EAST BRANCH CODORUS CREEK MITIGATION BANK DRAFT MITIGATION SITE PLAN

Springfield Township,
York County, Pennsylvania

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1.0 Introduction

1.1 Project Name and Organization

First Pennsylvania Resource, LLC (FPR, Bank Sponsor), a wholly owned subsidiary of Resource Environmental Solutions, LLC (RES) proposes to establish the East Branch Codorus Creek Mitigation Bank (Bank Site, Project) within the approved Pennsylvania Statewide Umbrella Mitigation Banking Instrument (PSUMBI). The purpose of the PSUMBI is to provide compensatory mitigation for unavoidable impacts to waters of the United States (U.S.) occurring as a result of activities authorized under Section 401 and 404 of the Clean Water Act; Section 10 of the Rivers and Harbors Act; Pennsylvania Department of Environmental Protection (PADEP) Chapters 102, 105, and 106 regulatory programs; and Department of the Army Permits, provided such activities have met all applicable requirements and are authorized by the appropriate agencies.

The Bank Sponsor is submitting this Mitigation Site Plan (MSP) to the U.S. Army Corps of Engineers (USACE), Baltimore District and Interagency Review Team to initiate evaluation of the proposed Bank Site in accordance with 33 CFR 332.8(d)(2). The proposed Bank Site is located within the Lower Susquehanna River Subbasin (8-digit HUC #02050306) (Pennsylvania State Water Plan Watershed Subbasin 7).

1.2 Authorities

The establishment, use, operation, and maintenance of the PSUMBI and the Bank Site are carried out in accordance with the following authorities:

1. Clean Water Act (33 USC 1251 et seq.);
2. Rivers and Harbors Act (33 USC 403);
3. Fish and Wildlife Coordination Act (16 USC 661 et seq.);
4. Regulatory Programs of the Corps of Engineers, Final Rule (33 CFR Parts 320-332);
5. Guidelines for Specification of Disposal Sites for Dredged and Fill Material (40 CFR Part 230);
6. Memorandum of Agreement between the Environmental Protection Agency and the Department of the Army concerning the Determination of Mitigation Under Clean Water Act, Section 404 (b)(1) Guidelines (February 6, 1990);
7. Regulatory Guidance Letter No. 05-01. U.S. Army Corps of Engineers, February 14, 2005;
8. Compensatory Mitigation for Losses of Aquatic Resources; Final Rule. 33 CFR Parts 325 and 332, Department of the Army, Corps of Engineers and 40 CFR Part 230, Environmental Protection Agency, April 10, 2008;
9. Regulatory Guidance Letter No. 08-03. U.S. Army Corps of Engineers, October 10, 2008;
10. Pennsylvania Department of Environmental Protection, Chapters 102, 105, and 106 regulatory programs; and
11. Pennsylvania State Programmatic General Permits (PASPGP) 3, 4 and 5 and the requirements of Title 25 PA Code 105 rules and regulations.

1.3 Phasing

This MSP is being submitted for review by the Interagency Review Team (IRT) and approval by the USACE as an addendum to the PSUMBI. Upon approval, the MSP for the Bank Site will be attached to the PSUMBI, and the Bank Site will be deemed a component of the PSUMBI. Credits will be released consistent with the schedule of credit availability in accordance with this MSP. Credits released for the Bank Site will be accounted for in the overall bank ledger for the PSUMBI. Bank sites will have separate ledgers and separate entries in the Regulatory In Lieu Fee and Bank Information Tracking System (RIBITS), but all ledgers will be governed by the PSUMBI.

2.0 Mitigation Objectives

2.1 Location

The Bank Sponsor has secured land (Project, Bank Site) consisting of waterways, wetlands, and riparian floodplains within the Lake Redman-Lake Williams-East Branch Codorus Creek Watershed (12-digit HUC #020503060602) of the Lower South Branch Codorus Creek Watersheds (10-digit HUC #020501011302) (Figure 1: Project Overview Map). The mainstem flowing across the Project is Tributary 08113 to East Branch Codorus Creek (EBCC, PADEP Historic Streams, 2004). Tributary 08114 to East Branch Codorus Creek and multiple unnamed tributaries (UNTS), as well as wetlands and riparian floodplains, surround the mainstem of the Project. Figure 2: Service Area Map (Appendix A: Figures) provides an overview of the Project site in relation to the area for which the Project is intended to provide compensatory mitigation; the Lower Susquehanna River Subbasin (Pennsylvania State Water Plan Watershed Subbasin 7). The Project is in York County in south central PA and is less than a one-half mile southeast of the town center of Loganville and approximately seven and one-half miles south of York, PA.

The Project is generally bordered by East Springfield Road to the east, Dunkard Valley Road (County Road 214) to the north, and State Route (SR) 3001 to the west. Figure 1: Project Overview Map (Appendix A: Figures) provides an overview of the location of the proposed Project.

The Bank Sponsor is investigating expansion opportunities for land surrounding the proposed Project site. If additional land is obtained, those additional areas may be included as part of the proposed Project and will be included as part of the Mitigation Site Plan (MSP).

The Project address and approximate center coordinates are listed below.

Address	1886 Dunkard Valley Road York, PA 17403
Approximate Center coordinates	39°51'26.579" North 76°41'25.276" West

Driving directions from the intersection of Market Street and George Street in York PA are as follows:

1. Head southeast on N George St toward E Market Street (1.3 miles);
2. At the I-83 interchange, keep right and follow signs for Harrisburg/Baltimore (1.9 miles);
3. Keep right at the fork, follow signs for I-83 S/Baltimore and merge onto I-83 S (3.8 miles);
4. Take exit 10 toward PA-214/Loganville (0.2 miles);
5. Turn right onto North St (signs for PA-214/Loganville) (0.3 miles);
6. Turn left onto N Main Street (0.7 miles);
7. Turn left onto PA-214 E/E Ore St (0.5 miles);
8. In less than one mile, the Project site will be on the left (or to the North).

Arrangements must be made with the Bank Sponsor prior to visiting the Bank Site as landowner coordination is necessary.

2.2 Objectives

The goal of the Bank Site is to restore and preserve self-sustaining, functional environmental resources identified within the Project area. In accordance with these goals, the Bank Site strives to replace the functions and values lost as a result of adverse impacts to streams and wetland areas due to various Section 10 and/or Section 404 authorized projects occurring elsewhere within the Lower Susquehanna River Subbasin (Pennsylvania State Water Plan Watershed Subbasin 7).

Project-centered restoration efforts will focus on the creation of a stable stream and riparian system. In addition to the reestablishment of appropriate riparian buffer zones along streams, restoration activities will result in runoff management solutions and capture and treat impacted waters before they are discharged into the watershed or points downstream in an effort to reduce excess nutrients threatening the health of the watershed's rivers and streams.

Functional gains from the restoration activities are anticipated to include the following:

- reestablishment of streams and wetlands;
- reestablishment of stream and floodplain connectivity;
- improvement of hydrologic connectivity of onsite stream channels to their historical flood prone areas (specifically the interaction of channel flow with the floodplain)
- improvement of onsite flood capacity, storage, and attenuation;
- improvement of onsite stream stability and appropriate channel geometry;
- improvement of aquatic and riparian terrestrial habitat;
- improvement of the vegetative diversity throughout all habitats within the system;
- promotion of native vegetation to reduce presence of invasive species establishment and colonization; and
- perpetual protection of the Bank Site through appropriate legal protections to ensure the continuity and evolution of the functional improvement goals once achieved.

Larger-scale environmental objectives of the Bank Site will:

- support the national goal of no-net-loss of wetlands;
- enhance and create wildlife habitat;
- provide compensation for wetland and stream losses in a manner that contributes to the long-term sustainable ecological function of the South Branch Codorus Creek Watershed;
- reduce nutrient pollution entering waters of the U.S.; and
- protect the biodiversity from harmful activities and processes, both natural and anthropogenic.

Multiple approaches and alternatives were considered for Bank Site resource restoration. The intensity of restoration proposed in different areas of the Bank Site is partially dependent upon the existing degree of resource degradation in those areas. As such, the Bank Site incorporates a variety of active restoration and enhancement activities which will maximize ecological uplift, while minimizing disturbance and construction impacts to existing resources. The Bank Sponsor anticipates that restoration efforts at the site will result in the establishment and preservation of a long-term self-sustaining and functional stream, wetland, and riparian corridor.

3.0 Site Protection Instrument

The Bank Site will be protected by multiple Declarations of Restrictive Covenant for Conservation (Declaration) that will be placed on the property parcels in advance of the proposed restoration activities, thereby ensuring the long-term protection of the site. The Declarations restrict activities that are incompatible with the objectives of the Bank Site. The Declarations will be recorded

within 60 days in the county courthouse after receipt of all required permits, clearances, approvals and authorizations and prior to Project implementation. The executed Declarations to be filed upon Bank Site authorization, in addition to the survey plats that show the title information as well as the reserved rights areas are included as Appendix B: Site Protection Instrument(s).

As described in Section VI.H. of the PSUMBI, the Sponsor will act as the initial long-term steward unless another qualified, watershed-focused, entity is willing to assume long-term stewardship responsibilities. The Bank Sponsor's heirs, assigns, or purchasers will be responsible for protecting lands contained within the Bank Site in perpetuity and in accordance with the terms of the approved MSP, unless the lands are transferred or sold to a third-party Declaration holder such as a local, state, or federal resource agency or non-profit conservation organization. Entrusting the Bank Site to a third-party Declaration holder may commence only when the Bank Sponsor and the IRT have mutually concluded that the Bank Site has achieved all its objectives and sufficiently satisfied performance standards. The third-party may transfer the Bank Site protective instrument to a conservation easement if they so wish with the review and approval of the USACE.

4.0 Site Selection

The site selection process prioritized the long-term self-sustaining ecological suitability of a site to provide desired aquatic resource functions as a result of compensatory mitigation activities. The factors that were used in selecting the proposed Bank Site include the following:

(i) Hydrological conditions, soil characteristics, and other physical and chemical characteristics;
(ii) Watershed-scale features, such as aquatic habitat diversity, habitat connectivity, and other landscape-scale functions;
(iii) The size and location of the compensatory mitigation site relative to hydrologic sources (including the availability of water rights) and other ecological features;
(iv) Compatibility with adjacent land uses and watershed management plans;
(v) Reasonably foreseeable effects that compensatory mitigation may have on ecologically important aquatic or terrestrial resources (e.g., shallow sub-tidal habitat, mature forests), cultural sites, functions and services, or habitat for federally- or state-listed threatened and endangered species; and
(vi) Other relevant factors including, but not limited to, development trends, anticipated land use changes, habitat status and trends, local or regional goals for the restoration or protection of particular habitat types or functions (e.g., re-establishment of habitat corridors or habitat for species of concern), water quality goals, floodplain management goals, and the relative potential for chemical contamination of the aquatic resources.

Additional key factors the Bank Sponsor considered in determining the site selection include:

(i) the headwaters location within the sub-watershed;
(ii) the extent of disturbance and restoration feasibility; and
(iii) the restoration activities and potential effects to neighboring properties.

Selecting sites that are located at the headwaters of their respective watershed is paramount to accomplishing an ecologically long-term self-sustaining ecosystem. Restoration in these locations reduces the risk of failure due to uncontrollable activities or inputs occurring upstream or upslope.

The likelihood of creating a self-sustaining and functional stream, wetland, and riparian corridor in addition to the possibility of restoring and preserving a large contiguous area of streams and wetlands were strong factors in the selection of the Project site. The Project area includes early

successional forested habitat, semi-degraded forested habitat, and agricultural floodplain areas. The significant extent of existing degradation was also a key factor during the site selection process. With the extent of the existing degradation within the Project site and in conjecture with an appropriate restoration approach, a successful, long-term, self-sustaining ecosystem will be established at the Project site.

4.1 General Watershed Characteristics

The proposed Project is in the EBCC drainage area of the Codorus Creek Watershed, a sub-watershed of the Lower Susquehanna River Basin. The EBCC has a drainage of 44 square miles and begins northeast of Stewartstown, York County, PA. The stream flows northeast and receives drainage from the southwest and northeast with larger streams Seaks Run, Barshinger Creek, and Inners Creek, all of which are listed as impaired on the Pennsylvania 303(d) list (PADEP 2018). EBCC-Dunkard Valley (Tributary 08113 To EBCC), the main unnamed tributary within the Bank Site drains from the southwest below the confluence of Barshinger Creek and EBCC and above the confluence of Inners Creek and EBCC. The EBCC then drains to Lake Redman, which flows into Lake Williams. Both of these reservoirs serve as public water supplies and are maintained by York Water Company Inc. (Codorus WIP 2007).

The Project is in the Piedmont Uplands Section of the Piedmont Physiographic Province. The Piedmont Physiographic Province is characterized by low, gently rolling hills intersected by shallow streams. The Piedmont Uplands Section is primarily comprised of intensely folded and faulted metamorphosed sediments and igneous rock. Soils within and surrounding the Project have depths ranging from 40 to 70 inches with slopes between zero and 20 percent, making them prime soils for agricultural uses. Additionally, permeable soils suitable for infiltration cover large portions of the watershed and the Project Site. Slope percentages within the Project site generally range between zero and eight percent, however, slopes upwards of 16 to 25 percent are present within the immediate surroundings. The watershed and Project area are underlain by the Crystalline-Rock Aquifer. The Crystalline-Rock Aquifer has a very slow permeability rate and a low yield, therefore, is it very important to allow as much water to reach the aquifer as possible. This in turn allows the aquifer the opportunity to recharge. Impervious surfaces inhibit waters from recharging the aquifer and result in increased runoff downstream. As such, protection of permeable soils for infiltration is necessary.

Historic land use within and surrounding the Codorus Creek Watershed can be characterized by a predominance of agricultural uses including both cropland and livestock grazing (65 percent in Codorus Creek Watershed but over 74 percent in the EBCC watershed, [Codorus WIP, 2007]). Poor agricultural management practices associated with these activities has left the streams in an impaired state. Although more recently and despite the fact that many crop farmers in York County have implemented best management practices to curtail high sediment and nutrient loads from overland runoff (e.g., no-till farming), many stream banks in agricultural lands remain denuded of riparian vegetation. This has resulted in stream channels that are deeply entrenched with severely eroding banks. These data are consistent with the land use characteristics of the Project. While approximately 34 percent of the land within the Project area is used for agriculture, the immediate surroundings suggest a significantly greater proportion of land adversely impacted by agricultural land uses. Furthermore, as shown in Figure 3: Existing Conditions Map (Appendix A: Figures), the riparian zone of the mainstem and UNT within the central portion of the Project is largely devoid of herbaceous and woody vegetation, providing little to no protection to the waters from erosion, sedimentation and overland runoff.

Landscape alterations due to anthropogenic activities may have the potential of increasing the frequency and intensity of stormwater pulse discharges into local streams, resulting in more dramatic episodes of bank erosion and loading of suspended sediments and nutrients. Loss of open space and vegetated ground cover immediately surrounding the Project site is evidenced in Figures 5A: 2001 National Land Cover Database Map and 5B: 2011 National Land Cover Database Map (Appendix A: Figures). The presence of developed, open space outside the Project site visibly increases from 2001 to 2011. This trend is anticipated to continue as the population continues to grow into headwaters areas of the Codorus Creek Watershed. Due to the increase in new home construction, existing forested areas are dwindling, and habitats are suffering from fragmentation and overall loss. Smaller isolated patches of forest limit the type, abundance and diversity of plant and animal species that utilize forest ecosystems. Areas closest to stream channels are those that are most adversely affected. Lack of riparian corridors not only negatively impact travel corridors used by birds and mammals to access larger forested areas and to find food and shelter, but also contribute to bank instability, water temperature variations, excess nutrients within the streams and increases in erosion and sedimentation rates.

4.2 Congruence with Watershed Needs

As demonstrated above, existing land uses and pressure from residential and commercial development continue to threaten what's left of the natural ecosystems still present within the Codorus Creek Watershed. Persistent degradation of water quality and habitat not only impacts ecosystem health and fishery value within the watershed but contributes to larger reaching impacts downstream to the Susquehanna River and the Chesapeake Bay, necessitating restoration of drainage systems within the Codorus Creek Watershed. According to the US Environmental Protection Agency (EPA) Grants Reporting and Tracking System (GRTS), there are 15 Non-Point Source (NPS) Pollution projects dating from 2002 to the present that have received funding from the Section 319 NPS Management Project for Best Management Practice (BMPs) design and implementation (USEPA 2016) to address watershed degradation within the Codorus Creek Watershed. The restoration activities associated with these projects are generally small scale and employ a combination of livestock exclusion techniques and natural channel design approaches, including riparian buffer plantings, streambank fencing installations, stream bank stabilization activities, and water quality trend assessments to address stream and water quality degradation. These types of restoration projects typically provide a reduction in erosion and sedimentation on a smaller-scale than the proposed approaches for the Project.

Stream restoration in general is an important practice that results in environmental, economic and recreational benefits. Stream restoration can't fully offset the years of anthropogenic induced degradation, but it can reverse the trend and begin providing functions and values once provided by natural stream and floodplain systems. Floodplain restoration reduces runoff and erosion rates, reduces flooding and associated property damage, and reconnects the stream to the floodplain to provide hydrologic equilibrium. The floodplain restoration approach more effectively addresses the cause(s) of degradation and promotes a larger scale ecological uplift through the establishment of a self-sustaining ecosystem.

Cumulative anthropogenic impacts resulting in impaired stream systems necessitate stream restoration. Unnatural conditions imposed on stream systems have caused major instability and environmental problems especially when bankfull channel morphologies including streamflows and sediment regimes are adversely modified. Anthropogenic-induced landscape changes have all but destroyed the conservation and amenity value of riverine areas. Negatively affected functions and values include degraded benthic and instream habitats, associated aquatic plant

and invertebrate communities, downstream flooding, property damage, poor aesthetics, and recreational opportunities. Without intervention, continued degradation through anthropogenic influence impedes potential natural recovery.

