Marginal	Possible	1
PS-5	Riparian Restoration	scope adjustment	likely adjustment to the configuration and elevations	Marginal	Possible	1
PS-6	AOP - Dam Removal	scope adjustment	not likely	Negligible	Unlikely	0
PS-7	AOP - Breach	scope adjustment	it is likely to have adjustments to scope and configuration	Negligible	Likely	1
PS-8	AOP - Fishways	scope adjustment	it is likely to have adjustments to scope and configuration	Negligible	Likely	1
PS-9	Culverts	scope adjustment	it is likely to have adjustments to scope and configuration	Negligible	Likely	1
PS-10	CRP - AOP - Removal/Breach	scope adjustment	Potential for additional cultural mitigation measures based on existing site information. However, this is contingent on future SHPO coordination (AOP - dam removal)	Moderate	Possible	2
PS-11	CRP - AOP - Fishways	scope adjustment	Unlikely potential for additional cultural mitigation measures (above and beyond what has been antipated) for a fishway based on existing information. However, this is contingent on futture coordination with SHPO.	Negligible	Unlikely	0
PS-12	CRP - Wetland Restoration/Side Channels/Shoreline Restoration	scope adjustment	Unlikely potential for additional cultural mitigation measures (above and beyond what has been antipated) based on existing information. However, this is contingent on future coordination with SHPO.	Negligible	Unlikely	0
PS-13	Remaining Construction Items	scope adjustment	Mob/demob issues unlikely	Negligible	Unlikely	0

PS-14	Planning, Engineering, & Design	scope adjustment	Increase project features/scope may require additional resources for labor	Marginal	Likely	2
PS-15	Construction Management	scope adjustment	Increase project features/scope may require additional resources for labor.	Marginal	Likely	2
Acquisition Strategy				**Maximum Project Growth**		**30%**
AS-1	Shoreline Restoration - Riprap	limited bid competition anticipated?	No concern since sufficient contractors to implement this type of work	Negligible	Unlikely	0
AS-2	Shoreline Restoration - Cribbing	limited bid competition anticipated?	No concern since sufficient contractors to implement this type of work	Negligible	Unlikely	0
AS-3	Side Channels	limited bid competition anticipated?	No concern since sufficient contractors to implement this type of work	Negligible	Unlikely	0
AS-4	Wetland Restoration	limited bid competition anticipated?	No concern since sufficient contractors to implement this type of work	Negligible	Unlikely	0
AS-5	Riparian Restoration	limited bid competition anticipated?	No concern since sufficient contractors to implement this type of work	Negligible	Unlikely	0
AS-6	AOP - Dam Removal	limited bid competition anticipated?	No concern since sufficient contractors to implement this type of work	Negligible	Unlikely	0
AS-7	AOP - Breach	limited bid competition anticipated?	No concern since sufficient contractors to implement this type of work	Negligible	Unlikely	0
AS-8	AOP - Fishways	limited bid competition anticipated?	Specialty construction of fishways needed and potential for limited competition due to limited number of contractors	Marginal	Possible	1
AS-9	Culverts	limited bid competition anticipated?	No concern since sufficient contractors to implement this type of work	Negligible	Unlikely	0
AS-10	CRP - AOP - Removal/Breach	limited bid competition anticipated?	No concern since sufficient contractors to implement this type of work	Negligible	Unlikely	0
AS-11	CRP - AOP - Fishways	limited bid competition anticipated?	No concern since sufficient contractors to implement this type of work	Negligible	Unlikely	0
AS-12	CRP - Wetland Restoration/Side Channels/Shoreline Restoration	limited bid competition anticipated?	No concern since sufficient contractors to implement this type of work	Negligible	Unlikely	0
AS-13	Remaining Construction Items	limited bid competition anticipated?	No concern since sufficient contractors to implement this type of work	Negligible	Unlikely	0
AS-14	Planning, Engineering, & Design	limited bid competition anticipated?	No concern since sufficient contractors to implement this type of work	Negligible	Unlikely	0
AS-15	Construction Management	limited bid competition anticipated?	No concern since sufficient contractors to implement this type of work	Negligible	Unlikely	0
Construction Elements				**Maximum Project Growth**		**25%**
CE-1	Shoreline Restoration - Riprap	Weather and harsh conditions	Weather and harsh condition impacts are exaggerated when dealing with restoration/natural systems in addition to tidal fluctuation. Can place rock/rip rap in bad weather and in standing water.	Marginal	Likely	2
CE-2	Shoreline Restoration - Cribbing	Weather and harsh conditions	Weather and harsh condition impacts are exaggerated when dealing with restoration/natural systems in addition to tidal fluctuation. The installation of these features is significantly effected by the ablity to control water and tidal fluctuation.	Significant	Very LIKELY	5

