

2020

Final Mitigation Banking Instrument- Amendment I

*Tarkington Bayou Mitigation Bank
SWG-2015-00169*



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Prepared by The Earth Partners, LP

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LIST OF ACRONYMS AND ABBREVIATIONS

Acre.....	Ac
Aquatic Use Variable.....	UV
Bank Erosion Hazard Index.....	BEHI
Channel Alteration.....	AV
Channel Condition.....	CV
Clean Water Act.....	CWA
Code of Federal Regulations.....	CFR
Facultative Species.....	FAC
Facultative Upland Species.....	FACU
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Geographic Information System.....	GIS
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Hydrologic Unit Code.....	HUC
Interagency Review Team.....	IRT
Light Detecting and Ranging.....	LiDAR
Linear foot.....	Lf
Maintain Plant and Animal Communities.....	MPAC
Mean Sea Level.....	MSL
National Wetland Inventory.....	NWI
Natural Resource Conservation Service.....	NRCS
North American Vertical Datum.....	NAVD
Obligate Species.....	OBL
Ordinary High Water Mark.....	OHWM
Removal and Sequestration of Elements and Compounds.....	RSEC
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Temporary Storage and Detention of Storage Water.....	TSDSW
Texas Commission on Environmental Quality.....	TCEQ
Texas General Land Office.....	GLO
Total Maximum Daily Load.....	TMDL
U.S. Army Corps of Engineers.....	USACE
U.S. Code.....	USC
U.S. Environmental Protection Agency.....	EPA
U.S. Fish and Wildlife Service.....	USFWS
U.S. Geological Survey.....	USGS
Upland Species.....	UPL
USACE 2014 National Wetland Plant List.....	NWPL
USFWS Information for Planning and Conservation.....	IPaC
Waters of the U.S.....	WOUS

Wetland Assessment Area WAA
Wetland Indicator Status WIS

1 INTRODUCTION

1.1 PRIMARY INFORMATION

This document defines the location, foundation, operation, and maintenance of the Tarkington Bayou Mitigation Bank (TBMB or Bank) and is an amendment of the TBMB Mitigation Banking Instrument. Henceforth it will be referred to as the Tarkington Bayou Mitigation Banking Instrument – Amendment 1 (MBI). This MBI is a revision of the MBI approved by the USACE on July 20, 2018. This revision entails changes to the credit release schedule and financial assurances in response to Regulatory Guidance Letter 19-01 *SUBJECT: Mitigation Bank Credit Release Schedules and Equivalency in Mitigation Bank and In-Lieu Fee Program Service Areas*. The reader is directed to the Mitigation Banking Instrument Tarkington Bayou Mitigation Bank Liberty County Texas SWG – 2015-00169 dated July 11, 2018.

Tarkington Bayou Mitigation, LLC (Sponsor) has prepared this Mitigation Banking Instrument – Amendment 1 (MBI) to provide the physical and legal characteristics for establishment and operation of the Tarkington Bayou Mitigation Bank (TBMB or “Bank”).

The proposed TBMB is a 1,438.5 acre (Ac) wetland and stream mitigation bank. TBMB is located in the U.S. Geological Survey (USGS) East Fork San Jacinto 8-digit Hydrologic Unit Code (HUC) 12040103, near Splendora, Liberty County, Texas (Appendix A, Exhibits 1 and 2). The approved Houston-Conroe Mitigation Bank (SWG-2013-00141) is located within the same parent tract. Specifically, the proposed TBMB site is located at latitude 30.235351° North and longitude 95.033182° West on the Plum Grove, USGS 7.5-minute quadrangle topographic map (Appendix A, Exhibit 3), and is situated within the South-Central Plains Level III Ecoregion. The Bank is approximately 5 miles east of the City of Splendora on U.S. Highway 59 and can be accessed from Farm to Market Road 1010 approximately 2.5 miles north of Plum Grove or 6 miles south of Cleveland, Texas.

1.2 CONTACT INFORMATION

Tarkington Bayou Mitigation, LLC is the Sponsor and the surface owner of the TBMB property as documented in Appendix B. The Sponsor is the responsible entity for providing the necessary financial resources; the technical and scientific expertise for the design and implementation; and financial management and long-term maintenance for the Bank. The contact information for the Sponsor and primary agent are shown in Table 1.

TABLE 1: CONTACT INFORMATION FOR TBMB

Sponsor/Owner:	Tarkington Bayou Mitigation, LLC
Primary Contact:	David Tepper
Mailing Address:	4317 Elm St, Chevy Chase, Maryland 20815
Phone Number:	202-492-0785
Email:	David.tepper@teplp.com
Secondary Contact:	Krystyn Krafka
Mailing Address:	4317 Elm St, Chevy Chase, Maryland 20815
Phone Number:	956-244-6263
Email:	krystyn.krafka@teplp.com

Conservation Easement Holder: Bayou Land Conservancy
 Primary Contact: Suzanne Simpson
 Mailing Address: 10330 Lake RD # J, Houston, TX 77070
 Phone Number: 281-576-1634
 Email: ssimpson@bayouland.org