There are several organizations that actively engage in the conservation and protection of the watershed and surrounding landscape. One such organization is the Codorus Creek Watershed Association (CCWA), "a membership-based, charitable non-profit watershed organization committed to restoration and protection of the Codorus Creek Watershed and its biodiversity, habitat, and environs, for future generations." The CCWA is actively involved in watershed planning, restoration and protection through its plans (including the Codorus Creek Watershed Conservation Plan, the Codorus Creek Watershed Conservation Plan 2007 and the Codorus Creek Source Water Protection Plan 2009, to name a few) and projects (including the Oil Creek Restoration & TMDL Implementation Project and the Barshinger Creek Watershed Renaissance Initiative). The CCWA offers environmentally based educational programs that support PA's Watersheds and Wetlands programs and offers a HELP-Buffers program to provide landowners financial and technical assistance in restoration and protection of headwater riparian buffers.

While the CCWA has had measurable success in fighting water pollution, a continued effort is still needed across the 54 percent of streams within the watershed that do not meet water quality standards (CCWA, 2016). Leading causes of water quality impairment in the watershed include urban runoff, stream erosion and sedimentation, agriculture, municipal wastewater, hydrologic alteration, habitat destruction, industrial wastewater and failing septic systems. Stream bank and bed erosion and sedimentation are responsible for more than half of the degraded streams in the watershed. According to the CCWA, every stream and tributary in the watershed has been affected by stormwater runoff in some form or another, and while urban stormwater runoff is the leading source of NPS pollution, agricultural runoff is among the top leading sources of water quality impairment in the watershed.

Also, working within the Codorus Creek Watershed is the Codorus Creek Restoration Efficacy Program (CCREP). Centered at Penn State University, York Campus (PSY), and in partnership with other local watershed organizations and the PA Department of Environmental Protection (DEP), CCREP assesses the outcomes of stream restoration efforts on the health of aquatic ecosystems within the watershed. In addition to this research mission, the program is committed to educational outreach to promote public awareness of watershed issues in York County including why many of the streams require restoration, what stream restoration entails, and what benefits are expected locally and downstream to the Susquehanna River and the Chesapeake Bay.

Despite impairments and degradation of the waters, the Codorus Creek Watershed, with its 278-square mile drainage area, 447 miles of streams, three major reservoirs and multiple small ponds, and around 20,000 acres of freshwater wetlands, still provides an approximately 3-million-dollar per year recreational industry, representing a very important asset for the local economy. With the continued degradation of the region's landscape, the significance, and importance of restoring and protecting the region's natural resources are critical. The need for continued resource restoration and protection efforts are warranted, as threats of development and other degradative land uses continue to grow. Balancing the environmental protection of lands and waters with growing residential and commercial development needs is a delicate task that should begin with protecting the natural resources that provide the sustenance for all life in these threatened areas.

The Lake Redman-Lake Williams-East Branch Codorus Creek Watershed has been classified by the PA Natural Heritage Program (PNHP) Aquatic Community Classification (ACA) as a Tier 2 Enhancement Watershed (Walsch et. al. 2007). Enhancement watersheds reflect conditions that

are likely not pristine, and that are prime candidates for restorative action because they are not as severely degraded as watersheds classified as Restoration Watersheds. Restoration of enhancement watersheds is anticpated to yield the most significant ecological gains when compared to the amount of effort required for restoration.

Moreover, as can be seen on Figure 4: Ecological Inventory Map (Appendix A: Figures), and in the image below, several PNHP core habitats and their supporting landscapes surround the proposed Bank Site. Table 1: Ecological Inventory Descriptions below presents a list of the PNHP core habitats that are located within the surrounding landscape of the Project.

Table 1: Ecological Inventory Descriptions

Agency	Site Name	Approximate Distance (miles) and Direction from Project	Description
PNHP	Lake Redman Site	<0.10, North	Species of Concern (SOC) habitat area
PNHP	Spring Valley Woods Site	2.6, Southeast	Bottomland forest and adjacent slopes support a good quality population of plant SOC. This site is also connected to an eastern provisional SOC site.
PNHP	Rehmeyer Hollow	4, Southeast	A streamside wooded site that supports a fair quality occurrence of a plant SOC.
PNHP	Strickhousers Iron Mines	6, West	Site supports an animal species of concern; includes part of Raab County Park.
PNHP	Seitzland Marsh	5, South	A graminoid marsh occurs on gradually sloping seepy floodplain along Trout Run
PNHP	North Branch Muddy Creek	4, Southeast	The species of concern inhabiting these shallow wetlands require specific plan communities within a matrix of open canopied habitats. Maintain this floodplain as a wetland complex, composed of multiple types of wetlands with both open and closed canopies.
PNHP	Winterstown Station Woods	4.5, East	A plant SOC occurs in this mixed hardwood forest.

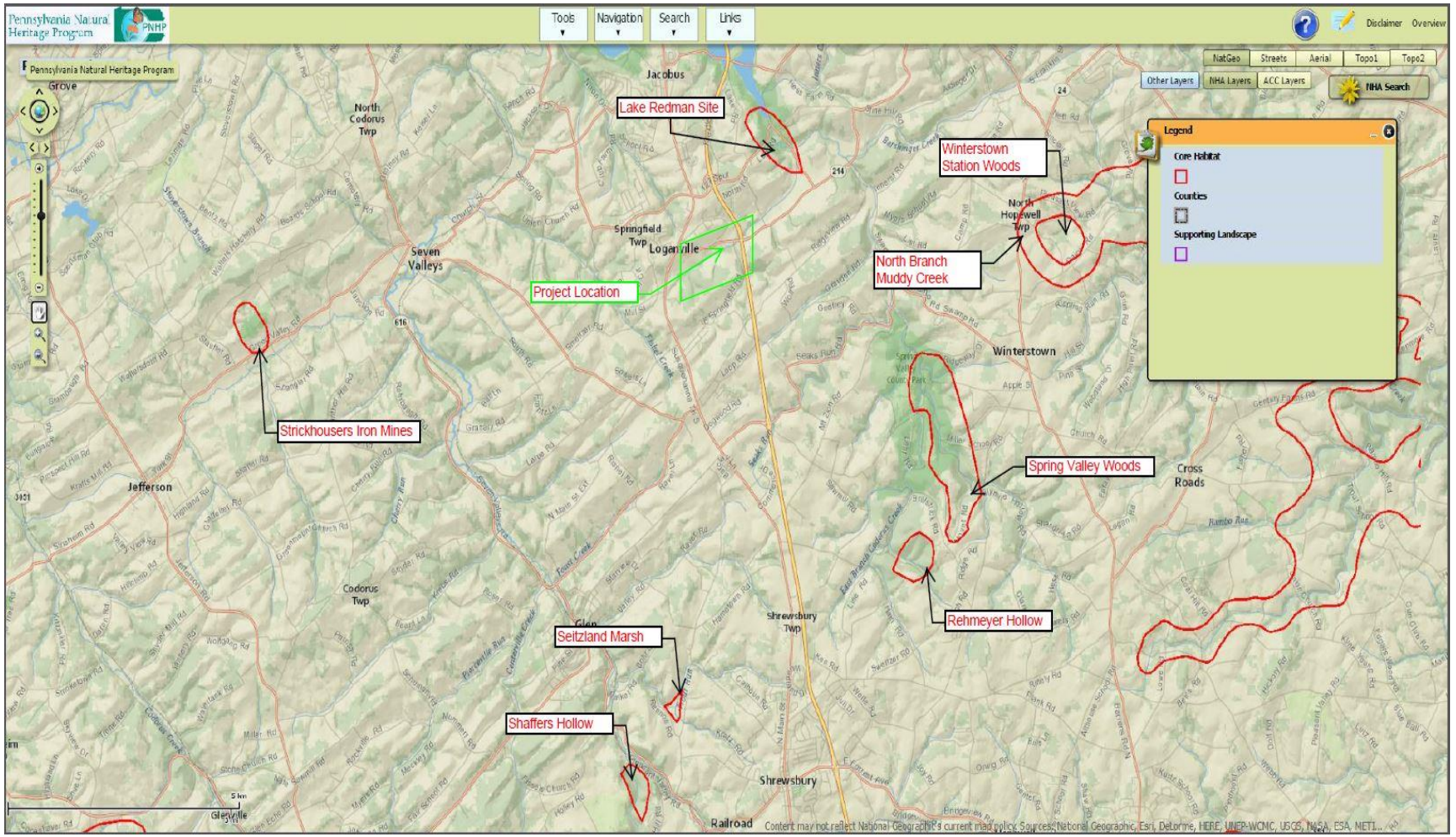


Image 1. The image above displays the PNHP Core habitats that surround the proposed Project Site.

Larger watershed initiatives also support the conservation, restoration, and protection of the region in which the Bank Site is located. These larger initiatives, their missions, and their goals are described in more detail, below.

4.3 Chesapeake Bay Watershed

The Bank Site is in the Chesapeake Bay Watershed. The Chesapeake Bay, spanning parts of six states and draining 64,000 square miles of land, is the largest estuary in the U.S. It is a complex ecosystem made up of the Bay itself, its feeding network of waterbodies, and all the plants and animals it supports. As evidenced by the bulleted list below, the Bay plays a critical role in the health of the regional watershed.

- The Bay supports more than 2,700 species of plants and animals, including 348 species of finfish and 173 species of shellfish.
- The Bay produces about 500 million pounds of seafood per year.
- The Chesapeake region is home to at least 29 species of waterfowl. Nearly one million waterfowl winter on the Bay – approximately one-third of the Atlantic coast's migratory population. The birds stop to feed and rest on the Bay during their annual migration along the Atlantic Flyway.
- Nearly 80,000 acres of bay grasses grow in the shallows of the Chesapeake Bay and its tributaries. Young and molting blue crabs rely on bay grass beds for protection from predators.
- Approximately 284,000 acres of tidal wetlands grow the Chesapeake Bay region. Wetlands provide critical habitat for fish, birds, crabs and many other species.
- Forests cover 58 percent of the Chesapeake Bay watershed. The region loses about 100 acres of forest each day to development.

Due to the multitude of pollution and threats to this precious resource, the Bay was the first estuary in the nation to be targeted for restoration as an integrated watershed and ecosystem.

The Bay Program partnership implements and tracks progress toward goals to reduce pollution, restore habitats, manage fisheries, protect watersheds, and foster stewardship. The health of local streams and water bodies, including those within the Project site depend on how the land surrounding them is used, protected, and preserved. The restoration and protection of the waters of the Project site, therefore, align with the restoration goals of the Bay Program partnership in its effort to restore the overall health of the Chesapeake Bay. Specifically, restoration efforts at the Project site will involve reducing sediment pollution, restoring wetlands, streams and riparian corridors, planting of native wetland, riparian, and upland vegetation, and protection of these resources in perpetuity.

4.4 Susquehanna River Basin Commission

The Bank Site is part of the Susquehanna River Basin. According to the information provided on the Susquehanna River Basin Commission website (SRBC, 2015), "The Susquehanna River is the nation's sixteenth largest river and is also the largest river lying entirely in the U.S. that flows into the Atlantic Ocean. The Susquehanna and its hundreds of tributaries drain 27,510 square miles, an area nearly the size of South Carolina, spread over parts of the states of New York (NY), PA, and Maryland (MD)."

The river, from its origin in Otsego Lake near Cooperstown, NY, flows over 400 miles south where it empties into the Chesapeake Bay at Havre de Grace, MD, contributing one-half of the freshwater flow to the Chesapeake Bay.

The river basin borders major population centers of the east coast, and although relatively undeveloped, has experienced problems with water pollution and over usage. To address these problems, the Susquehanna River Basin Compact (Compact) was signed into law on December 24, 1970. The Compact, as adopted by the Congress of the U.S. and the legislatures of NY, PA, and MD provides the mechanism to guide the conservation, development, and administration of the water resources of the vast river basin. The Compact also established the Susquehanna River Basin Commission (SRBC) as the agency to coordinate the water resources efforts of the three states and the federal government. The mission of the SRBC is to enhance public welfare through comprehensive planning, water supply allocation, and management of the water resources of the Susquehanna River Basin.

To accomplish this mission, the SRBC works to: reduce damages caused by floods; provide for the reasonable and sustained development (which includes any change in land use from a natural or semi-natural state for a purpose such as agriculture, housing, commercial and etc.,) and use of land surface and ground water for municipal, agricultural, recreational, commercial and industrial purposes; protect and restore fisheries, wetlands and aquatic habitat; protect water quality and instream uses; and ensure future availability of flows to the Chesapeake Bay.

The proposed mitigation activities at the Project site directly support the SRBC's efforts to accomplish their mission, specifically with respect to protection and restoration of fisheries, wetlands, and aquatic habitats.

The activities of the SRBC are further guided by multiple goals, some of which are also directly supported by the proposed Project site restoration activities. These goals include the following:

1) To be a leader in issues concerning the conservation, utilization, allocation, development, and management of water resources within the Susquehanna River Basin;
    - The proposed Bank Site restoration activities may support this goal as it is anticipated to provide an exemplary example of conservation and natural resource management.
2) To provide public information and education about the water resources of the basin.
    - The proposed Bank Site restoration activities may also provide a location where education about the conservation and restoration of natural resources can occur.

SRBC staff develops and implements the program as directed by the commissioners and as found in SRBC's comprehensive plan, Comprehensive Plan for the Water Resources of the Susquehanna River Basin (SRBC Comprehensive Plan, http://www.srbc.net/planning/comprehensiveplan.htm). The SRBC Comprehensive Plan identifies six priority management areas along with goals to be used to guide management efforts. Of the six, below are two management areas that will be directly supported by the restoration activities that may be proposed as part of the Project:

1) Water Quality
    - Monitor and assess the biological, chemical, and physical quality of the basin's waters to support restoration and protection efforts.
    - Develop, support, and implement plans and projects to remediate and enhance the basin's water quality.
    - Protect the quality of the basin's biological resources and sources of public drinking water supply.
2) Ecosystems

- Perform ecosystem monitoring and assessment to provide data needed for effective watershed management.
- Protect and restore biological resources throughout the basin and in each of the major subbasins.
- Restore populations of migratory fish throughout the Susquehanna River system.

Although on a smaller scale as compared to the Susquehanna River Basin, it is clear to see how the potential restoration activities at the Bank Site will support a subset of the management areas and the goals of both the Chesapeake Bay Watershed and the SRBC.

4.5 Susquehanna Greenway Partnership

The Susquehanna Greenway Partnership (SGP) links natural, cultural, historic, and recreational resources along the 500-mile corridor of the Susquehanna River in PA. The SGP has established a basin-wide organization for resource management and community conservation - factors of lasting importance to the economies and quality of life of river communities.

The SGP works to advance public and private efforts to connect people with their natural and cultural resources and promote a sustainable and healthy environment. To accomplish this mission, the SGP has laid out six initiatives. Of the six, the following two are directly supported by the proposed Project restoration activities:

1) Conserving & Enhancing Natural Resources
    - The Project proposes to restore the natural resources on-site and protect them in perpetuity. As stated by the SGP, "Conserving critical wetlands, forestlands, farmlands and riparian areas…will enhance our water resources and the quality of life for all living things." In support of this statement, the SGP also works to preserve and enhance riparian corridors along the river and its tributaries in addition to advocating for priority conservation projects.
2) Interpreting Natural and Cultural Assets
    - Interpreting natural and cultural assets along the river promotes the critical connection between the Susquehanna River Corridor and the Chesapeake Bay. Interpretation emphasizes the preservation and conservation of the Susquehanna's many diverse natural and cultural resources, and historic communities and increases pride in the community and ownership of its resources. The Project will become a natural asset that will improve the health of the landscape as well as the improve aesthetics and could potentially become a part of a greenway driving tour, similar to the SGP's Middle Susquehanna Driving Tour.

5.0 Bank Site Description

As previously stated, the proposed Bank Site is located in Springfield Township in York County, PA. The main stem UNT to East Branch Codorus Creek flows adjacent to Dunkard Valley Road. The Bank Site includes the majority of the headwaters of the mainstem onsite, which is designated as a Cold-Water Fishes (CWF) and Migratory (MF) Fishes according to the PA Code; Title 25; Chapter 93.9a to 93.9z. In addition, the Project site contains multiple headwater and floodplain complex wetlands within the proposed Project boundary.

The Bank Site resides in a relatively shallow and gently sloping topographic setting within a wide valley bottom. The existing land-use surrounding the Project area can be characterized as mixed

agricultural and residential. Two small, early successional forested stands in the upstream and lower downstream portions of the Project area also occur within the bounds of the Project area. The headwaters begin at the western end of the Project area, in a densely vegetated, early successional forest habitat. As shown in Figure 3: Existing Conditions Map (Appendix A: Figures), multiple tributaries empty into the mainstem of the Project, from the north and south. The headwaters of the main stem exit the portion of forest cover near the central portion of the Project and enters the heavy agriculturally influenced portion of land for the remaining eastern extent of the Project. Agricultural practices including hay, soybean, and corn production, as well as livestock grazing occur in the north-central portion of the Project site.

5.1 Physiographic and Geographic Setting

The Bank Site is in the Marburg Schist and sections of the Wakefield Marble geologic units of the lower Paleozoic age, containing major lithologic constituents of phyllite, mica-chlorite schist, and marble and minor lithologic constituents of the sedimentary conglomerate. Soil units include Mt Airy and Manor Soil, Chester Silt Loam, Glenville Silt Loam, Codorus Silt Loam, and Chagrin Silt Loam, all of which are characterized as predominately prime agricultural upland loam and silt loam soils present on three to eight percent slopes. As such, the Bank Site has been heavily impacted by historic and existing agricultural practices. The relationship of PA's physiographic provinces and sections to the underlying geology was obtained via the Department of Conservation and Natural Resources (DCNR) PA Geological Survey web-mapping application PaGEODE (DCNR, 2020).