CE-3	Side Channels	Weather and harsh conditions	It is likley that the contractor will need to adjust construction techinques for weather and flow conditions.	Marginal	Likely	2
CE-4	Wetland Restoration	Weather and harsh conditions	It is likley that the contractor will need to adjust construction techinques for weather and flow conditions.	Marginal	Likely	2
CE-5	Riparian Restoration	Weather and harsh conditions	It is likley that the contractor will need to adjust construction techinques for weather and flow conditions.	Marginal	Likely	2
CE-6	AOP - Dam Removal	Weather and harsh conditions	It is likley that the contractor will need to adjust construction techinques for weather and flow conditions. Hydrodynamics and mobilization of sediments could be a concern.	Marginal	Likely	2
CE-7	AOP - Breach	Weather and harsh conditions	It is likley that the contractor will need to adjust construction techinques for weather and flow conditions. Hydrodynamics and mobilization of sediments could be a concern.	Marginal	Likely	2
CE-8	AOP - Fishways	Weather and harsh conditions	It is likley that the contractor will need to adjust construction techinques for weather and flow conditions.	Significant	Likely	4
CE-9	Culverts	Weather and harsh conditions	It is likley that the contractor will need to adjust construction techinques for weather and flow conditions.	Marginal	Likely	2
CE-10	CRP - AOP - Removal/Breach	Potential for modifications to the design should monitoring of dam removal result in unanticipated archaeological discoveries	Monitoring is likely to be recommended following completion of cultural resources surveys to observe and document historic dams and related features during construction. Time will be built into the schedule to accommodate monitoring during construction however, there is potential for monitoring to lead to additional work that will delay construction activities.	Marginal	Possible	1
CE-11	CRP - AOP - Fishways	Potential for modifications to the design should monitoring of dam removal result in unanticipated archaeological discoveries	Monitoring is likely to be recommended following completion of cultural resources surveys to observe and document historic dams and related features during construction. Time will be built into the schedule to accommodate monitoring during construction however, there is potential for monitoring to lead to additional work that will delay construction activities.	Marginal	Possible	1
CE-12	CRP - Wetland Restoration/Side Channels/Shoreline Restoration	Potential for modifications to the design should monitoring result in unanticipated archaeological discoveries	CulturalMonitoring is likely to be recommended following completion of cultural resources surveys to observe and document historic dams and related features during construction. Time will be built into the schedule to accommodate monitoring during construction however, there is potential for monitoring to lead to additional work that will delay construction activities.	Negligible	Unlikely	0
CE-13	Remaining Construction Items	Weather and harsh conditions	It is likley that the contractor will need to adjust construction techinques for weather and flow conditions.	Negligible	Unlikely	0
CE-14	Planning, Engineering, & Design	Potential for modification and claims		Marginal	Possible	1
CE-15	Construction Management	Potential for construction modification and claims		Marginal	Possible	1
Specialty Construction or Fabrication				**Maximum Project Growth**		**65%**
SC-1	Shoreline Restoration - Riprap	No Concern	Traditional construction	Negligible	Unlikely	0

SC-2	Shoreline Restoration - Cribbing	Atypical construction elements, unusual material or equipment manufactured or installed? Confidence in constructibility or methodology?	Cribbing installation challenging due to depth water and flow	Moderate	Likely	3
SC-3	Side Channels	No Concern	Traditional construction	Negligible	Unlikely	0
SC-4	Wetland Restoration	No Concern	Traditional construction	Negligible	Unlikely	0
SC-5	Riparian Restoration	No Concern	Traditional construction	Negligible	Unlikely	0
SC-6	AOP - Dam Removal	No Concern	Traditional construction	Negligible	Unlikely	0
SC-7	AOP - Breach	No Concern	Traditional construction	Negligible	Unlikely	0
SC-8	AOP - Fishways	Atypical construction elements, unusual material or equipment manufactured or installed? Confidence in constructibility or methodology?	Fabrication costs and the craftmenship to create the features can vary as well as material.	Marginal	Likely	2
SC-9	Culverts	No Concern	Traditional construction	Negligible	Unlikely	0
SC-10	CRP - AOP - Removal/Breach	May require historic preservation specialists to design elements that are in keeping with historic character of National Register of Historic Places eligible dam and mill sites.	Dams that are determined eligible for the National Register must be treated in accordance with the terms of the Agreement document.	Marginal	Possible	1