Mitigation Consultant: Alluvion Resource Company, LLC
 Primary Contact: Chance Kimbrough
 Mailing Address: 8010 FM 699, Joaquin, TX 75954
 Phone Number: 936-465-5247
 Email: chance@alluvionrc.com

Financial Assurances Holder: Texas Parks and Wildlife Foundation
 Primary Contact: Merrill Gregg
 Mailing Address: 2914 Swiss Avenue, Dallas, TX 75204
 Phone Number: 217-720-1478
 Email: mgregg@tpwf.org

1.2.1 Qualifications of Sponsor and Sponsor's Agent

The Sponsor and the Sponsor's Agent have been actively involved in the development of successful aquatic mitigation sites throughout the southern United States for the past two decades. The Sponsor has prior experience in selecting high quality sites with excellent potential for restoration success. By employing accomplished designers and regional technical experts, the success rate for these banks has been exceptional. A summary of the experience of the Sponsor, the Sponsor's Agent, and key personnel within the Earth Partners (TEP) includes the following:

Mitigation Banking Experience

- The Earth Partners have been involved in the construction of the first fresh and salt water tidal wetland in Texas as part of the Gulf Coast Plains Mitigation Bank project.
- Over the past several years, key personnel have participated in establishing and managing roughly 25,000 acres of mitigation banks in Texas.
- Key personnel with TEP acquired interest in a mitigation bank within Chicago metropolitan area and currently manage the investment.
- With a total of approximately 30,000 Lf of in-channel stream restoration, TEP has completed the first two phases (18,000 Lf total) of the Houston-Conroe Mitigation Bank construction.

- In addition to the 15 mitigation projects listed in Table 2 below, the Sponsor's Agent and other consultants have been involved with numerous other mitigation banks and permittee responsible sites over multiple U.S. Army Corps of Engineers (USACE) districts.

Ecological Restoration Experience

- One of TEP's flagship projects has been the removal of invasive brush species on Texas rangelands and recycling said brush as a biofuel for export.
- During their Black Hills Forest Restoration, TEP discovered new ways to convert the low value biomass (tree fall) created by an infestation of pine beetle into a variety of consumer products, thereby minimizing the overall carbon release of the site.
- Through their many forest restoration and preservation projects, TEP has developed and sold over \$1 billion in carbon credits.

Policy Experience

- The Earth Partners participated as a member of the stakeholder group in the development of the Compensatory Mitigation for Losses of Aquatic Resources; Final Rule (2008 Rule).
- Members of the TEP team provided input to the Council on Environmental Quality (CEQ) and the United States Mid-Century Strategy for Deep Decarbonization.
- Staff and collaborators with TEP created methodologies for environmental crediting as well as the soil and ecosystem carbon quantification.
- In addition to the development of certification standards for sustainable biomass harvesting and production of derivative products in the United States, the team has led policy work to create a separate classification in the United Kingdom and the Netherlands for sustainable biomass sources from the removal of invasive species.

Table 2 below highlights the locations of the specific compensatory mitigation projects where the Sponsor and/or the Sponsor's Agent were intimately involved.

TABLE 2: BANK SPONSOR QUALIFICATIONS

	Project	State	Year Initiated	Status	Mitigation Type	Acres/Linear Feet
1	Tower Road	GA	1995	Monitoring Year 2	Stream	125.6 Ac/ 2,756 Lf
2	Tower Phase II	GA	2011	Permitted (2013)	Stream & Wetland	449.8 Ac
3	Messer Creek	GA	2011	Design/Permitting	Stream & Wetland	239 Ac
4	Good Neighbor Creek	GA	2009	Permitted (6/2012)	Stream	308 Ac/ 73,710 Lf
5	Cochran's Creek	GA	2009	Permitted 2010 Purchased 2012	Stream	126 Ac/ 19,444 Lf
6	Tallapoosa	GA	2012	Design/Permitting	Stream & Wetland	289 Ac
7	Upper Neches Mitigation Bank	TX	2015	Prospectus Submitted	Riparian Buffer	1,253 Ac
8	Houston/Conroe Mitigation Bank	TX	2010	Approved, Under Construction	Stream	396 Ac/ 29,003 Lf
9	Lufkin Mitigation Bank	TX	2012	MBI Submitted	Stream	57.7 Ac/ 9,485 Lf
10	Sabine Investment Project Specific Mitigation	TX	1996	Completed	Wetland	14 Ac
11	Humble Independent School District Project Specific Mitigation	TX	2005	Completed	Wetland	50 Ac
12	Silver Stone III Project Specific Mitigation	TX	2006	Completed	Wetland	15 Ac
13	Home Depot, Lufkin Project Specific Mitigation	TX	2007	Completed	Stream	5,000 Lf
14	242-LLC Project Specific Mitigation	TX	2008	Completed	Wetland	190 Ac
15	Lufkin Garden District Project Specific Mitigation	TX	2010	Completed	Stream	5,600 Lf

1.2.2 Qualifications of Sponsor's Consultants

RS & H, Inc.