5.2 Degradation Summary

Streams and wetlands identified onsite have been degraded to varying degrees through anthropogenic alterations including historic and ongoing agricultural activities. Representative site photographs are included as Appendix C: Representative Site Photographs.

Streams and wetlands identified onsite have been degraded significantly because of anthropogenic alterations including present and historical agricultural and timber uses. Furthermore, historic timbering practices have created an environment ideal for the proliferation of invasive species colonization and monoculture establishment within the early sectional forested sections of the Project. For example, multiflora rose (*Rosa multiflora*) and honeysuckle (*Lonicera morrow*) have colonized the understory with great success.

Sedimentation from crop fields and nutrient runoff from barnyard wastes and livestock loafing in waterways are two major non-point source pollutants entering into the stream system. Stream channel conditions including physical and chemical alterations, as well as instream habitat retention abilities, and functions of native riparian vegetation and their corridors have been negatively impacted as a result of the surrounding land uses.

In the central portion of the Bank Site, the mainstem traverses an active cattle pasture, where livestock have free range of the stream and its banks. Trampling and grazing have degraded the banks, left no riparian vegetation and contributed to poor water quality downstream. Upland soil erosion and fecal matter enter freely into the stream, contributing to polluted waters and a dysfunctional aquatic ecosystem, nonfunctional floodplain and dry riparian soils.

6.0 Baseline Information

6.1 Baseline Data Review

Extensive baseline site investigations were completed at the Bank Site by Bank Sponsor staff (Appendix D: Baseline Data). Baseline investigations and data collected include:

- Subsurface soil borings;
- Wetland delineation and waterbody identifications;
- Flora community composition data;
- Informal terrestrial and aquatic fauna community composition data;
- PA Natural Diversity Inventory Review (PNDI);
    - Rare, threatened, and endangered species surveys;
- Bed stability and habitat pebble counts;
- Bank Erosion Hazard Index (BEHI) Assessments;
- Benthic macroinvertebrate sampling;
- Fish sampling; and
- Photo and field note documentation.

The following sections present the findings of the baseline data collection and review. The data were assessed and used to guide the restoration approach(es) proposed at the Bank Site, as described in Section 8.0 Mitigation Work Plan.

6.2 Land Use

6.2.1 Adjacent Land Use

The proposed Bank Site is surrounded by large tracts of agriculturally productive land, primarily pasture and crop fields. Northwest of the Bank Site is the residential community of Loganville. Interspersed rural residential communities surround the proposed Bank Site.

6.2.2 Project Site Historic and Present Land Use

Historic imagery dating back to 1937 (Figure 6A: 1937 Historic Aerial) confirms that the historical land use centered around agriculture, primarily row crop production and livestock grazing. As demonstrated between the 1937, 1957 and 1971 historic aerials (Figures 6A, 6B, and 6C, respectively, of Appendix A: Figures), the riparian buffer surrounding the Bank Site's mainstem tributary diminished with the passing decades. Based on the 2001 and 2011 National Land Cover Database (NLCD) mapping provided as Figures 5A and 5B, respectively (Appendix A: Figures), the presence of forest cover has stayed mostly consistent from 2001 to 2011. Table 2: 2001 to 2011 NLCD Comparisons provided below presents the NLCD land use types and cover percentages of the Bank Site in both 2001 and in 2011.

Table 2: 2001 to 2011 NLCD Comparisons			
Year / Land Cover Type	2001	2011	Net Change
Cultivated Crops	31.34	31.34	0.00
Pasture/Hay	6.62	6.62	0.00
Total Agriculture	*37.96*	*37.96*	*0.00*
Developed[2]	16.12	16.02	-0.10
Forest[1]	21.95	21.95	0.00

Notes:
1. Includes all forest/tree cover types.
2. Includes developed open space and low-intensity land cover types.

The Bank Site is currently in varying stages of ecological degradation and recovery as a result of historical anthropogenic influences, many of which are consistent with historic land use trends across the state. In its current state, the Project site's biological integrity has been adversely, ecologically, and physically altered as a result of intense agricultural uses.

6.3 Soils

The U.S. Department of Agriculture Natural Resource Conservation Service (USDA-NRCS) identifies 10 distinct soil series/complexes within the Project. The soil identities and summary attributes are included in Table 3: Soil Series, below. The mapped locations of the soils are shown in Figure 7: Hydric Soils Map (Appendix A: Figures).

Table 3: Soil Series [1]								
Soil Series Symbol	Soil Series Description	Soil Series Setting (Landform)	Farmland Classification	Soil Limitations				Hydrologic Soil Group
				Depth to Restrictive Features		Natural Drainage Class	Hydric Rating Percentage (%)[2]	
				Depth to Any Soil Restrictive Layer (centimeters)	Depth to Water Table (centimeters)			
Cd	Chagrin silt loam	Flood plains	All areas are prime farmland	>200	153	Well drained	0	B
CeB	Chester silt loam, 3 to 8 percent slopes	Hillslopes	All areas are prime farmland	>200	>200	Well drained	0	B
Cm	Codorus silt loam	Flood plains	All areas are prime farmland	217	69	Moderately well drained	11	C
GbB	Glenelg channery loam, 3 to 8 percent slopes	Hillslopes, interfluves	All areas are prime farmland	196	>200	Well drained	0	B
GbC	Glenelg channery loam, 8 to 15 percent slopes	Hillslopes	All areas are prime farmland	127	>200	Well drained	0	B
GdA	Glenville silt loam, 0 to 3 percent slopes	Hillslopes	All areas are prime farmland	48	53	Moderately well drained	5	C/D
GdB	Glenville silt loam, 3 to 8 percent slopes	Swales, drainageways	All areas are prime farmland	76	51	Moderately well drained	10	C/D
MOC	Mt. Airy and Manor soils, 8 to 15 percent slopes	Hillslopes	Farmland of Statewide Importance	81	>200	Somewhat excessively drained	0	C
MOD	Mt. Airy and Manor soils, 15 to 25 percent slopes	Mountainsides	Not prime farmland	81	>200	Somewhat excessively drained	0	C
MOE	Mt. Airy and Manor soils, 25 to 35 percent slopes	Hillslopes	Not prime farmland	81	>200	Somewhat excessively drained	0	C

Notes:

1. Soils data obtained from the following: Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed (March 2020).
2. This rating indicates the percentage of map units that meets the criteria for hydric soils. Map units are composed of one or more map unit components or soil types, each of which is rated as hydric soil or not hydric. Map units that are made up dominantly of hydric soils may have small areas of minor nonhydric components in the higher positions on the landform, and map units that are made up dominantly of nonhydric soils may have small areas of minor hydric components in the lower positions on the landform. Each map unit is rated based on its respective components and the percentage of each component within the map unit

6.4 Environmental Resource Identification

Initial wetland and stream delineations of the proposed Bank Site were conducted between April – June 2017 and supplemental field work was performed in January 2018, and again between February and March 2020. Wetland delineations were completed following the *1987 Army Corps Wetland Delineation Manual* (USACE, 1987) and the *Eastern Mountains and Piedmont Regional Supplement Version 2* (USACE, 2012). Streams were identified and geographically located using handheld global positioning satellite systems (GPS) technology. Results from the environmental surveys are described briefly in this section. Detailed descriptions, data forms, photographs and additional mapping are included in the wetland report, provided in Appendix E: Wetland and Waterbody Identification Report.

6.4.1 Wetlands

Wetland delineation efforts at the Bank Site uncovered multiple palustrine emergent (PEM) and palustrine scrub-shrub (PSS) wetlands. Table 4: Summary of Existing Resources provides a breakdown of the classes and approximate sizes of the wetlands within the Bank Site. Figure 3: Existing Conditions Map (Appendix A: Figures), shows the locations of the wetlands by Cowardin classification within the proposed Bank Site.

Wetlands identified within the Bank Site are considered exceptional value (EV) wetlands per PA Code Title 25 Chapter 105.17, as they are hydrologically connected to or are wetlands which serve as habitat for fauna or flora listed as "threatened" or "endangered" under the Endangered Species Act of 1973 (7 U.S.C.A. § 136; 16 U.S.C.A. § § 4601-9, 460k-1, 668dd, 715i, 715a, 1362, 1371, 1372, 1402 and 1531—1543).

Table 4. Summary of Existing Resources

Resource Type		Pre-Restoration (AC/LF)[1]
Bank Site Acreage		78.78
Upland Acreage[2]		58.93
Wetlands (AC +/-)	**PEM**	17.09
	PSS	0.09
	PFO	-
Wetland AC Total		**17.18**
Streams (LF +/-)	**Perennial**	15,300.72
	Intermittent	825.98
	Ephemeral	521.47
Stream LF Total[3]		**16,648.17**

Notes:
1. Pre-restoration resources are based on the resource delineations within the Bank Site. Acreages and lengths do not include the areas within the reserved rights areas.
2. Upland acreage does not account for stream acreages.

The Bank Site consists predominantly of PEM wetlands, with interspersed PSS wetlands throughout (Appendix A: Figures, Figure 3: Existing Conditions Map). No palustrine forested (PFO) wetlands were identified at the Bank Site. While a larger portion of wetlands onsite are characteristic of a floodplain complex hydrogeomorphic (HGM) wetland class, some wetlands are

classified as slope wetlands, while the remaining are characterized as depressional. Specific acreages for each wetland are provided in the Wetland and Waterbody Identification Report provided as Appendix E: Wetland and Waterbody Identification Report.

Primary and secondary hydrology indicators consistently documented across the Project Site include: surface water (A1), high water table (A2), saturation (A3), water stained leaves (B9), drainage patterns (B10), hydrogen sulfide odor (C1), oxidized rhizospheres on living roots (C3), drainage patterns (B10), geomorphic position (D2), microtopographic relief (D4) and FAC-neutral test (D5).

Dominant vegetation found in the wetlands across the Bank Site include: spicebush *(Lindera benzoin),* black walnut *(Juglans nigra), black willow (Salix nigra),* black elderberry *(Sambucus nigra),* sensitive fern *(Onoclea sensibilis),* reed canarygrass *(Phalaris arundinacea),* fox sedge *(Carex vulpinoidea),* shallow sedge *(Carex lurida),* jewelweed *(Impatiens capensis),* skunk cabbage *(Symplocarpus foetidus),* stickywilly *(Galium aparine*and Japanese stiltgrass *(Microstegium vimineum)*. Species of hydrophytic grasses (*Poa spp.)* were also consistently documented across the Bank Site.

Dominant indicators of hydric soils found include indicator F3, depleted matrix, and F6, redox dark surface.

6.4.2 Streams

Watercourses identified throughout the Bank Site are UNTs to East Branch Codorus Creek and are designated as CWF, MF waters per the PA Code; Title 25; Chapter 93.9a to 93.9z. Due to the presence of wetlands that serve as habitat for fauna or flora listed as "threatened" or "endangered" under the Endangered Species Act of 1973 (7 U.S.C.A. § 136; 16 U.S.C.A. § § 4601-9, 460k-1, 668dd, 715i, 715a, 1362, 1371, 1372, 1402 and 1531—1543), the waters are considered exceptional value (EV), as they may provide a source of hydrologic connectivity. The waters are listed as attaining for their aquatic life use designation per the Clean Water Act Section 305(b) reporting and Section 303(d) Integrated Streams List in PA. No existing use has been assigned for the waterbodies within the Bank Site. Waters onsite, while not classified as approved trout waters, do drain to the EBCC main stem, which is an approved trout waterbody, as well as a trout-stocked stream.

Figure 3: Existing Conditions Map (Appendix A: Figures), details the location of watercourses identified within the Bank Site. Table 4: Summary of Existing Resources provides a breakdown of the stream types and lengths within the Bank Site.

The main channel flowing southwest to northeast across the Bank Site is a perennial stream. As shown in Appendix C. Representative Site Photographs, watercourses identified within the Bank Site are significantly degraded. Streambank incision and erosion are evidenced throughout the length of the mainstem. Undercutting of trees and woody vegetation is evidenced along the actively eroding banks. These observations are supported by the preliminary bank erosion hazard data collected at the Bank Site.

6.5 Baseline Methodology

The Bank Sponsor conducted hydrologic, geomorphic, and habitat evaluations at the Bank Site to gain an understanding of the current state and functionality of the existing resources onsite. For the purposes of assessing baseline conditions across the spectrum of stream types onsite, baseline cross-section locations were installed at representative locations to qualitatively and quantitatively assess and monitor horizontal and vertical stability, erosion, habitat, hydrology,

geomorphology, vegetation, wildlife, and macroinvertebrate and fish communities. (Appendix A: Figures: Figure 11: Baseline Monitoring Location Map). The results of the baseline monitoring are summarized below and a summary table of the functions based on performance standards is provided in Appendix D: Baseline Data. All data was collected between September 2018 and March 2020. Please reference Appendix A: Figures: Figure 11: Baseline Monitoring Location Map for a visual depiction of cross-section locations and sampling points. Please reference Appendix D: Baseline Data for the results of baseline assessments and investigations.

6.5.1 BEHI

The Bank Sponsor used the Bank Erosion Hazard Index (BEHI) procedure to determine stream bank erosion conditions and potentials throughout the Bank Site. The BEHI procedure assigns point values to several aspects of bank condition and provides an overall score that can be used to inventory stream bank conditions and prioritize eroding banks for restorative action.

The BEHI assessments were completed at each of the seven baseline monitoring locations within the Bank Site (Appendix A: Figures, Figure 11: Baseline Monitoring Location Map). Preliminary results of the BEHI calculations indicate an average BEHI rating across the Project Site to be between 'High', meaning the bank conditions are poor and erosion potential is high. The high and very high erosion potential ratings that were observed can be attributed to low levels of vegetative stratum along stream banks, contributing to the siltation observed within the system. All but one stream reach scored a 'High' or greater BEHI rating. Reach 7, or XS7, had a BEHI rating of "Moderate" and exhibited better bank conditions and, therefore, a lower potential for excessive erosion.

6.5.2 LWD

Large-woody debris (LWD) indices were also collected at each of the seven baseline monitoring locations. Hedman et al. (1996) studied in-stream LWD loading for various riparian forest serai stages in the southern Appalachian Mountains. The results that generated from this study were used to compare LWD loading at the Bank Site to assess the degree of impairment at the selected baseline monitoring locations. Hedman et al. (1996) defined LWD as woody debris greater than 1.5 meters in length and greater than or equal to 10 centimeters (cm) in diameter. For accurate comparison, the previous definition was used for the assessment of LWD loading at the Bank Site. Channel widths were collected to calculate the approximate area of the channel. The collected LWD data and channel dimensions were then used to calculate the approximate LWD volume per channel area. Results show that LWD was negligible at all reaches, except for XS5. The lack of LWD presence negatively affects the vertical and horizontal stability, bed stability, habitat availability, and carbon retention for fish and macroinvertebrate habitat within the stream system.

6.5.3 Habitat and Stability Pebble Counts

Two methods of pebble counts were conducted separately to assess both streambed stability and habitat availability. Habitat pebble counts were conducted using a modified frame approach. Percent habitat type (riffles, runs and pools) were estimated visually to account for particle variability within each respective reach. One-hundred pebbles were collected within the wetted parameter at all seven cross sections within 100-meter sampling reaches based on the representative percent habitat type (Appendix A: Figures, Figure 11: Baseline Monitoring Location Map). Sampling was performed using an Environmental Protection Agency (EPA) approved sampling frame (Bunte and Abt, 2001). Stability pebble counts were conducted using the same modified frame approach. However, particles were collected from individual riffles to properly

assess bed stability. Data collected from the performed pebble counts were analyzed via cumulative frequency distributions, bed particle type distributions, and grain size analysis.

Habitat pebble count analyses show that the system is largely gravel dominated. However, higher percentages of cobble and silt/clay materials were also documented throughout. Stability pebble count data also shows that the system is largely gravel dominated and contains a notable presence of cobble as well. The stability pebble count data shows that riffle particles are highly mobile, likely a result of incision and high shear stresses, and ultimately a contributor to bed instability in the system.

6.5.4 Fish Community Survey

Semi-quantitative fish surveys were completed at the five proposed restoration baseline monitoring locations (XS1, XS2, XS3, XS6, and XS7) (Appendix A: Figures, Figure 11: Baseline Monitoring Location Map). Fish were collected using a backpack electrofishing unit and team of dip-netters. Semi-quantitative sampling efforts followed protocols established in *Wadeable Semi-Quantitative Fish Sampling Protocol for Streams* (PADEP, December 2013). Individuals were identified to the species level in the field and released upon proper identification. The collected data was utilized to calculate appropriate biological metrics, which included Species Richness, Percent Generalist, Percent Tolerant, Percent Insectivore, Percent Intermediate, Shannon's Diversity Index, and Shannon's Evenness Index. As demonstrated in the survey data provided in Appendix D: Baseline Data, and as discussed below, the preliminary fish community survey results suggest a moderate degree of impairment.

Species richness was relatively low across the Bank Site, ranging from no species at XS3 to eight (8) species at XS1. The average richness across the site is four (4) species. The number of individual fish observed through electrofishing efforts ranged from none at XS3 to 207 at XS6. Creek chub (*Semotilus atromaculatus)* and blacknose dace (*Rhinichthys atratulus*) were the dominant species observed site-wide and are considered pollution tolerant generalist species. The only pollutant intolerant species identified include the longnose dace (*Rhinichthys cataractae*, n=1) and the northern hog sucker (*Hypentelium nigricans*, n=5). These species make up less than one percent of the fish sampled. Although the resulting Shannon's Diversity and Shannon's Evenness indices indicate that the fish community is moderately diversity and even, the observed low species richness and dominance of pollutant tolerant, generalist species suggests that the fish community would benefit from improved in-stream and floodplain habitat.