SC-11	CRP - AOP - Fishways	May require historic preservation specialists to design elements that are in keeping with historic character of National Register of Historic Places eligible dam and mill sites.	Dams that are determined eligible for the National Register must be treated in accordance with the terms of the Agreement document.	Negligible	Unlikely	0
SC-12	CRP - Wetland Restoration/Side Channels/Shoreline Restoration	May require historic preservation specialists to design elements that are in keeping with historic character of National Register of Historic Places eligible or listed sites.	Historic properties and archaeological sites that are determined eligible for the National Register must be treated in accordance with the terms of the Agreement document.	Negligible	Unlikely	0
SC-13	Remaining Construction Items	No Concern	Mob/demob- Traditional construction	Negligible	Unlikely	0
SC-14	Planning, Engineering, & Design	No Concern		Negligible	Unlikely	0
SC-15	Construction Management	No Concern		Negligible	Unlikely	0
Technical Design & Quantities				**Maximum Project Growth**		**30%**
T-1	Shoreline Restoration - Riprap	Detailed surveys/hydrodynamic calculations were not conducted to develop refined quantities.	*Disposal of material from all efforts was assumed to be onsite. If offsite disposal is required this will have a signinifant effect on cost but due to the overall size of the projects and the dredge material disposal locations in close proximity the effect is only possible. * LIDAR data used to supplement topographic surveys and would influence quantities of soil excavation and grading * No hydrodynamic modeling/site specific wave energy data to calculate adequate rock size.	Significant	Possible	3

T-2	Shoreline Restoration - Cribbing	Detailed surveys were not conducted to develop refined quantities.	*Disposal of material from all efforts was assumed to be onsite. If offsite disposal is required this will have a signinifant effect on cost but due to the overall size of the projects and the dredge material disposal locations in close proximity the effect is only possible. * LIDAR data used to supplement topographic surveys and would influence quantities of soil excavation and grading	Significant	Possible	3
T-3	Side Channels	Detailed surveys were not conducted to developed refined quantities.	*Disposal of material from all efforts was assumed to be onsite. If offsite disposal is required this will have a signinifant effect on cost but due to the overall size of the projects and the dredge material disposal locations in close proximity the effect is only possible. * LIDAR data used to supplement topographic surveys and would influence quantities of soil excavation and grading	Significant	Possible	3
T-4	Wetland Restoration	Detailed surveys were not conducted to developed refined quantities.	*Disposal of material from all efforts was assumed to be onsite. If offsite disposal is required this will have a signinifant effect on cost but due to the overall size of the projects and the dredge material disposal locations in close proximity the effect is only possible. * LIDAR data used to supplement topographic surveys and would influence quantities of soil excavation and grading * Geotechnical data needs to be collected but is not anticpated to have any appreciable impact	Significant	Possible	3
T-5	Riparian Restoration	Detailed surveys were not conducted to developed refined quantities.	*Disposal of material from all efforts was assumed to be onsite. If offsite disposal is required this will have a signinifant effect on cost but due to the overall size of the projects and the dredge material disposal locations in close proximity the effect is only possible. * LIDAR data used to supplement topographic surveys and would influence quantities of soil excavation and grading	Significant	Possible	3
T-6	AOP - Dam Removal	Concrete removal and hydraulic modeling	Concrete was assumed to stay on site to be used at existing of future erosional areas. Hyrdraulic Modeling to be done during PED phase may indicate downstream erosion and sediment mobilization concerns	Marginal	Possible	1
T-7	AOP - Breach	Concrete removal and hydraulic modeling	Concrete was assumed to stay on site to be used at existing of future erosional areas. Hyrdraulic Modeling to be done during PED phase may indicate downstream erosion and sediment mobilization concerns	Marginal	Possible	1
T-8	AOP - Fishways	Increased design of fishway and/or dam construction.	Need to rehab dam due to NYSDEC permit issue related to installation of fishway	Significant	Likely	4
T-9	Culverts	Disposal of material from all efforts was assumed to be onsite.	Size or number of culverts may change pending design and cost can vary. Material costs tend to increase over time and the specific of hydrualics needed for crossings will be completed during PED (If offsite disposal is required this will have a signinifant effect on cost but due to the overall size of the projects and the dredge material disposal locations in close proximity the effect is only possible)	Marginal	Possible	1