6.5.5 Benthic Macroinvertebrate Sampling

Macroinvertebrate samples were collected at six (6) of the seven (7) baseline monitoring locations across the Bank Site (Appendix A: Figures, Figure 11: Baseline Monitoring Location Map). Protocols established by PADEP's *Bureau of Point and Non-Point Source Management* were used as guidelines for the macroinvertebrate sampling process. Bank Sponsor qualified biologists identified samples to the taxonomic rank of genus. The resulting data was used to calculate the index of biotic integrity (IBI) and aquatic life use attainment benchmarks, derived from the following metrics: Taxa Richness, EPT Richness (PTV 0-4), Beck's Biotic Index Version 3, Hilsenhoff Biotic Index, Shannon's Diversity Index, Percent Sensitive Individuals (PTV 0-3), BCG 123/BCG 456 Taxa, BCG 123/BCG 456 Individuals, Mayfly Taxa, and Mayfly Percent. Results from the macroinvertebrate sampling are provided in Appendix D: Baseline Data.

Table 5: Summary of Macroinvertebrate Sampling Results is provided below. As shown in the table, each sampling location failed to reach the designated life use attainment benchmark. Baseline monitoring locations that are non-attaining for the aquatic life designated use exhibit

higher quantities of pollution tolerant taxa and are dominated primarily by non-biting midges (*Diptera chironomidae*).

Table 5: Summary of Macroinvertebrate Sampling Results

XS ID	IBI Score	Attaining/Non-Attaining
XS1	35.38	Non-Attaining
XS2	27.89	Non-Attaining
XS3	26.07	Non-Attaining
XS4	N/A	Not Sampled[1]
XS5	62.62	Non-Attaining
XS6	35.38	Non-Attaining
XS7	63.68	Non-Attaining

Notes:
1. Reaches designated as Enhancement reaches are not sampled for macroinvertebrates.

6.5.6 Water Table Assessment

Continuous water level data loggers were deployed into subsurface monitoring wells at fourteen (14) monitoring stations to assess the baseline hydrology and water table fluctuations. Onset HOBO 30-Foot Depth Water Level Data Loggers (U20-001-01) were selected for this application and set to record continuous water level elevations at 30-minute intervals. Data collection is ongoing and will be provided as part of the final draft and final prospectus submittals.

6.6 Upland Assessment

The Bank Site is composed of a diverse upland mosaic, characteristic of the long history of active agricultural activities across central PA. Agricultural fields surrounding and partially within the Project area that were farmed at the turn of the century continue to be used to produce corn and soybeans, and for livestock grazing.

A review of the historic and current aerial mapping shows that some of the tributaries within the Bank Site have narrow riparian zones. However, due to the extent of historical and ongoing landscape and stream degradation coupled with the fragmented land position, these riparian zones generally contain a monoculture of two species including black walnut (*Juglans nigra*) and spicebush (*Lindera benzoin*). An ample presence of invasive species including honeysuckle (*Lonicera morrowii*), multi-flora rose (*Rosa multiflora*), Japanese stiltgrass (*Microstegium vimineum)*, Japanese knotweed (*Fallopia japonica*), and Japanese barberry (*Berberis thunbergii*) inhibit natural native regeneration. Canopy cover is variable, ranging between 60 and 90 percent cover. Small pockets of hawthorne (*Crataegus Spp.*) and red maple (*Acer rubrum*) are present, but these species are not dominant across the Project area.

6.7 Threatened and Endangered Species

A PA Natural Diversity Index Environmental Review (PNDI) was completed on February 7, 2020. PNDI records indicate that there are potential impacts to a sensitive species under the jurisdiction of the PA Fish and Boat Commission (PFBC) and the U.S. Fish and Wildlife Service (USFWS). Coordination with these agencies has been initiated and is ongoing. Final correspondence including clearance letters and any special conditions to address impacts to sensitive species and their habitat will be included in Appendix F: Jurisdictional Agency Coordination, upon receipt.

6.8 Cultural Resources

The Bank Sponsor will initiate consultation with the PA Historical Museum Commission (PHMC) Bureau of Historic Preservation (BHP) to determine the potential presence of historic and archaeological resources that may be present within the Bank Site. The Bank Sponsor does not anticipate adverse impacts to historic and archaeological resources as a result of the Project. The final clearance letter will be provided to the IRT upon receipt and will be appended to this MSP as part of Appendix F: Jurisdictional Agency Coordination.

7.0 Determination of Stream and Wetland Credits

The crediting totals based upon the USACE-sponsored Ratio Model are included in Table 6: Crediting Summary Tables, below. The Bank Site proposes to restore the resource types in the amounts described as shown in Table 6: Crediting Summary Tables. Impact calculations are also provided in Table 6: Crediting Summary Tables. Locations of the anticipated impacts are shown in Figure 12: Impact Location Map (Appendix A: Figures). The Bank ledger is provided as Appendix G: Bank Ledger.

Hydrologic, geomorphic, geotechnical, and biological data were collected at the Bank Site and assessed to develop measures of condition differential and complete functional crediting calculations based on identified causes of degradation and the proposed restoration design. Indices from these data were used to calculate a crediting strategy based on the PADEP Aquatic Resource Compensation Protocol Riverine and Wetland Rapid Assessments (Compensation Protocol) and are provided in Appendix D: Baseline Data.

The Resource Development Map ("RDM"), which shows each stream and wetland compensation strategy, is provided in Appendix A: Figures, Figure 10: Resource Development Map.

The following section provides a description of the physical work proposed to deliver functional gain. Appendix H: Design Plans provides additional information.

Table 6: Crediting Summary Tables[1, 2, 3]

Wetland Restoration Summary[1]

Resource Type		Existing (AC)	Proposed (AC)	Net Change
Bank Site		78.78	78.78	-
Uplands		58.93	45.08	(13.85)
Wetlands	PEM	17.09	19.99	2.90
	PSS	0.09	-	(0.09)
	PFO	-	11.45	11.45
Totals		**17.18**	**31.44**	**14.26**

Projected Wetland Crediting Summary[2]

Restoration Approach	Restored Resources (AC)	Ratio (x:x)	Credits Generated
Reestablishment	14.38	1:1	14.38
Rehabilitation	2.14	1:1.5	1.43
Enhancement	14.92	1:2.5	5.97
Permanent Impacts[4]	(0.12)	1:1	(0.12)
Totals	**31.44**	**-**	**21.66**

Wetland Impact Summary[3]

Impact Type	Impact (AC)
Temporary	2.15
Permanent	0.12
Total	**2.27**

Notes:
1. Existing and restored resource calculations account for stream lengths and wetland acreages within the easement but do not account for lengths and acreages that traverse across the Reserved Rights areas.
2. Credit calculations do not include resource calculations for stream lengths and wetland acreages that traverse across the Reserved Rights areas.
3. Impact calculations include stream lengths and wetland acreages that traverse the Reserved Rights areas.
4. Permanently impacted wetland acreages are not calculated as part of the 'Restored Resources' but have been accounted for in the 'Credits Generated' calculations.

Stream Restoration Summary[1]

Resource Type		Existing (AC / LF)	Restoration Approach	Proposed (AC / LF)	Net Change
Streams	Perennial	15,300.72	Restoration	13,106.02	1,484.74
			Rehabilitation	1,940.15	
			Enhancement	1,739.29	
	Intermittent	825.98	Restoration	817.82	568.25
			Rehabilitation	250.59	
			Enhancement	325.82	
	Ephemeral	521.47	Restoration	-	(267.58)
			Rehabilitation	140.76	
			Enhancement	113.13	
Totals		**16,648.17**	Restoration	**13,923.84**	**1,785.41**
			Rehabilitation	**2,331.50**	
			Enhancement	**2,178.24**	
			-	**18,433.58**	

Projected Stream Crediting Summary[2]

Resource Type		Restoration Approach	Restored Resources (LF)	Ratio (x:x)	Credits Generated
Streams	Perennial	Restoration	13,106.02	1:1	13,106.02
		Rehabilitation	1,940.15	1:1.5	1,293.43
		Enhancement	1,739.29	1:2.5	695.72
	Intermittent	Restoration	817.82	1:1	817.82
		Rehabilitation	250.59	1:1.5	167.06
		Enhancement	325.82	1:2.5	130.33
	Ephemeral	Restoration	140.76	1:1.5	93.84
		Enhancement	113.13	1:2.5	45.25
Totals		**Restoration**	**13,923.84**	1:1	**13,923.84**
		Rehabilitation	**2,331.50**	1:1.5	**1,554.33**
		Enhancement	**2,178.24**	1:2.5	**871.30**
		-	**18,433.58**	-	**16,349.47**

Stream Impact Summary[3]

Impact Type	Impact (LF)
Temporary	2,378.89
Permanent Beneficial	12,605.58
Total	**14,984.47**

8.0 Mitigation Work Plan

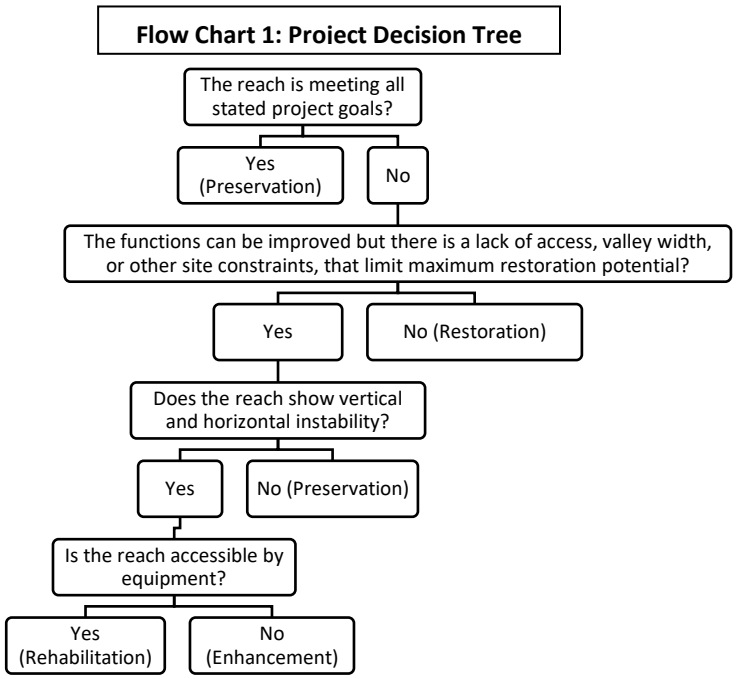
The Bank Site uses a watershed-scale restoration approach to optimize the functional ecological uplift to the existing onsite resources. The Bank Site proposes to reestablish an integrated stream and wetland complex to restore localized groundwater aquifers and reconnect floodplains to the water table and streams. This approach optimizes and diversifies habitat and creates a hydrologic system that allows for the retention of nutrients, stream bed material, and organic carbon, such as leaves and twigs. This design approach will provide the basis for the continued evolution of ecological complexity and long-term stability at the Bank Site. In accordance with the PSUMBI, the Design Plan for the Bank Site is attached as Appendix H: Design Plans.

8.1 Determination of Restoration Designations & Approaches

Best professional judgment, experience, and data driven decision-making were used for determining restoration approaches across the Bank Site. All streams were assigned a restoration approach based upon the degree of impairment and following the decision tree listed below. Table 7: Stream Restoration Approach by Monitoring Location summarizes the results of the data driven decision-making process in relation to the restoration designation for data-sampled reaches within the Bank Site.

Table 7: Stream Restoration Approach by Monitoring Location

Baseline Monitoring Location	Proposed Restoration Approach
XS1	Restoration
XS2	Restoration
XS3	Restoration
XS4	Enhancement
XS5	Rehabilitation
XS6	Restoration
XS7	Restoration



8.2 Stream Restoration Reaches

Full-extent stream restoration efforts will utilize a combination of channel relocation, floodplain grading, and subsurface grade control and habitat structures. The restoration of the channel pattern and floodplain will promote the spread of high flow events through the reconnected floodplain and dissipate the kinetic energy that frequently mobilizes bed and bank substrate. Subsurface log and rock structures will be used to establish grade control and ensure long-term vertical bed stability. These structures will promote the reestablishment of bed material, which in combination with lowering the floodplain and raising the invert of the channel bed will allow water to more frequently access the adjacent floodplains. Floodplain restoration efforts will improve hydrologic connectivity, water storage capacity, and biogeochemical cycling through the reestablishment of the hyporheic zone. Full-extent stream restoration design parameters will ensure that the stream and floodplain have stable profiles throughout the entire Bank Site.

The goal of the full-extent stream restoration approach is to enable the stream corridor to recover to a functioning and self-sustaining system. The proposed floodplain restoration technique as this section describes is designed to restore the stream at or near its original elevation by removing the accumulated sediment that sits atop the historic floodplain layer. In different locations at the Bank Site, the floodplains will be cut down to reduce shear stresses while keeping the stream at or near the gravel layers throughout valley bottom. In other areas, the floodplain design will raise the streambed up to an elevation where field indicators show the valley floodplain was historically at, or to keep an overall stable profile while transitioning across existing driveways and access paths. Appropriate sinuosity will be given during the full-extent stream restoration process. These restoration activities will result in a system characterized by a stable channel with low shear stresses under normal and frequent storm events with a high degree of stream and floodplain interaction.

The goal of the design in full-extent stream restoration reaches is to keep shear stresses within the floodplain below 2.5 pounds per square foot (lbs/sf) during 100-year return internal (RI) storm events, and shear stresses within the channel below 1.5 lbs/sf during 100-year RI storm events. These target parameters are based off stability criteria as presented in the peer-reviewed published article *Stability Thresholds for Stream Restoration Materials* (Fischenich, 2001). Designing to these parameters optimizes the stability of the epifaunal substrate within the stream and promotes the long-term stability of the floodplain. In the future, ruts may form within the floodplain during high magnitude storm events, and secondary channels may even form within the floodplain, however these evolutions are not anticipated to threaten the stability or functional value of the restored system, but rather, increase the ecological complexity and functional values offered at the Bank Site.

Transitional stream restorations are proposed between the restored floodplain and the smaller contributing tributaries through all stream restoration reaches. Transitional stream restorations ensure that the tributaries confluence into the main reaches with a stable pattern and profile, and at times will require "running" the tributary either up or down the valley to increase the length of its profile, thereby reducing its slope and shear stresses.

Full-extent stream restoration reaches were designated based on reach characteristics including extent of degradation, exhibiting significant bank erosion, vertical incision, and floodplain disconnection. The streams designated for full-extent restoration represent those that have experienced the greatest degree of degradation. Streams proposed for full-extent stream restoration include the entire length of the mainstem within the Bank Site and portions of side tributaries as shown in Figure 10: Resource Development Map (Attachment A: Figures).

In general, full-extent stream restoration reaches are entrenched streams exhibiting disconnected floodplains that that are not capable of surface water (channel bed) and/or groundwater interaction. In most locations, several vertical feet separate the bed of the stream from the top of the bank. High flows continue to scour the exposed stream banks, further increasing erosion, excessive meandering and overall stream instability. This entrenched condition was caused by a combination of intentional anthropogenic stream movement (relocation) to clear more areas for agriculture and was then further exacerbated by the high shear stress created under the modified conditions. As can be seen from the existing shear stress modeling, the mainstem channel experiences shear stresses between 2.5 and greater than 3.50 lbs/sf under the 2, 10, and 100-year storm events in several locations, respectively. These conditions create continued vertical and horizontal instability in the full-extent stream restoration reaches under their current conditions. As a result, riparian areas and floodplain wetlands, where present, are now composed of accumulated fine sediments deposited from surface water runoff from the surrounding landscape.

One key to maintaining or restoring channel stability is to prevent the incision of the channel bed and erosion of the streambanks. While the stream bed elevation is determined by the balance between sediment supply and sediment transport capacity, streambank stability requires that the applied shear stress remain below erosive levels. These erosive levels are quantified by the soil critical shear stress.

The mainstem channel within the Bank Site, which experiences high shear stresses and flashy flows from increased rates of runoff, (Appendix H: Design Plans, Sheets S100-S111), is an incised channel exhibited by steep, vertical banks, disconnected floodplains, altered groundwater hydrology, and dry riparian zones. The incised channel is currently in an over-widening phase as active erosion caused by fluvial processes and high shear stresses have left the stream banks highly exposed. Yearly freeze-thaw cycles and the influence of needle ice on the exposed vertical stream banks contribute to erosion and downstream sedimentation.

Sediment stored in the valley bottom that now covers the historic hydric layer was established by the effect of increased sediment supply from surrounding uplands. The valley fill surfaces and associated stream incision produced from sediment accumulation and increased runoff can readily be seen in photos 1 and 2 below. Photo 1 demonstrates the accumulating layers of sediment atop the historic floodplain layer. The top brown-colored layer represents the new floodplain, which sits above a second darker gray layer. This second layer is the historic hydric layer. And finally, the bottom lighter gray layer represents the gravel/cobble layer. The groundwater table and stream bed should otherwise sit at the top of this bottom layer, but due to degradation occurring throughout the system, the stream has vertically incised and now exists below the groundwater table. Because the groundwater table is below the surface water elevation, the hyporheic zone within the floodplain is drained, which explains the sporadic presence of floodplain wetlands within and across the valley bottom.

Photographs 2 demonstrates the extent of the vertical and lateral erosion occurring within the Bank Site. The stream was pushed to the valley side slope and began to erode into the hill. The height of the bank at this location is approximately four feet. Piping of groundwater within the water table layer (the layer below the historic hydric/floodplain layer) is also evidence of the accumulation of sediment over time. Trees that once grew comfortably along stream banks now either slough into the stream channel, or are approaching that condition as the banks continue to erode from underneath them, as shown in Photo 3. The bank has eroded back approximately

five feet from where it once stood. The stream bed has also vertically incised upwards of two half feet from where its elevation once existed.

Photo 1. Photo evidence of legacy sediment accumulation and streambank incision. The groundwater table is above the surface water. This is evidenced by the leaching of groundwater through the historic hydric layer above the elevation of the stream.

Photo 2: Photo evidence of the eroded bank into the valley side slope due to relocation, sediment covered stream bottom and historic hydric and gravel layers covered by sediment accumulation from surrounding upland hillslopes.

Photo 3. The above photo demonstrates how lateral and horizontal movement of the stream has caused severe undercutting of the tree.

With the existing extent of aggregation of sediments, the lack of floodplain connectivity, the continued vertical and horizontal erosion, the entire length of the mainstem within the Project will be relocated within the valley floodplain. Floodplains will be excavated to the gravel layers and the stream bottom will be stabilized with subsurface log and rock structures, such that the result is a stream system that no longer transports sediment, but rather moves as little sediment as possible. Placement of log and rock structures will not only provide stability, but in some locations, these structures will raise the stream bed elevation to natural historic elevations, restore the hyporheic zone and reconnect the streambed with the hydric soils layers as identified during the geotechnical surveys.

This approach to removing accumulated fine-grained sediments is the sustainable approach for the Project Site. Following accumulated floodplain sediment removal, rapid planting of native flora along the stream banks and re-established floodplain is necessary because weedy species are more likely to colonize the disturbed environment first, excluding the native riparian vegetation and decreasing ecosystem function and riparian zone restoration success. Furthermore, removal of the accumulated floodplain sediments and the re-establishment of native species in the riparian zone will decrease the amount of sediment eroded and transported to downstream areas.

The grading plan as shown in Appendix H: Design Plans was completed in conjunction with the data analyses from the existing and proposed 2D modeling results. As indicated previously, the current shear stress modeling shows high shear stress in many locations throughout the Bank Site. Degradation due to flashy flows and high shear stresses will be significantly reduced once the restoration is complete.

The result will be a restored floodplain system that is not only completely accessible during a two-year storm event, but one that will be accessible during less than a two-year storm event. Based on the proposed design, shear stresses along the mainstem will be kept below two lbs/sf within the floodplain. Under the 100-year RI event, shear stresses on the floodplain increase between two and three lbs/sf in most locations, and up to four lbs./sq. ft. in isolated locations. The shear stresses in the channel are kept very low, meaning the epifaunal substrate remains stable, even

under a 100-year storm event. Slight rutting within the floodplain under these larger magnitude storm events may occur, however the cross-valley grade control structures provide vertical grade control and will prevent headcuts from forming and moving up through the stream system. This will prevent the stream system from incising in the future.

The cross-valley grade control structures shown throughout the restored floodplain serve multiple purposes. As noted above, they provide vertical grade control, and ensure that headcuts do not form and move upstream under high magnitude storm events. These structures also help to restore the hyporheic zone aquifer within the valley's gravel layer. The log structures are set on bedrock or another impermeable surface (splash logs) and extend all the way across the valley bottom. The invert of the log structures establishes the elevation of the stream bed. In general, the logs used for these structures are 12 to 18 inches in diameter, so they help retain water through that depth of the gravel layer. Restoring the stream to the top of the gravel layer means that water from the stream is flowing into and recharging the gravel layer, rather than the stream draining the gravel layer. The cross-valley grade controls help hold water in the hyporheic zone during low flow conditions, and by raising the bed, there is room for pools to form over the bedrock in the systems. These pools serve as areas where stream flow can exchange with groundwater flow moving through the hyporheic zone. Re-meandering the stream through the valley bottom also increases stream and hyporheic zone exchange.

In-stream structures will be used to provide additional habitat and keep sheer stresses in the center of the channel away from the cut bank. These will be woody habitat structures installed in both the stream and the floodplain to create additional roughness within the floodplain, while also creating in-stream and terrestrial habitat. Woody material that is too small to be used for the sub-surface grade control structures will be cut on-site during the grading process.

In summary, the full-extent stream restoration design approach will improve channel stability and increase floodplain connection and continuity. The design will promote the stabilization of bed sediment and provide habitat for aquatic communities. In addition, restoration efforts will enhance LWD and fine carbon retention, providing additional food sources and unique niches that will promote the further enhancement of aquatic biological communities. The reestablishment of stream habitat and floodplain diversity will also provide new habitat for amphibians and terrestrial organisms and aid in the reestablishment of historic wetland plant communities. Furthermore, floodplain restoration efforts will improve hydrologic connectivity, water storage capacity, and biogeochemical cycling through the reestablishment of the hyporheic zone.

8.3 Stream Rehabilitation Reaches

Rehabilitation reaches are identified in Figure 10: Resource Development Map (Appendix A: Figures). The rehabilitation approach will involve establishing geological and hydrologically stable conditions that support the surrounding natural ecosystem mosaic.

Streams proposed for rehabilitation tend to have constrained valleys, steeper valley slopes, and are located more towards the upper headwater reaches of the system. These systems have stream and floodplain interaction, mainly since they are 'A' type valleys, and have an overall small size to the valley bottom. They show high shear stresses through observation metrics. Primarily, the evidence suggests frequent gravel and cobble mobilization, little carbon retention, a lower amount of LWD than reference conditions, and impaired macro-invertebrate communities based upon the IBI scores. The BEHI scores in these areas are high, and there are several instances of the stream banks eroding into the valley wall, although not at the magnitude of the relocation reaches.

These areas have likely been anthropogenically altered through the removal of LWD that would have been in the stream to encourage faster drainage and flow, along with headcuts caused by slope changes from the relocation of the main stem or downstream tributaries. At the same time, the uplands have been cleared or recently forested, reducing the carbon and woody debris inputs into the streams. These influences have created high shear stress environments that perpetuate the evacuation of what large larger woody debris there is, along with fine carbon material, and epifaunal substrates.

The restoration approach in these reaches involves the installation of in-stream structures, which will improve epifaunal substrate stability and retention, retain more carbon, reduce bank erosion, increase LWD within the system. Log sills, log vanes, steep channel jams, toe wood, and stick ups will be used through these reaches. The stick ups will be incorporated with and between the other rehabilitation structures to serve as anchor points for finer carbon material within the system, holding small twigs and branches during storm events.

Small to mid-sized track hoes will be used to install all structures in these areas and must travel through the stream valley bottoms during construction. Pump- or pipe-arounds will be used to keep the work areas dry where possible and all erosion and sediment control activities will be approved under the project's approved NPDES permit. Where feasible, track matting will be used while traversing the stream valley bottom to reduce impacts to existing resources through these areas.

Wood used in these areas is anticipated to be harvested from the immediately adjacent forested areas. In general, one tree, approximately eight to nine inches DBH will be installed per 100 lf of structures and habitat wood. A higher density of tree enhancement plantings is proposed in the areas where harvesting will occur.

8.4 Stream Enhancement Reaches

Stream enhancement activities will focus on the addition of LWD, invasive species control, and native seed and woody vegetative plantings. These efforts will promote improved fine carbon retention and create a healthier adjacent riparian buffer. Herbaceous and woody enhancement plantings are planned along all areas proposed for restoration.

Stream enhancement reaches are characterized as reaches that lack habitat elements such as LWD or that contain invasive species along the stream banks but do not exhibit significant vertical/horizontal instability or floodplain disconnection. Stream reaches proposed for enhancement have a similar geomorphic profile to the rehabilitation reaches but have not seen the same extent of degradation due to surrounding land uses. Generally, the enhancement reaches are located within the mature forested areas where the stream systems have more carbon and LWD inputs. While these systems are further along in the natural restoration process, they are still below the regional reference levels for LWD; are beginning to develop headcut formations that move upstream through the system; and in some areas banks are experiencing erosion and overall instability issues.

The restoration activities within the enhancement reaches will primarily be conducted by human labor. This will include the installation of live stakes, fascine bioengineering along eroding banks, tree plantings, and a specialized riparian seed mix based on reference native communities within the Bank Site. Activities will also include the addition of LWD and smaller woody debris to the stream. The goal will be to increase LWD to levels closer to the regional references, while also restoring woody species for the future recruitment of additional LWD. LWD will improve in-stream habitat, create riffle/pool sequences and increase micro-topography within the system. The

riparian area surrounding the enhancement reaches, in which the size and width is dictated by the easement boundary, will have supplemental plantings for the tree, shrub and herbaceous layers. The stream banks will be planted with live-stakes, and bank grading or bioengineering will be used in any areas of significant bank instability greater than one foot. Supplemental native riparian vegetation will reinforce the soil and provide an important safeguard against erosion and bank collapse. These stream enhancement techniques are anticipated to address stream erosion and degradation potential in the future, as they hold soil particles together to increase bank stability, increase hydraulic resistance to flow and reduce local velocities in small channels, act as a buffer against hydraulic forces and abrasive effect of transported materials, induce sediment deposition, and redirect flow away from the bank. Habitat structures in the form of debris piles will also be installed along the enhancement reaches. Herbaceous and woody enhancement plantings are planned along all areas proposed for restoration.

8.5 Wetland Restoration

Wetland restoration activities will focus on restoring stream and floodplain connectivity throughout the mainstem tributary floodplain valley bottoms, resulting in the reestablishment of a dynamic stream and wetland complex that maximizes groundwater recharge and capture, habitat diversity, carbon and nitrogen cycling, and long-term system stability.

Most of the wetlands identified within the Bank Site are either located adjacent to or abutting the stream channels. Many wetlands originating at spring seeps were also identified within the Bank Site. A large percentage of the wetlands identified within the Bank Site are classified as PEM wetlands and are comprised predominantly of emergent vegetation with minimal tree and shrub cover characteristic of the upland species rooted outside of the wetland boundaries.

As previously mentioned, historic alterations including selective tree clearing, removal of native vegetation and planting of non-native pasture grasses within the floodplains and side slopes of the tributaries, in addition to historic land uses including pasture use within the floodplains has resulted in an adversely impacted headwater site. The degradation to the Bank Site has resulted in a lowered elevation of the groundwater table and draining of the hyporheic zone, which has decreased the availability of wetland hydrology in riparian areas along the main tributaries. The presence of these degraded wetlands presents a valuable opportunity to elevate the function and holistic benefit of the Bank Site's overall restoration and conservation value.

The excavation involved with creating a more natural stream channel and floodplain results in the immediate removal of invasive species on the site, and as such the wetland restoration process will capitalize on furthered diligent invasive species management and replanting efforts. These efforts will focus on replacing invasive and non-native species with tolerant, native shrub and tree plantings. The post-construction planting of native vegetation along the stream corridor discourages the re-establishment of invasive, non-native vegetation.

The wetland enhancement areas will require initial weed controls which will be conducted either early or late in the growing season, while native species are dormant, with mowing and/or chemical herbicide to control non-native and/or invasive species. After this initial treatment, spot spraying and follow-up control will be completed on an as-needed basis. Invasive shrub species will be cut, and the cut stumps treated with a dicot specific chemical herbicide applied directly to the cut surface. Follow-up control will be applied in a similar manner, again with a dicot-specific chemical herbicide. After the initial weed control efforts, the site will be prepared for planting. A variety of large and small native trees and shrubs will be installed in the wetland enhancement areas and they will be seeded with a native seed mix. Trees and shrubs will be planted per their hydrologic needs and adaptability, with trees and shrubs that are able to tolerate wetter

conditions installed in and around the lower gradient areas and more facultative species installed within the slightly higher wetland areas.

The nutrient-rich topsoil excavated from the Bank Site will be recycled back into farming practices. Excavated material will be returned to the uplands where it originated. These areas are either existing hay fields, which will continue to function as such, or for areas within the restoration easement, the spoil areas will be restored with native meadow plant communities and woody vegetation, which will create a highly variable spectrum of biological gradients across the valley profile. The profiles will vary from the stream, to the restored wetland floodplains, into early successional meadow and forested habitat, and finally into more mature secondary successional woodlands of varying quality across the Bank Site.

8.6 Upland Restoration Sequence

Upland restoration efforts based on proposed conditions are summarized in Table 8: Upland Restoration Activities. The table details restoration types and proposed activities.

Table 8: Upland Restoration Activities

Restoration Approach	Activities
Preservation	None
Enhancement	Upland invasive control
	Seeding
Restoration	Grading, seeding, and planting
	Upland invasive control

The restoration of the upland areas at the bank Site is driven by both the condition of the upland areas, along with the condition of the aquatic resources in that area. Upland forests in a healthy mid-successional forested state will be immediately preserved, allowing them to mature into high quality upland resources, providing important habitat for terrestrial/avian species while also supporting aquatic resource functions.

Enhancement uplands within the Bank Site contain invasive species and/or exist in a low-quality state. Invasive species control and installation of supplemental plantings will be the primary focus within these areas.

Upland restoration areas are generally located along the edge of the proposed floodplain grading corridors and/or as existing pasture. Soil excavated from the valley bottom during the floodplain restoration will be returned to the valley side slopes from where much of it originated. Existing trees falling within proposed grading extents will be harvested and re-used for sub-surface grade control and/or habitat structures. These areas will be seeded and replanted. Selected trees may be left standing but girdled and buried around the base to create standing snags, increasing the immediate post restoration habitat diversity and vertical heterogeneity within the restored uplands. Planting these restored valley side slopes with native prairie grasses will increase groundwater infiltration during storm events over the existing pasture habitat, create high quality grassland habitat, and provide valuable wildlife habitat for early successional species like the golden winged warbler (*Vermivora chrysoptera*) while the planted tree species mature. Areas currently existing as pasture will receive invasive species control and high-density woody plantings.

8.7 Potential Expansion Areas

The Bank Sponsor is currently investigating two Bank Site expansion areas as shown in Figure 13: Potential Expansion Area Map (Appendix A: Figures). Landowner negotiations within these

areas is ongoing. Both Expansion Areas A and B consist of active cattle grazing and exhibit extensive resource degradation. Varying levels of baseline data and design are provided as part of this MSP. While delineation data for Expansion Area B was collected in 2018, no delineation has been completed for Expansion area A. Preliminary design plans are provided for Expansion Area B, however no design plans are provided for Expansion Area A. As landowner negotiations continue, the Bank Sponsor will determine whether these areas can be included as part of the final MSP. Table 9: Preliminary Expansion Area Resource Summary Table below provides a breakdown of the estimated resources and the potential crediting for both expansion areas. Totals are in addition to the proposed calculations provided in Table 6: Credit Summary Tables. These calculations are not incorporated into the crediting summary tables, credit ledgers or functional calculations.

Table 9: Preliminary Expansion Area Resource Summary Table[1]

Expansion Area	Resource	Existing Amount	Mitigation Approach	Crediting Ratio	Credits Generated
A[2]	Streams (LF)	4,810.85	Restoration	1	4,810.85
	Wetlands (AC)	2.64			2.64
B[3]	Streams (LF)	2,764.54	Rehabilitation	1.5	1,382.27
	Wetlands (AC)	7.47			3.74
Totals	**Streams (LF)**	**7,575.39**	**-**		**6,193.12**
	Wetlands (AC)	**10.11**	**-**		**6.38**

Notes:

1. Landowner negotiations are ongoing.
2. No delineation has been performed as part of Expansion Area A. All calculations are estimates based on desktop analyses and preliminary design.
3. Delineations were performed in 2017. Calculations are preliminarily based on these data in conjunction with desktop analyses. Stream and wetland credits are generated from existing delineations, as such, restoration work is averaged using the rehabilitation crediting ratio. No design has been proposed for Expansion Area B at this time.

9.0 Maintenance Plan

Per Section VI. Maintenance and Monitoring of the Bank of the PSUMBI, the Bank Sponsor will perform all necessary work to maintain the Bank Site consistent with the maintenance plan criteria outlined in this MSP. The Bank Sponsor will perform all necessary maintenance and monitoring to ensure the continued viability of the Bank Site once initial construction is complete. Maintenance activities will continue through completion of the monitoring period as described in Exhibit B of the PSUMBI. Monitoring will occur until all released credits have been sold or until the Bank has been closed-out and is in the responsibility of the Long-Term Steward. The Long-Term Steward will be responsible for monitoring and maintaining the Bank Site as described in Section 13.0 Long-Term Management Plan. At Bank Site closure, the Bank Sponsor will remain responsible for long term maintenance and management activities until a Long-Term Steward is identified. The Bank Sponsor will also be responsible for maintenance and monitoring activities during the interim maintenance and monitoring period, if applicable.

The need to perform maintenance will be assessed in the monitoring reports and during monitoring site visits, and if deemed necessary by the Bank Sponsor or the IRT, the appropriate required maintenance will be conducted.

Routine maintenance activities will be conducted at the Bank Site to ensure continued viability of from the time of Bank approval through Bank Closure. Maintenance activities will be conducted to include at minimum, yearly inspections of all mitigation areas. Maintenance and monitoring crews will assess the Bank Site to ensure no trespass, vandalism, dumping, or trash accumulations occur. Crews will be responsible for posting and repairing any damaged signage, and where applicable, maintain and repair fencing, gates, and in-stream structures. Maintenance activities will also include supplemental planting efforts and invasive species management if and where necessary, as detailed below. As shown in Table 10: Invasive Species Management Timeline, crews will be onsite multiple times a year for the first three years, and at minimum annually until Bank Site close-out. Crews will primarily focus on invasive species management, however additional observations and activities (as indicated above) will be noted and addressed as necessary.

Invasive species management is a key component of the Maintenance Plan. The control of invasive species and the promotion of the native plant community have many ecological, physical and chemical benefits that will result in highly functional wetland and stream ecosystems. Some of these benefits include habitat and food sources for wildlife, natural erosion and flood control, and active nutrient cycling and temperature regulation, all of which will benefit water quality.

Intense maintenance will occur during the first three years of establishment. This maintenance will involve a combination of species-specific mechanical and chemical weed control to support the establishment of a diverse herbaceous native plant community while controlling invasive species on site.