T-10	CRP - AOP - Removal/Breach	Potential for modification to design due to identification of NRHP eligible or listed historic properties or archaeological sites during PED.	Cultural resources surveys will be carried out in PED, identification of historic properties may result in changes to the design.	Significant	Possible	3
T-11	CRP - AOP - Fishways	Potential for modification to design due to identification of NRHP eligible or listed historic properties or archaeological sites during PED	Cultural resources surveys will be carried out in PED, identification of historic properties may result in changes to the design.	Marginal	Unlikely	0
T-12	CRP - Wetland Restoration/Side Channels/Shoreline Restoration	Potential for modification to design due to identification of NRHP eligible or listed historic properties or archaeological sites during PED	Cultural resources surveys will be carried out in PED, identification of historic properties may result in changes to the design.	Marginal	Unlikely	0

T-13	Remaining Construction Items		Mob/Demob	Negligible	Unlikely	0
T-14	Planning, Engineering, & Design			Moderate	Likely	3
T-15	Construction Management		Redesign????	Marginal	Possible	1
Cost Estimate Assumptions				**Maximum Project Growth**		**35%**
EST-1	Shoreline Restoration - Riprap	cost book and project experience were used for unit cost items	Using the national average/cost book is adequate since labor and equipment is based on locality. Material costs are consistent for the region.	Negligible	Likely	1
EST-2	Shoreline Restoration - Cribbing	cost book and project experience were used for unit cost items	Using the national average/cost book is adequate since labor and equipment is based on locality. Material costs are consistent for the region.	Negligible	Likely	1
EST-3	Side Channels	cost book and project experience were used for unit cost items	Using the national average/cost book is adequate since labor and equipment is based on locality. Material costs are consistent for the region.	Negligible	Likely	1
EST-4	Wetland Restoration	cost book and project experience were used for unit cost items	Using the national average/cost book is adequate since labor and equipment is based on locality. Material costs are consistent for the region.	Negligible	Likely	1
EST-5	Riparian Restoration	cost book and project experience were used for unit cost items	Using the national average/cost book is adequate since labor and equipment is based on locality. Material costs are consistent for the region.	Negligible	Likely	1
EST-6	AOP - Dam Removal	cost book and project experience were used for unit cost items	Using the national average/cost book is adequate since labor and equipment is based on locality. Material costs are consistent for the region.	Negligible	Likely	1
EST-7	AOP - Breach	cost book and project experience were used for unit cost items	Using the national average/cost book is adequate since labor and equipment is based on locality. Material costs are consistent for the region.	Negligible	Likely	1
EST-8	AOP - Fishways	cost based on experience and input from fisheries biologist	Use of historical projects and experience escalated to current price level	Marginal	Likely	2
EST-9	Culverts	cost book and project experience were used for unit cost items	Using the national average/cost book is adequate since labor and equipment is based on locality. Material costs are consistent for the region.	Negligible	Likely	1
EST-10	CRP - AOP - Removal/Breach	Potential for increased mitigation costs due to identification of cultural resources on site during PED	Cultural resource cost estimates were estimated using existing information. No archaeological surveys or historic architectural evaluations were performed during feasibilty	Marginal	Possible	1
EST-11	CRP - AOP - Fishways	Potential for increased mitigation costs due to identification of cultural resources on site during PED	Cultural resource cost estimates were estimated using existing information. No archaeological surveys or historic architectural evaluations were performed during feasibilty	Negligible	Unlikely	0
EST-12	CRP - Wetland Restoration/Side Channels/Shoreline Restoration	Potential for increased mitigation costs due to identification of cultural resources on site during PED	Cultural resource cost estimates were estimated using existing information. No archaeological surveys or historic architectural evaluations were performed during feasibilty	Negligible	Unlikely	0
EST-13	Remaining Construction Items	cost book and project experience were used for unit cost items	this will likely have marginal effect on the cost	Marginal	Likely	2
EST-14	Planning, Engineering, & Design	Confidence of costs for PED activities	PED funding was determined through an itemization of specific activities for each type of project and compared to default total percentage of 29.5%. Professional judgement was used for selectino between the two.	Marginal	Possible	1