Mechanical control will involve mowing, trimming or cutting of invasive or undesirable annual species to prevent these species from setting seed and to allow light filtration for developing herbaceous material, trees and shrubs. Two or more timed mowing events are expected to be needed during the first three years of establishment to promote the establishment of a healthy community of perennial herbaceous species that will be resistant to re-colonization of annual invasive species. Once established, these stands are resistant to re-colonization by annual invasive species and greatly reduce maintenance requirements for the Bank Site in the future.

Chemical control methods will be needed for highly aggressive invasive species that grow rhizomatously, disperse large quantities of seed, and/or are generally resistant to most methods of mechanical weed control. There are several different methods for chemical application, all of which require the use of the proper herbicide. Aquatic-approved herbicides will be used in wetland areas. When possible, a dicot-, monocot-, or family-specific herbicide will be used to target specific invasive species. This will allow native species to continue to grow and establish in those areas, creating more competition and reducing the invasive species' ability to re-colonize. Additionally, the invasive species to be managed on site are active earlier and later in the year than native species, as they are cold weather adapted. This allows for herbicide application to be conducted before native species have propagated and/or budded out in spring and after they have gone dormant in fall, further reducing any negative impacts to native species in those areas. A general invasive species management table has been provided below. As these are dynamic systems, maintenance activities will be modified as needed on a yearly basis to best suit the Bank Site's needs. Yearly maintenance activities and proposed activities for future years are discussed

in yearly monitoring reports. The following table illustrates the general invasive species management timeline.

Table 10: Invasive Species Management Timeline[1]			
Year	**Season**	**Mechanical**	**Chemical**
Years 1 and 2	Winter	Cut and paint stump control on woody invasive material	
	Spring	Late spring mowing	Early season weed control
	Summer	Early summer mowing/trimming as needed	
	Fall	Late fall mowing, if needed	Late-season weed control
Year 3	Winter	Cut and paint stump control on woody invasive material, if needed	
	Spring	Spot mowing or trimming, if needed	Early season weed control
	Summer	Trimming, if needed	
	Fall	Spot mowing or trimming, if needed	Late-season weed control
Year 4	Winter		
	Spring		Early season weed control
	Summer		
	Fall		Late-season weed control
Year 5+	Winter	Species-specific maintenance conducted on an as-needed basis	
	Spring		
	Summer		
	Fall		

Note:
1. Each invasive species maintenance event will also serve as a site inspection event to assess conditions and conduct additional maintenance activities as needed across the larger Bank Site.

If properly maintained and managed, maintenance requirements drastically drop off between years four and five, mainly requiring one to two events a year that are highly targeted to specific areas and species. Upon Bank Closure, all terms and conditions set forth in the Long-Term Management Plan, described in Section 13: Long-Term Management Plan will take effect.

Maintenance for streams should require little to no work as the streams are designed to be self-sufficient. The stream restoration is designed to reduce shear stresses that occur within the channel and floodplain, and with the implementation of sub-surface grade control structures, vertical and horizontal stream instability at the Bank Site decreases. The sub-surface grade control structures reduce vertical incision because the structures are placed on bedrock or are stacked with a splash log on the downstream end, inhibiting vertical movement. Additionally, because the structures extend all the way across the floodplain, the channel cannot cut around the structures, even if it were to completely shift its location horizontally.

Reduced shear stresses significantly reduce the likelihood of horizontal instability. If an extreme storm event occurred (greater than 100-year RI), and the stream did move horizontally, there would still be minimal risk of vertical incision or stream impairment because of the presence of the sub-surface grade control structures that extend across the valley floodplain.

During the maintenance and monitoring period of the Bank Site, streams will be monitored annually. Stream monitoring, as detailed in Table 12: Monitoring Requirements, will encompass longitudinal and cross section profiles, grade control structure surveys, stream elevation monitoring, pebble counts and BEHI assessments. If during the monitoring event, it appears the stream is not within acceptable design parameters, and if the results indicate failure to achieve performance standards, the Bank Sponsor will evaluate the failure and implement a maintenance activity or conduct remedial work to correct the deficiency.

Please refer to Section 11.0 Monitoring Requirements, Section 13.0 Long-Term Management Plan and Section 14.0 Adaptive Management Plan for additional discussions related to monitoring requirements and overall stream stability maintenance and management.

10.0 Performance Standards

In accordance with both standards developed in PSUMBI and commentary from the IRT, the performance standards for the Bank Site have been developed with consideration to site-specific features of the Bank Site and are outlined in Table 11: Performance Standards and Percent Credit Release by Stage. The proposed performance standards follow guidance received from the CELRP and take into consideration the design approaches proposed and level of work, type of resource and key indicators of functions or features desired. Of note, LWD performance standards were added to address the retention of organic debris, and a pebble distribution change performance standard was added to address and ensure limited bedload transport.

Table 11: Performance Standards and Percent Credit Release by Stage[1]

Activity/ Monitoring Type	PADEP Classification[2,*]	Credit Release Milestones				
		15% Administrative Credit Release Objectives	**15% Construction Credit Release Objectives**	**Stage 1: Credit Release Performance Standards 35 % for Streams 25% for Wetlands**	**Stage 2: Credit Release Performance Standards 25% for Streams 25% for Wetlands**	**Stage 3: Credit Release Performance Standards 10% for Streams 20% for Wetlands**
Streams (Restoration, Rehabilitation, Enhancement*)	RS1, BGC1, HAB1	- Approval of MSP - Issuance of Corps Permit - Implementation of Financial Assurances[5] - Recordation of Site Protection Instrument	- Completion of construction and As-Built approval	- At least ten live stems per 50 linear feet per bank monitoring plot - BEHI of "Low" or "Very Low" - Sinuosity of stream does not increase or decrease by more than 20% from approved as-built pattern within the monitoring reach - D50 particle size remains in the same size class as the approved As-Built[3] - Channel access to floodplain a minimum of once during Stage 1 - No visual instability noted at any structure locations - Minimum 25% increase in pre-construction large woody debris*	- At least ten live stems per 50 linear feet per bank monitoring plot - BEHI of "Low" or "Very Low" - Sinuosity of stream does not increase or decrease by more than 10% from previous Tier 2 or 3 monitoring within monitoring reach - D50 particle size remains in the same size class as previous Tier 2 or 3 monitoring[3] - Channel access to floodplain a minimum of twice during Stage 2 - No visual instability noted at any structure locations - Minimum 25% increase in pre-construction large woody debris*	- At least ten live stems per 50 linear feet per bank monitoring plot - BEHI of "Low" or "Very Low" - Sinuosity of stream does not increase or decrease by more than 10% from previous Tier 2 or 3 monitoring within the monitoring reach - D50 particle size remains in the same size class as previous Tier 2 or 3 monitoring[3] - Channel access to floodplain a minimum of twice during Stage 3 (for a cumulative of 5 total events across the 3 credit release stages) - No visual instability noted at any structure locations - Minimum 25% increase in pre-construction large woody debris*
Wetlands (Reestablishment, Rehabilitation, Enhancement*)	HYD2, BGC2, HAB2	- Approval of MSP - Implementation of Financial Assurances - Recordation of Site Protection Instrument	- Completion of construction and As-Built approval	- 80% survivorship of planted woody stems[2] - No more than 15% invasive species coverage, with no colony exceeding 5%[2] - Native non-invasive plant coverage at least 60%[2] - Saturation of the upper 12 inches of the surface soil profile for at least 12.5% of the growing season and/or hydrograph like reference HGM subclass profile	- 350 living woody stems per acre - Average shrub height of all surviving shrubs within sample plots are at least 2 feet in height* - Average tree height of all surviving trees within sample plots are at least 3 feet in height[2] - No more than 10% invasive species coverage, with no colony exceeding 5%[2] - Native non-invasive plant coverage should be at least 70%[2] - Saturation of the upper 12 inches of the surface soil profile (with a maximum ponding depth of 18 inches) for at least 12.5% of the growing season and/or hydrograph similar to reference HGM subclass profile	- 300 living woody stems per acre[4] - Average shrub height of all surviving shrubs within sample plots are at least 3 feet in height* - Average tree height of 5 feet[2] - No more than 10% invasive species coverage, with no colony exceeding 5%[2] - Native non-invasive plant coverage should be at least 85%[2] - Saturation of the upper 12 inches of the surface soil profile (with a maximum ponding depth of 18 inches) for at least 12.5% of the growing season and/or hydrograph similar to reference HGM subclass profile
Upland[6]	NA	NA	NA	- Less than 15% invasive species	- Less than 10% invasive species	- Less than 5% invasive species

Notes:
*Enhancement Reaches

1. Credit release stages build upon the previous stage and are not directly linked to a set monitoring year. If the site reaches the necessary performance standards in a given year, a credit release can be requested. During a year where performance standards are not met, and no credit release is requested, the Bank Sponsor will follow the Tiered level of monitoring and reporting as described in Exhibit B: Monitoring Plan of the PSUBMI. In addition to Performance Standards, credit releases are also contingent on the incremental funding of the endowment account detailed in Table 15: Long Term Management Funding Deposits.
2. Achievement of performance standards aimed at assessing vegetative development and woody cover establishment across the site will be determined based on the site-wide average of each vegetative parameter. As such, some individual plots may not achieve all vegetative performance standards in each stage but the performance standard can still be met, and credit awarded, if the average results meet the performance standard. The Bank Sponsor may request either a full or a partial credit release under these premises, recognizing that credit release requests must be approved by the IRT/USACE.
3. Different reaches will exhibit different D50 particle sizes. D50 particle sizes are determined based on channel geometry, channel gradient, stream power indices and drainage size. For the purpose of credit release, values taken at the monitoring plots (cross sections) are typically used to determine if the Project is achieving a given performance standard for that reach, and other reaches with the same restoration approach.
4. A reduction in living woody stems is anticipated during Stage 3 as trees engage in a competitive struggle with each other for water, sunlight and nutrients.
5. Implementation of Financial Assurances includes: submittal the executed performance bond (to be fully executed by the USACE upon receipt), issuance of the Corps permit, proof of Declaration recordation at the appropriate county courthouse, and documentation that the Long-Term Management endowment account was established. Please note that the performance bond covers the full funding for the construction and maintenance and monitoring of the Bank Site.
6. Although upland areas within the Bank Site will be restored and protected, no credit is awarded or released for upland performance within the Bank Site. Evaluating the development of vegetation in the surrounding uplands provides valuable information about the trajectory and overall health of the Bank Site, and therefore will be assessed during the active and interim M&M phase(s).

11.0 Monitoring Requirements

In accordance with the standards developed in PSUMBI, and in support of achieving the site-specific goals of the Bank Site, the Bank Sponsor will monitor the Bank Site following the guidelines below as well as those outlined in Table 12: Monitoring Requirements. Monitoring of the Bank Site will demonstrate compliance with the performance standards detailed in Section 10: Performance Standards and outlined in Table 11: Performance Standards and Percent Credit Release by Stage.

The monitoring requirements detailed in PSUMBI provide the framework or basic structure for which monitoring and reporting may occur. The monitoring requirements detailed in Table 12: Monitoring Requirements do not follow the exact framework provided in PSUMBI due to site-specific requirements.

Immediately following construction, permanent monitoring cross sections will be established at or near the baseline data cross section locations. These areas will be surveyed in and physically demarcated in the field to ensure re-surveying consistency throughout the initial or active monitoring phase of the Bank Site life cycle.

In conjunction with the wetland plots established within the permanent monitoring cross sections, the Bank Sponsor may annually monitor additional wetland vegetative monitoring plots. The number of additional plots may be based on the final wetland restoration acreage, whereby half of the wetland vegetative monitoring plots will be at fixed locations within the rehabilitated and/or reestablished wetlands, and the remaining half will be randomly selected every monitoring year during the maintenance and monitoring phase of the Bank Site. All plots will be assessed, and results provided and discussed in the annual monitoring reports to be submitted to the agencies for review.

11.1 As-Built Survey and Report

Following construction, the Bank Sponsor will complete an as-built survey of all full-extent stream restoration and rehabilitation reaches. This will include stream cross sections placed at or near the location of the baseline data monitoring stations, a full longitudinal profile of all full-extent restoration reaches, and surveys of each installed in-stream structure. The as-built survey will include a topographic survey of all graded areas as well an as-built planting plan sheet that displays the general locations and quantities of all vegetative material that was planted. The as-built report will be submitted to the IRT/USACE following Bank Site construction and planting completion.

11.2 Annual Monitoring Reports

Following construction completion, annual monitoring reports will be submitted to the IRT by December 31 each year monitoring occurs, for a minimum of seven years, or five years if early release is requested and approved by the IRT. If performance standards have not been achieved by Year 7 of monitoring, the monitoring period may be extended, and/or additional mitigation may be required.

The monitoring report will include all data collected from the year's monitoring and maintenance site visit, which will be used for comparison to the Bank Site's progress towards the performance standards. If the Bank Site achieves all its performance standards prior to Year 7, an early bank close-out may be requested.

Annual monitoring reports will include a brief discussion of the maintenance and management activities conducted during that year and may include a proposed maintenance schedule for the

following year based on the years' monitoring results. The report will also include a brief discussion of the restoration-related activities that took place at the Bank Site.

Monitoring reports will also include tables and graphs to document results and trends that may be occurring at the Bank Site. These tables and graphs can be used to assess site progress.

At a minimum, monitoring reports will include the following

- For the entire site:
    - A description of the general condition of all wetland and upland areas, including a general status on plantings and the herbaceous seeding, and a visual estimation of percent invasive species at the site;
    - A description of all maintenance work that was completed throughout the year;
    - Representative site photos from the established photo points;
    - Proposed maintenance activities for the next year, and if needed a corrective action plan or explanation to address any Performance Standards that have not been achieved, if applicable;
- At each permanent cross section:
    - Photos taken from ground level at each permanent cross section monitoring station;
    - A stream bank vegetation plot, which generally extends two feet up the bank from the normal high-water mark and twenty feet up-stream (2' x 20');
    - A BEHI analysis;
    - Visual observation of all stream banks near the permanent cross section;
    - In-stream LWD measurements;
    - A survey of the stream cross section at that location; and
    - Pebble (Habitat and Stability) counts.

During years 3 and 5, and at bank close-out, fish and macroinvertebrate surveys and results will be collected and compared to the baseline data. This data, however, will not be used as a performance standard for credit release.

- At each wetland monitoring plot:
    - Photos taken in four cardinal directions;
    - Estimate of percent cover of all native and invasive species; and
    - Observed woody stem density, quality, and percent deer browse.

In general, monitoring reports will also include tables and graphs to document results and trends that may be occurring at the Bank Site. These tables and graphs can be used to assess site progress.

At Bank closure, a final report detailing the maintenance and management tasks conducted and the budget expended throughout the initial monitoring period will be submitted. The final report will include the following:

- Summary of the general conditions of the bank site,

- recommendations regarding enhancement measures deemed to be warranted,
- any problems that may need attention and any changes to the long-term monitoring or management plan that appear to be warranted based on monitoring results to date, and
- if applicable, any necessary maintenance activities anticipated at Bank closeout and associated cost estimates will be provided to the agencies and long-term steward.

The Bank Sponsor will address any maintenance and repair issues that would require attention prior to Bank closeout. Funding for maintenance and monitoring activities will come from the Bank Sponsor's operating budget.

11.3 Interim Monitoring Period

The interim monitoring period (IMP) represents the time from when all performance standards are met, but not all credits are sold. The IMP will follow those details and guidelines established for the Long-Term Management Plan detailed in Section 13: Long-Term Management Plan. The maintenance and monitoring bond will remain active/open during this time.

Table 12: Monitoring Requirements[9]											
Parameters						Monitoring Year					
Resource Type	Restoration Type	Monitoring Method[4]	Sampling Sizes	Sampling Parameters	Performance Criteria	0[1]	1	2	3	4	5 +
Streams	Full-Extent Restoration / Rehabilitation	Reach Assessment	Reestablishment/rehabilitation reaches	Survey of stream longitudinal profile, cross-section, and grade control structures within the monitoring reach (100 meters)[3]	Structural and Sinuosity	Full long pro survey for as-built	X	X	X	X	X
				Continuous stream elevation monitoring			X	X	X	X	X
		Cross-sections (XS)	Permanently mark XS locations	Survey of stream profile, cross-section, and grade control structures.	BEHI, Shrub Height, Stem/Acre, Sinuosity, Particle Size, LWD, and Bankfull	Set up permanent transect locations, deploy water level loggers, survey cross-sections, and install permanent monitoring plot locations	X	X	X	X	X
			1 per XS location	Bank vegetation monitoring (2' x 10' plot)			X	X	X	X	X
			1 per XS location	Wetted perimeter pebble count (100 total pebbles)			X	X	X	X	X
			1 per XS location	Photo documentation			X	X	X	X	X
			2 Permanent XS locations	Water level logger Associated floodplain logger			X	X	X	X	X
			1 per XS location	BEHI evaluation			X	X	X	X	X
			1 per XS location[8]	Fish and Macroinvertebrate Surveys[8]	N/A[8]				X		X
	Enhancement	Cross-sections (XS)	Permanently mark XS locations	Survey of stream profile and cross-sections	Shrub Height, Stem/Acre, LWD	Set up permanent transect locations and survey cross-sections	X	X	X	X	X
			1 per XS location	Photo documentation			X	X	X	X	X
Wetlands	Re-establishment / Rehabilitation / Enhancement	Wetland Vegetation Monitoring Stations[2, 5]	1 per acre of wetland for large wetland complex; 1 additional monitoring station for each area where there is a notable difference in vegetative community composition, hydrology, or other noted functions as seen during the field visit	Tree/sapling & shrub stratum (20'x20') sampling	Stems/Acre, % Invasive, and % Native	Install permanent monitoring plot locations, list species planted and the number of each species, and deploy water level logger	X	X	X	X	X
				Herb stratum sampling (3'x3')			X	X	X	X	X
				Photo documentation (4 total N,S,E,W)			X	X	X	X	X
			Additional as needed (half of which will be fixed, and half to be randomly selected across the site each monitoring year)	Wetland hydrology data from HOBO logger			X	X	X	X	X
		Wetland Vegetation Monitoring Transects[7]	2 total transects (1 in tributary floodplains, 1 in mainstem floodplain)	Tree/sampling and shrub stratum (10m x10m plot, 3-5 plots per transect based on site conditions)	Stems/Acre, % Invasive, and % Native				X		TBD
				Herb stratum sampling (1m x 1m nested subplot, 1 per plot)					X		TBD
				Photo documentation (4 total N,S,E,W)					X		TBD
		Wetland Delineation	Entire restoration site	Wetland Delineation according to USACE EMP V.2 Regional Supplement[6]	Wetland Area Verification		TBD				
		Visual Assessment	Entire restoration site	Visual assessment for invasive species outside of monitoring plots	% Invasive		X	X	X	X	X
Uplands	NA	Upland Vegetation Monitoring Stations[5]	5 total plots	Tree/sapling and shrub stratum (20'x20') sampling	% Invasive	Install permanent monitoring plot locations and list species planted and the number of each species	X	X	X	X	X
				Herb stratum sampling (3'x3')			X	X	X	X	X
				Photo documentation (4 total N, S, E, W)			X	X	X	X	X
		Visual Assessment	Entire restoration site	Visual assessment for invasive species outside of monitoring plots			X	X	X	X	X

Notes:
1. Year '0' represents the year of Bank Site construction and development of the as-built drawings. Locations for all cross-sections and sampling or monitoring plots to be identified, installed, surveyed in and included as part of the as-built report, which will be submitted to the IRT following completion of all the work required to restore the Bank Site.