EST-15	Construction Management	Confidence of costs for construction management activities	Construction funding was determined through an itemization of specific activities for each type of project and compared to default total percentage of 14.5%. Professional judgement was used for selectino between the two.	Marginal	Possible	1
External Project Risks				**Maximum Project Growth**		**40%**
EX-1	Shoreline Restoration - Riprap	Potential for severe adverse weather and fuel/material inflation	These projects can be effected by weather and tidal conditions, material and fuel inflation, and other external factors as this is the planning phase of the project	Marginal	Likely	2
EX-2	Shoreline Restoration - Cribbing	Potential for severe adverse weather and fuel/material inflation	These projects can be effected by weather and tidal conditions, material and fuel inflation, and other external factors as this is the planning phase of the project	Marginal	Likely	2
EX-3	Side Channels	Potential for severe adverse weather and fuel/material inflation	These projects can be effected by weather and tidal conditions, material and fuel inflation, and other external factors as this is the planning phase of the project	Marginal	Likely	2
EX-4	Wetland Restoration	Potential for severe adverse weather and fuel/material inflation	These projects can be effected by weather and tidal conditions, material and fuel inflation, and other external factors as this is the planning phase of the project	Marginal	Likely	2
EX-5	Riparian Restoration	Potential for severe adverse weather and fuel/material inflation	These projects can be effected by weather and tidal conditions, material and fuel inflation, and other external factors as this is the planning phase of the project	Marginal	Likely	2
EX-6	AOP - Dam Removal	Potential for severe adverse weather and fuel/material inflation	These projects can be effected by weather and tidal conditions, material and fuel inflation, and other external factors as this is the planning phase of the project	Marginal	Likely	2
EX-7	AOP - Breach	Potential for severe adverse weather and fuel/material inflation	These projects can be effected by weather and tidal conditions, material and fuel inflation, and other external factors as this is the planning phase of the project	Marginal	Likely	2
EX-8	AOP - Fishways	Potential for severe adverse weather and fuel/material inflation	These projects can be effected by weather and tidal conditions, material and fuel inflation, and other external factors as this is the planning phase of the project	Marginal	Likely	2
EX-9	Culverts	Potential for severe adverse weather and fuel/material inflation	These projects can be effected by weather and tidal conditions, material and fuel inflation, and other external factors as this is the planning phase of the project	Marginal	Likely	2
EX-10	CRP - AOP - Removal/Breach	Potential for project delays and increased costs due to public concerns regarding historic properties.	The public has been notified regarding the porposed measures. The state historic preservation office has been notified of the proposed measures and their comments have been requested. However there may be concerns expressed as more information is obtained about historic sites.	Marginal	Possible	1
EX-11	CRP - AOP - Fishways	Potential for project delays and increased costs due to public concerns regarding historic properties.	The public has been notified regarding the porposed measures. The state historic preservation office has been notified of the proposed measures and their comments have been requested. However there may be concerns expressed as more information is obtained about historic sites.	Marginal	Unlikely	0
EX-12	CRP - Wetland Restoration/Side Channels/Shoreline Restoration	Potential for project delays and increased costs due to public concerns regarding historic properties.	The public has been notified regarding the porposed measures. The state historic preservation office has been notified of the proposed measures and their comments have been requested. However there may be concerns expressed as more information is obtained about historic sites.	Marginal	Unlikely	0

EX-13	Remaining Construction Items	Potential for severe adverse weather and fuel/material inflation	These projects can be effected by weather and tidal conditions, material and fuel inflation, and other external factors as this is the planning phase of the project	Marginal	Unlikely	**0**
EX-14	Planning, Engineering, & Design	Project delays due to political influence and availability of funding	If project is delayed with significant time lapse may result in need to collect additional data and PED activities.	Marginal	Possible	**1**
EX-15	Construction Management	Project delays due to political influence and availability of funding	If project is delayed with significant time lapse may result in need to increase funds for labor effort	Marginal	Possible	**1**