2. Additional wetland vegetative monitoring locations may be installed, of which half will be fixed locations, and the remaining half will be randomly selected across the site each monitoring year.
3. Stream longitudinal profile surveys will be conducted within the monitoring reaches of the relocation and rehabilitation reaches only.
4. Monitoring events are anticipated to occur during the late-Summer to early-Fall season (mid-August to November).
5. The shape of monitoring plots may be modified as appropriate to adapt to site conditions. In locations where the floodplain is less than 20 feet wide, the monitoring plot shape will be modified to represent the same square footage.
6. One full longitudinal profile and wetland delineation per the USACE Eastern Mountains and Piedmont Region (EMP) v2 Regional Supplement will be completed prior to site close-out.
7. Wetland vegetation monitoring transects sampling may be conducted during Years 3 and 5/7, upon request. If transect data is consistent with the fixed wetland plot monitoring station data, Years 5/7 wetland transect monitoring may not be conducted.
8. During years 3, 5 and at Bank Site close-out, fish and macroinvertebrate surveys will be conducted. Results will be provided in the annual monitoring report. This data will not be used as a performance standard for credit release.
9. These monitoring requirements are specific to the East Branch Codorus Creek Mitigation Bank. The monitoring requirements detailed in PSUMBI provide the framework or basic structure under which monitoring, and reporting may occur. The monitoring requirements detailed in this table do not follow the exact framework detailed in PSUMBI due to site-specific requirements and requests made to address agency comments specifically applicable to the East Branch Codorus Creek Mitigation Bank Site.

12.0 Credit Release Schedule

In light of Regulatory Guidance Letter (RGL) 19-01: Mitigation Bank Credit Release Schedules and Equivalency in Mitigation Bank and In-Lieu Fee Program Service Areas, released on February 22, 2019, the Bank Sponsor is presenting two credit release options: 1) the originally proposed conventional credit release schedule based on PSUMBI; and 2) an alternate adjusted credit release schedule based on RGL 19-01, as described below. The Bank Sponsor may propose to follow either of these credit release options, if requirements are met, with approval from the PA IRT.

The Bank Sponsor will adopt the conventional credit release schedule as detailed in PSUMBI while the IRT reviews the application/consideration of the alternate adjusted credit release schedule based on RGL 19-01. The Bank Sponsor reserves the right to request a modification to the credit release schedule when the alternate adjusted credit release schedule based on RGL 19-01 is approved.

12.1 PSUMBI-Based Credit Release Schedule

As shown in Table 11: Performance Standards and Percent Credit Release by Stage, five credit release milestones are proposed as part of the credit release schedule for the Bank Site. In general, credit releases are tied to achievement of performance standards. A description of each stage and the effect of monitoring results on mitigation credit releases are provided in this section.

The Administrative credit release stage represents the first 15 percent of the bank's total mitigation credits that are released and available for sale upon the following: approval of the final MSP, implementation of the financial assurances, issuance of the Corps permit, and recordation of the SPI. These items must be completed before any credits can be released during this stage.

The Construction credit release stage represents 15 percent of the bank's remaining total mitigation credits that can be made available for sale upon the following: completion of Bank Site construction, which includes the initial physical and biological improvements to the Bank Site pursuant to the MSP, and approval of the as-built plans that reflect the final grading and planting of the Bank Site.

The remaining 70 percent of the Bank Site's mitigation credits are tied directly to performance-based milestones. Performance standards are measurable criteria for assessing achievement of the Banks's goals and objectives. The performance standards for the Bank Site are detailed in Table 11: Performance Standards and Percent Credit Release by Stage.

The release of mitigation credits, as authorized by the USACE, occurs throughout the establishment and maintenance and monitoring period of the Bank, which typically lasts between 7 and 10 years, and as the suite of performance standards for each credit release stage is met. Once a stage's performance standards are met, the Sponsor will submit a monitoring report documenting achievement of the performance standards in addition to a credit release request letter requesting release of that stage's percentage of credits to the USACE. For example, there are seven stream performance standards and four wetland performance standards that must be met in Stage 1 before 35 percent of the Bank's stream mitigation credits and 25 percent of the Bank's wetland mitigation credits can be released. Once the credits are released for Stage 1, the Bank then progresses to achieving performance standards in Stage 2.

During the maintenance and monitoring phase of the Bank Site life cycle, if for any reason the performance standards are not achieved in any given monitoring year, the Bank Sponsor may fall

back to the Tiered level of monitoring and reporting as described in Exhibit B: Monitoring Plan of the PSUMBI.

The steps to be used to review and approve any reduction in the financial assurances, including payments for expenditures is generally as follows:

1) Determine if the Bank Site is meeting performance standards.
   a) If yes, request approval for bond reduction with annual monitoring report submittal/credit release request letter.
   b) If not all performance standards are attained, the Bank Sponsor may still request a bond reduction, understanding that a reduction must be approved by the IRT/USACE.

Along with the annual monitoring report submittals and credit release requests, the Bank Sponsor will provide a statement of deposit to show that funds have been deposited into the LTM endowment account. The Bank Sponsor understands that this documentation is required as part of the IRT/USACE credit release request approval. Section 15.0: Financial Assurances provides additional details regarding the process for LTM financial assurances.

The results from the annual monitoring events determine whether the Bank Site has achieved the performance standards for the bank in a given credit release stage. The credit release stages are not tied to monitoring years. Please note that results of the monitoring, and therefore achievement of the vegetation-based performance standards, represent an aggregate for the entire site. As such, some plots may not achieve all performance standards in each credit release stage. A performance standard may still be met, and credits awarded, if the average results for the vegetation-based performance criteria meet the performance standard. The applicable performance standards for this approach are indicated in Table 11. Performance Standards and Percent Credit Release by Stage. If the Bank Site is not meeting performance standards, the IRT/USACE may not grant entire credit release per the credit release schedule as described in Table 11: Performance Standards and Percent Credit Release by Stage. The Sponsor may also adjust credit release requests based on the percentage of the Bank Site that is meeting performance standards.

12.2 Alternate Credit Release Schedule (Adjusted per RGL 19-01)

The conventional credit release schedule includes several interim credit releases that align with the performance standards detailed in Table 11: Performance Standards and Percent Credit Release by Stage. RGL 19-01 presents an alternate approach that requires additional financial assurances in exchange for a greater percentage of credits released earlier in the project lifecycle. Below, Table 13: Conventional and Alternate Credit Release and Bonding Schedules provides a side-by-side comparison of the two credit release schedule approaches.

To use the Alternate RGL 19-01 credit release approach, the Sponsor must implement additional financial assurances (RGL Bond) to provide a sufficient level of confidence that the Bank Site will be successfully constructed and achieve its performance standards. Prior to each credit release, as shown on the Alternate RGL 19-01 credit release schedule in Table 13: Conventional and Alternate Credit Release and Bonding Schedules, the additional RGL Bond would be implemented and would be equal to the value of credits that would otherwise be unreleased under the conventional credit release schedule. Table 13: Conventional and Alternate Credit Release and Bonding Schedules illustrates the percentage of the Bank Site's credits that the Outstanding RGL Bond Amount needs to cover. This value of the RGL Bond is determined by multiplying this percentage by the total number of credits and then by the credit replacement value.

Table 13: Conventional and Alternate Credit Release and Bonding Schedules							
Project milestone	**Credit Release Schedule**	**Conventional**		**Alternate (RGL 19-01)**		**RGL Incremental Bond Adjustment**	**Outstanding RGL Bond Amount**
		Credit Release	**Cumulative Release**	**RGL Credit Release**	**Cumulative RGL Release**		
MSP Approval, Site Protections, Financial Assurances Executed	Initial Administrative Credit Release	15%	15%	40%	40%	+25%	25%
Completion of Construction & As-Built Approval	Interim Credit Release 1	15%	30%	0%[1]	40%	-15%	10%
Stage 1 Performance Standards	Interim Credit Release 2	35%	65%	40%	80%	+5%	15%
Stage 2 Performance Standards	Interim Credit Release 3	25%	90%	0%[2]	80%	-15%	0%
Stage 3 Performance Standards	Final Credit Release	10%	100%	20%	100%	0%	0%

Notes:

1. Under RGL 19-01, no credit release is associated with completion of construction and as-built approval. This approach is in exchange for additional credits under the MSP approval Site Protection filing and Financial Assurance execution Credit Release Stage proposed under the conventional credit release schedule.
2. Under RGL 19-01, no credit release is associated with Stage 2 Performance Standards. This approach is in exchange for additional credits under the Stage 1 Performance Standards Credit Release Stage proposed under the conventional credit release schedule.
3. The Sponsor understands that performance standards must be met and approved by the USACE/IRT prior to credit release.

12.3 General Credit Release Process

General Process/Steps for Requesting and Releasing of Mitigation Credits:

1. The Bank Sponsor will submit the annual monitoring report containing documentation supporting achievement of performance standards for a given Stage. This submittal is accompanied with a letter requesting release of the credits for that stage, and a request for performance bond reduction, if appropriate.
2. Within 60 days of package receipt, the IRT should review the submittal. The IRT may request, schedule, and conduct a site inspection following review of the monitoring report. In lieu of a site visit and upon request, the Bank Sponsor can provide drone footage of the site.
    a. The Bank Sponsor acknowledges that additional review time may be needed should the USACE/PADEP/IRT determine that additional information or a site inspection is needed for monitoring report evaluation and credit release approval.
3. Based on the submittal and site inspection or review of drone footage (if conducted/provided) the co-chair will notify the Bank Sponsor via e-mail or letter whether the submittal is approved, or if additional information is needed.
4. If the submittal package is approved, the co-chair will respond with a letter authorizing release of the requested credits and bond reduction (if appropriate).
5. The Sponsor will update the credit ledger with the addition of the newly released credits and will submit the updated ledger to the IRT within 30 days.

The IRT/ USACE can delay credit release if insufficient information is reported or if the information does not accurately represent on-the-ground conditions. This delay in credit release can continue until the Bank Sponsor submits the requested information and the IRT/USACE approves of the revised documentation.

Based on the information provided in the performance standard documentation, the IRT/USACE can conduct a site inspection to confirm information or to answer any questions raised during their review. The co-chairs may schedule the Bank Site inspection after receipt and review of the performance standard documentation.

12.4 Credit Ledger

Credits and debits will be accounted for by way of a mitigation bank ledger (Appendix G: Bank Ledger) that is maintained by the Bank Sponsor. Following each approved credit transaction, an updated copy of the bank's ledger will be submitted to the USACE. A project-specific transaction statement, or 'Affidavit of Credit Sale', which documents the that a permittee has secured the appropriate number and type of credits and establishes the legally enforceable transfer of compensatory mitigation responsibility from the permittee to the mitigation sponsor, will be provided to the IRT and USACE for each credit transaction. Any additional credit changes (additions and/or subtractions) affecting credit availability will be provided to the IRT and USACE for review. The resulting mitigation credit availability will be updated in the USACE Regulatory In lieu fee and Bank Information Tracking System (RIBITS).

13.0 Long-Term Management Plan

Per the provisions identified in PSUMBI, the Sponsor has established the following Long-Term Management Plan (LTM Plan) to ensure that the Bank Site is managed, monitored, and maintained

following achievement of all performance standards and site sign-off from the USACE. The LTM Plan, described below, establishes objectives, priorities, and tasks to monitor, manage, maintain, and report on the jurisdictional waters of the U.S. within this Bank Site. The site will be managed by a third-party long-term steward. Per PSUMBI, if a third-party long-term steward is not identified that will assume responsibilities for long-term management, including the long-term funding mechanism, the Sponsor will remain legally responsible for long-term management of the mitigation site. If a long-term steward is identified, the Sponsor must first meet all requirements for Bank Closure (including identification of the long-term steward and execution of a Long-Term Management and Maintenance Agreement), before the Sponsor is relieved of all further long-term management and maintenance responsibilities.

13.1 LTM Funding

A Long-Term Management Fund (LTMF) will be established to provide funding for the long-term steward's maintenance, monitoring and management responsibilities of the Bank Site. The long-term management fund (LTMF) will be developed using the Pennsylvania Land Trust Association Stewardship Calculator (PALTA, see references for citation). The LTMF assumes that the conservation area will be held by a local, non-profit land conservancy, and that minimal staffing and efforts will be necessary to complete annual monitoring, reporting, and maintenance activities. The LTMF accounts for one site visit per year to assess and document site conditions. Site maintenance is assumed to be necessary every 2 to 3 years. The LTMF also considers landowner communications, legal costs, and costs to respond and defend the site against minor and major violations.

The Bank Sponsor will also establish a Catastrophic Event Fund (CEF) to be available, if necessary, to address unanticipated and/or unforeseen catastrophic events. The CEF can be used to identify/provide an off-site mitigation site in the event of surface impacts to the Bank Site from existing utility-related encumbrances, invasive species outbreaks, and rehabilitation activities associated with damage resulting from 100-year or greater storm event. Please note that as stated in PSUMBI, "*Should a catastrophic event or event of Force Majeure occur, an Adaptive Management Plan will be developed to correct the problem. The Bank Sponsor will not be responsible for Mitigation Bank Site failure that is attributed to a natural catastrophe, such as flood, drought, disease, regional pest infestation, etc., which the IRT, acting through the Chairs, determines is beyond the reasonable control of the Bank Sponsor to prevent or mitigate. The Bank Sponsor is, however, required to take corrective actions associated with catastrophic events and events of Force Majeure that do not result in Mitigation Bank Site failure and to use the Financial Assurances to fund corrective measures required to repair the Mitigation Bank Site from such events.*"

The CEF will be established as a separate endowment fund and will be managed by the same third-party endowment fund manager as the LTM fund. The funding of the CEF will follow the same schedule as the LTM Fund (see Table 16: Long-Term Management Funding Deposits).

The Bank Sponsor will provide funding amounts and itemized costs separately to the IRT as proprietary and confidential information. This information will be provided as part of the Final MSP submittal.

13.2 LTM Reporting

An annual report will be submitted to the IRT by December 31 containing photographs and a brief discussion of any maintenance needed to keep the property in a mature non-threatened state. As the initial long-term steward, the Sponsor will be responsible for long-term maintenance,

unless a long-term steward is identified prior to Bank closure. If a long-term steward is not identified prior to Bank closure, the Sponsor, acting as the initial long-term steward, will be responsible for long-term maintenance and monitoring, until an alternative long-term steward is identified and approved by the IRT, in advance of assignment.

The Long-Term steward will be responsible for financial assurances reporting, including beginning and ending balances, deposits into and debits from the maintenance, monitoring, long-term management, and catastrophic event financial assurance funds. The Long-Term steward will be responsible for coordinating with the IRT/USACE to ensure adequate financial assurance reporting is completed.

13.3 General LTM Management Activities

At minimum, during the long-term management period, one site visit is to be conducted annually. During the long-term management period, annual site visits act as assessment opportunities that allow for the assessment of general Bank Site conditions, including general topographic conditions, hydrology, vegetation cover and composition, invasive species presence, bank stability, erosion/incision observations, and any additional observations. Below is a discussion of the list of observations to be made during the annual long-term management period site visits.

13.3.1 Periodic Patrols

At least one annual walk-through survey will be conducted to qualitatively monitor the general condition of these habitats. General topographic conditions, hydrology, general vegetation cover and composition, invasive species, and erosion will be noted, evaluated and mapped during a site examination. Notes to be made will include observations of species encountered, water quality, general extent of wetlands and streams, and any occurrences of erosion, structure failure, or invasive or non-native species establishment. The report should provide a discussion of any recent changes in the watershed.

13.3.2 Invasive Species Monitoring

Each year's annual walk-through survey (or a supplemental survey) will include a qualitative assessment (e.g. visual estimate of cover) of invasive species. Additionally, during each maintenance event, the project manager and field crew will actively evaluate the condition of the project and will note any additional maintenance activities that may be needed. At the end of the year, the observations made during the year will be used to establish the maintenance schedule of activities for the following year.

13.3.3 Signage

Signs identifying the protected site will be established and visibly displayed across the Bank Site to prevent casual trespass, while also allowing necessary access. During each site visit, the condition of signs, crossings, and property boundaries will be assessed. Recommendations to implement repair or replace signage, crossings, or property boundary markers will be made, if applicable.

13.3.4 In-Stream Structures

In-stream structures will be visually monitored during the annual monitoring event. Any active erosion around in-stream structures will be noted, and remedial actions recommended as needed.

13.3.5 Forestry Management Practices

Vegetation will be reduced in any areas recommended by authorities, and as approved by the USACE/IRT, for fire control. Any practices to reduce diseased or dead vegetation will be allowed if the vegetation compromises the long-term viability of the Project or any installed structure within the Bank Site.

13.3.6 Trash and Trespass

At least once yearly, trash will be removed and any necessary measures to prevent or repair damage from vandalism and trespass impacts will be taken.

13.4 Right to Inspection

The IRT and its authorized agents will have the right to inspect the Bank Site and take actions necessary to verify compliance with the LTM Plan. The LTM Plan herein will be enforceable by any proceeding at law or in equity or administrative proceeding by the IRT, including the USACE or PADEP. Failure by any agency (or owner) to enforce the LTM Plan contained herein will in no event be deemed a waiver of the right to do so thereafter. If the long-term steward fails to succeed to adhere to the requirements of the LMT Plan, the IRT Chairs may locate/identify a new long-term steward or request that the Sponsor assist in the process if after Bank Closure.

14.0 Adaptive Management Plan

Adaptive management will be used to address uncertainties that may potentially affect compensatory mitigation activities. By their very nature, adaptive management actions are implemented on an "as needed" basis and are informed by maintenance and monitoring of the Bank Site. Maintenance and monitoring site visits will determine the degree to which issues and events adversely affect or limit proposed compensatory mitigation activities. It is anticipated that the range of uncertainties will narrow as monitoring of the Bank Site progresses throughout the monitoring phase.

The Bank Site will be monitored and maintained yearly to assess conditions and progression towards meeting performance standard requirements. As part of this process, it is expected that unanticipated conditions will arise which may require adaptive management. Most of the adaptive management needs will be recorded in the annual monitoring reports, along with suggested remedial or corrective actions.

The Sponsor will adaptively manage issues and events that adversely affect, or limit proposed compensatory mitigation by employing corrective or remedial actions to address unsuccessful mitigation activities (e.g., grade adjustments, reseeding, replanting, increased weed control).

Vegetative management will be modified on a yearly basis to address Project needs. Modifications and/or adjustments will be recorded in the annual monitoring reports. If there is any instability noted around the in-stream structures, the instability will be noted in the annual monitoring report, and if needed remedial actions will be recommended. This may include, but not be limited to, additional work in or around the structure or work further upstream of the structure to remove the cause of instability at the structure.

Any conditions that arise which may require immediate attention will be brought to the attention of the IRT outside of the regular monitoring reporting period along with remedial actions that were conducted.

A few potential situations that would necessitate an Adaptive Management Plan (AMP) as a result of unforeseen and/or unanticipated performance standard failures are provided below.

14.1 Stream Stability

The restoration approach at the Bank Site is designed to reduce shear stresses that occur within the channel and distribute those stresses more evenly across the floodplain. This design approach decreases the chances for vertical and horizontal stream instabilities.

The potential for vertical incision is largely removed by the presence of the sub-surface grade control structures because the structures are placed on bedrock or are stacked with a splash log on the downstream end. Additionally, because the structures extend across the width of the floodplain, the channel cannot cut below the structures, even if the channel were to completely shift its location horizontally. If there were a significant vertical degree of incision, it would have to be based upon one of the sub-surface structures being improperly installed. Under these circumstances, the failure would be evaluated, and remedial construction work would be conducted to correct the deficiency.

Reduced shear stresses significantly reduce the likelihood of horizontal instability. If an extreme storm event occurred (greater than 100-year RI), and the stream did move horizontally, there would still be no risk of vertical incision because of the presence of the sub-surface grade control structures, and therefore, the stream function would not be impaired. The only risk would be if the stream channelized, which would reduce retention time and available habitat, however the presence of LWD installed across the floodplain during construction, and the floodplain plantings create roughness and friction throughout floodplain that would prevent any channel movement from creating a straight channel. If horizontal changes did occur, they would be surveyed, and evaluated to see if they negatively affected the Bank Site design. If they did not, no remedial action would be needed; if they did, corrective construction work would be done, however this is extremely improbable based upon the project design.

14.2 Tree and Shrub Establishment and Growth

Yearly planting densities and annual growth will be monitored as part of the annual monitoring activities for the Bank Site. Some mortality is expected in any restoration project. If there were a massive mortality in any given year, it would most likely be driven by one of two scenarios, drought conditions or herbivory.

Plantings are conducted either early in the spring or late in fall to allow the trees to establish with adequate rainfall and start developing their root systems prior to regular summer drought periods. There is little to no threat of plantings in the wetland areas being affected by drought based on the expected hydrology within the restored floodplain systems. Secondly, because bare root species are being planted, the root systems are also more proportionate to the above ground biomass, allowing for better establishment. With larger material (#7 container material for example), the above ground biomass is proportionately larger than it should be for the size root system the tree has at the time of planting, which can make it more susceptible to drought or require regular watering through establishment.

To prevent mortality from herbivory, all plantings are sprayed with an all-natural anti-browse agent, which has shown to drastically reduce browse rates on other Bank Sponsor projects. This will reduce the chance of large-scale damage from herbivores.

Maintenance mowing during the first three years will be used in the upland areas to ensure adequate tree and shrub establishment. The maintenance mowing aids in the establishment of the herbaceous understory in the uplands, prevents the establishment of weeds, and reduces competition for the trees during the first two to three years while they establish.

Lastly, if for some unforeseen reason, there was a large-scale impact to the planted tree and shrub species, and the densities per acre were below the required amount, replanting would be conducted.

14.3 Live Stakes

Based on anticipated groundwater hydrology the live stake plantings are generally planted on four-foot-approximate spacing and should establish well. If for some unforeseen reason, they did not, the reason for mortality would be evaluated, and replanting would be conducted.

14.4 Increase in the quality or quantity of macroinvertebrates or fish

Increased substrate within the channel bed, and increased habitat in the smaller tributaries should provide a basis for an expansion in the range of fish species, and increased macroinvertebrate habitat. The additional retained carbon in the floodplain should provide an increase in detritus for macroinvertebrate species to feed on. Because the macroinvertebrate and fish populations may take time to respond to these changes, no corrective actions will be taken if these metrics are not being met in the first two years.

In Year 3, if the Bank Site is not showing a trend of increasing either the quality or quantity of macroinvertebrates or fish, the previous year's water quality data will be examined to identify factors that may be limiting quality increases. Additionally, carbon retention within the floodplain can be visually evaluated to determine if the floodplain is capturing fine carbon material such as twigs and leaf litter. Lastly, stream elevation data, rainfall data, and floodplain hydrology data would be evaluated to determine if lower than average rainfall and associated hydrology was limiting both the macroinvertebrate and fish populations.

Of the three metrics: water quality, carbon, and flow, if a determining factor can be identified, a corrective action plan will be developed to attempt to address the limitation. In certain instances, corrective action may not be possible - for example, the sponsor cannot influence the weather to increase rainfall and flow at the site. A corrective action that could be taken is if the floodplain is found to be lacking carbon, additional fine carbon material can be brought into the restoration site and placed within the stream and floodplain complex to provide additional food sources.

14.5 Invasive Species and Native Dominance

If at any point there was an intense colonization of invasive species which brought the total percent of invasive species well above the allowed performance standards, remedial action would be needed. The management technique used would be dependent on the type of invasive species colonizing the site (i.e. annual, or perennial, primary reproduction through vegetative spread or through seed). If the species are annual, they can be dealt with through maintenance mowing and mechanical weed control methods to stop them from re-seeding into the site. After the seed bank is depleted, they drop out of the vegetative matrix. If they are perennial in nature, chemical herbicides need to be used; mechanical weed control is still used to stop further spreading through seed if they are a species that has high germination rates.

Once the invasive species control has begun, additional seeding or planting would need to be conducted to re-introduce a native plant community into the area of concern. Depending on the type of invasive (i.e. broad leaf or monocot), replanting and reseeding strategies can be used to allow for continued chemical control of the invasive species in the area while still allowing the native species to germinate and develop.

The likelihood of this scenario is low; once established, native plant communities develop strong resiliency to invasion by invasive species, as long as they are not disturbed or impacted. Invasive

species issues on a restoration site tend to be most problematic during the first two years because there is bare soil immediately available for germination and colonization immediately following construction. Presence of invasive species within the seed bank pose a threat as they are quick to germinate and can easily establish. As such, maintenance activities are always the most intense during the first two to three years post-construction to control any invasive species before they can establish and become problematic.

If the site were not meeting its performance standards for native herbaceous cover, additional seeding would be conducted. Again, the most important factor for establishing a healthy stand of upland herbaceous species is proper maintenance during the first two to years of establishment, specifically mowing in upland areas. This ensures enough light is reaching the developing seedlings, while also eliminating competition from annual weedy species that may be trying to colonize the site. In the wetland areas, mowing cannot be conducted, but mechanical weed control with weed whips can be used. Based on the anticipated hydrology in the wetland areas at the site, the floodplains will have water within 12 inches of the surface for most of the growing season. These conditions will discourage the growth of most invasive species and annual weedy species usually seen at a restoration site. The primary invasive species that would react well to these conditions are reed canary grass (*Phalaris arundinacea*) and Phragmites (*Phragmites australis*). Phragmites spreads primarily through vegetative means, and has not been seen or documented within the Bank Site and therefore is not a concern. Reed canary grass is prevalent throughout North America and therefore must be monitored and controlled if seen on-site. Once the wetland community is well established, it is largely self-controlling and resistant to invasive species with minimal maintenance as long as it is not significantly disturbed.

15.0 Financial Assurances

15.1 Performance Bond

A performance bond will be established to ensure that the Bank Site construction is completed and that all performance standards are met throughout the maintenance and monitoring phase (Table 14: Performance Bond Release Schedule and Target Milestones). A draft example performance bond conforming to PSUMBI's sample document with minor alterations is provided in Appendix I: Financial Assurances. The financial assurance mechanism will be a surety bond that will cover construction, maintenance, and monitoring costs associated with the Bank Site. The bond will take effect 60 days following receipt of all permit authorizations and prior to construction start. The performance bonding entity has a rating of A+ (A.M. Best Ratings, 2010).

Bond terms are annual and are renewed on an annual basis. The construction bond is anticipated to be in place for the duration of construction. If construction exceeds 12 months, the bond will be renewed to cover the remaining duration of construction. Following construction, the Bank Sponsor will request bond reduction to correlate to the maintenance and monitoring costs. If the request is approved by the IRT/USACE, the construction bond will be reduced and be replaced as a maintenance and monitoring bond.

Upon completion of the restoration activities and approval of the as-built plans by the regulatory agencies, the bond will be reduced, as laid out in Table 14: Performance Bond Release Schedule and Target Milestones below. The remaining bond amount will be left in place to cover the initial and interim maintenance and monitoring costs. The bond will be reduced proportionately each year the Bank Site meets its performance standards. The steps to be used to review and approve any reduction in the financial assurances is as follows:

1. Determine if the Bank Site is meeting performance standards.

i) If yes, request approval for bond reduction with annual monitoring report submittal/credit release request letter.
ii) If not all performance standards are attained, the Bank Sponsor may still request a bond reduction, understanding that the reduction must be approved by the IRT/USACE.

Along with the annual monitoring reports and credit release request, the Bank Sponsor will provide a statement of deposit to show that funds have been deposited into the LTM endowment account.

The performance bond will be released once the Bank Site receives final sign-off from the IRT/USACE. The Bank Site will only be closed upon meeting all performance standards and MBI requirements and when all credits have been sold (unless the Bank Sponsor forfeits any remaining mitigation credits).

The bond will be closed once all performance standards are met and released credits are sold and final sign-off on the Bank Site has been provided by the IRT/USACE. The following table presents the performance bond release schedule and target milestones.

Table 14: Performance Bond Release Schedule and Target Milestones					
Financial Instrument Used	**Project Phase Covered**	**Specific Items Covered**	**Approx. Amount Reduced[1]**	**Approx. Amount Available[1]**	**Explanation**
Surety Bond	Construction/ Development	Construction	0%	100%	100% of funds remain in-place until construction is complete
		Approval of As-Built Design Plans	~85%	~15%	Upon submittal and approval of the as-built design plans, the bond is reduced to the costs of the maintenance and monitoring project phase
	Maintenance and Monitoring	Year 1 - 7 Maintenance & Monitoring, Reporting	~15%	0%	The reduced bond will cover Maintenance, Monitoring, and Reporting for the initial and interim management periods through Bank Site closure.[1]

Note:

1.0 Percentages are approximate and are based on the Bank Sponsor's experience with other project performance bond release schedules and target milestones.

2.0 Pending review/approval by the IRT/USACE, the performance bond may be reduced by approximately 14 percent (or 1/7th) each year the Bank Site progresses towards close-out. The bond cannot be closed-out if all performance standards have not been met or if credits remain available. The bond will remain open until the Bank Site is transferred to the long-term steward.

15.2 Alternate Credit Release (RGL 19-01) Bond

Should the Bank Sponsor propose to employ the alternate credit release schedule consistent with RGL 19-01 as described in Section 12: Credit Release Schedule, an additional bond must be executed that will provide a sufficient level of confidence that the Bank Site will be successfully constructed and will achieve its performance standards. The penal sum of this additional bond would equal the credit replacement value that would otherwise be unreleased under the conventional credit release schedule. The bond would reduce over time according to Table 15: RGL 19-01 Bond Reduction Schedule, below.

Table 15: RGL 19-01 Bond Reduction Schedule			
Project Milestone	**Credit Release Schedule**	**RGL 19-01 Incremental Bond Adjustment**	**Outstanding RGL 19-01 Bond Amount**
MSP Approval, Site Protections, Financial Assurances Executed	Initial Administrative Credit Release	+ 25%	25%
Completion of Construction and As-Built Approval	Interim Credit Release 1	- 15%	10%
Stage 1 Performance Standards	Interim Credit Release 2	+ 5%	15%
Stage 2 Performance Standards	Interim Credit Release 3	- 15%	0%
Stage 3 Performance Standards	Final Credit Release	0%	0%

15.3 Long Term Management and Catastrophic Event Funds

In addition to the performance bond, the Bank Sponsor will establish a Long-Term Management (LTM) fund to fund long-term maintenance, monitoring, and management of the Bank Site. A

separate fund will be established for Catastrophic Events (CE). Both funds will be managed by the same third-party endowment fund manager. As described in Section 13.0 Long-Term Management Plan, the LTM and CE funds may also be used to fund corrective measures pertaining to natural disasters, invasive species outbreaks, or other unforeseen events. One instance in which funding from the CE fund may be used might be replacement by an off-site mitigation site in the event of surface impacts to the Bank Site from existing utility-related encumbrances.

As per PSUMBI "Should a catastrophic event or event of Force Majeure occur, an Adaptive Management Plan will be developed to correct the problem. The Bank Sponsor will not be responsible for Mitigation Bank Site failure that is attributed to a natural catastrophe, such as flood, drought, disease, regional pest infestation, etc., which the IRT, acting through the Chairs, determines is beyond the reasonable control of the Bank Sponsor to prevent or mitigate. The Bank Sponsor is, however, required to take corrective actions associated with catastrophic events and events of Force Majeure that do not result in Mitigation Bank Site failure and to use the Financial Assurances to fund corrective measures required to repair the Mitigation Bank Site from such events."

15.4 Long Term Management and Catastrophic Event Funding Approach

Along with the annual monitoring reports and credit release requests, the Bank Sponsor will provide statements of deposit to show that monetary distributions have been deposited into the LTM and CE endowment accounts.

Prior to submitting the Year 1 monitoring report, the Sponsor will deposit 15 percent of the total long-term management funds into an endowment account, that will be held and managed by a third-party financial institution according to the terms of the example endowment agreement provided in Appendix I: Financial Assurances. As shown in Table 16: Long-Term Funding Deposits, the Sponsor will deposit the remaining 85 percent of the long-term management funds into the endowment account over a period of 4 years (the fund will be 40% funded in Year 2, 70 percent funded in Year 3, and fully funded in Year 4). To document implementation of long-term financial assurances, the Sponsor will provide the executed endowment agreement with the administrative credit release request package and will provide statements of deposit with annual monitoring reports until the endowment account is fully funded in Year 4. Submittal of the statements of deposit are required as part of the credit release process.

The CEF will be established as a separate endowment fund and will be managed by the same third-party endowment fund manager as the LTM fund. The funding of the CEF will follow the same schedule as the LTM Fund (see Table 16: Long-Term Management Funding Deposits).

Along with the annual monitoring reports and credit release requests, the Sponsor will provide statement of deposits to show that funds have been deposited into the LTM and CE endowment account.

Table 16: Long-Term Management Funding Deposits	
Contribution Year	**Long-Term Management and Catastrophic Event Funds Deposits by Sponsor**
Year 1	15%
Year 2	25% (for a total 40%)
Year 3	30% (for a total 70%)
Year 4	30% (100% fully funded)

Note:
1. Statements of deposit will be submitted with the annual monitoring reports.

15.5 Financial Assurance Reporting Requirements

The Bank Sponsor is responsible for fulfilling financial assurance reporting requirements during the active and interim maintenance and monitoring phase. The Bank Sponsor will submit with the annual monitoring reports statements of deposits that detail deposits made as well as beginning and ending balances during the active and interim maintenance and monitoring phases. If bond reduction release is granted by the IRT/USACE, documentation of those bond adjustments will also be provided to the IRT/USACE. If any debits are made from the financial assurance funds, documentation will be provided to the IRT/USACE accordingly.

During the Long-Term Management phase of the Bank Site, the long-term steward will be responsible for coordinating financial assurance reporting to the IRT/USACE. This reporting may include information on the status of the funding accounts including any credits to or debits from the funds, as well as expenditures that go above the annual allocated amount.

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