RS&H, Inc. (RS&H) is a facilities and infrastructure consulting firm employing a multidisciplinary staff of over 1,000 architects, engineers, planners, and environmental scientists. Kate Lindekugel (Project Manager) leads RS&H's efforts on the TBMB. RS&H personnel possess extensive experience in aquatic resource restoration throughout the southeast and have been involved in protecting, enhancing, and/or restoring over 15,000 Ac on numerous restoration-sites. RS&H's responsibilities for the TBMB have consisted of conducting preliminary studies including a market analysis to determine feasibility of the Bank; desktop assessments of the biological and hydrologic suitability of the site; preparation of prospectus and dMBI documents; coordination with other project partners; negotiations with the permitting agencies; and completion of final MBI documents.

Hydrex Environmental, Inc.

Hydrex Environmental, Inc. (Hydrex), led by Clayton Collier (Manager of Ecological Services), has over 15 years of experience conducting wetland investigations, Phase I Environmental Site Assessments, and numerous other environmental sampling and analyses. Hydrex Environmental, Inc. has assisted in conducting extensive preliminary field studies to characterize the site and determine the Bank's feasibility, as well as conducting the wetland determination/delineations for the site. In addition to their in-depth knowledge of the ecology of the region, Hydrex possesses advanced technology such as multiple drone units to allow for remote sensing and hydrologic model development.

Engineering 303, LLC

The staff of Engineering 303, LLC (Engineering 303) has more than 40 years combined experience in over 1,800 developments and development related services. Their client services include; land surveying ("ALTA/ACSM" surveys including title examination), stream mitigation design, 303(d) jurisdictional consulting, and civil engineering construction plan design. They have designed 137,980 Lf of stream restoration in 30 different counties. To date, 61,935 Lf of these designs have been built, and they have supervised the construction of 60,330 Lf of stream restoration. Members of Engineering 303 have worked as team members with private mitigation banking and environmental assessment/permitting companies to design and supervise the construction of 16 privately held mitigation banks and 10 stream restoration/stabilization projects. They have been identifying and then directing the data collection on several "reference reach streams" for use in the on-going and future design of stream restoration and mitigation banks in the State of Georgia.

1.3 SERVICE AREA

The Sponsor is requesting the designation of the Bank as a unique, high-quality restoration area to provide compensatory wetland and stream mitigation credits for the Lake Houston and Galveston Bay geographic area. The Bank is located within the East Fork San Jacinto Sub-basin (8-digit HUC 12040103), which is a sub-basin of the San Jacinto Basin (6-digit HUC 120401).

The following guidelines were utilized in the designation of primary and secondary service areas. All service area designations are limited to the Galveston District of the USACE and exclude all Texas Parks and Wildlife Department (TPWD) properties and facilities. Appendix A, Exhibit 2 illustrates the proposed service area.

The **primary service area** is the Lake Houston Watershed (excluding the Western Gulf Coastal Plain Level III Ecoregion), which includes portions of the following sub-basins (8-digit HUCs):

- East Fork San Jacinto (8-digit HUC 12040103);
- West Fork San Jacinto (8-digit HUC 12040101), downstream of Lake Conroe;
- Spring (8-digit HUC 12040102), within South Central Plains Ecoregion.

The **secondary service area** consists of the following 8-digit HUCs, or portions thereof, adjacent to the primary service area with proven hydrologic connection to the primary service area:

- West Fork San Jacinto (8-digit HUC 12040101), Lake Conroe watershed (upstream of Lake Conroe);
- Spring (8-digit HUC 12040102), outside of South Central Plains Ecoregion.

1.3.1 Rationale for Service Area Determination

The Geographic Service Areas were determined by utilizing the watershed approach combined with ecological, hydrological, and finally, economic considerations for compensatory mitigation. The rationale for this service area determination was developed in accordance with the 2008 mitigation banking rule (USACE, 2008) by considering comprehensive scientific justifications, appropriate supporting data, and references to peer reviewed literature to support these assertions. The following are the major justifications for determination of the service area for TBMB:

- A watershed approach was utilized to determine all service areas.
 - Primary Service Area flows into one common waterbody (Lake Houston).
 - Secondary Service Area flows into one common waterbody (Galveston Bay).
 - Significant hydrologic connectivity exists between mapped HUC boundaries within the proposed service area.
 - Watershed approach follows locally developed standards and practices.
- Wetland and stream restoration within TBMB will provide direct and tangible aquatic resource benefits to the service area.
 - TBMB will provide a substantial benefit to Luce Bayou, one of the few remaining unimpaired streams in the area and one of the few watersheds lacking a Total Maximum Daily Load (TMDL) limit (TCEQ, 2012).
 - Wetland and stream restoration within the TBMB will provide water quality improvement and protection for both the East Fork of the San Jacinto as well as Lake Houston. This can mitigate the inputs from the more impacted West Fork of the San Jacinto and Spring Sub-basins.
 - Ecological “in-kindness” and significance extends beyond the limits of the mapped ecoregion boundaries.
 - Proximity to other protected areas, such as State and National Forests, increase the ecological effectiveness and overall footprint of the site.

- Proposed Service Area is based on needs within the watershed.
 - Greater Houston (located within proposed service area) was ranked 2014's number one market for investment and development prospects and the number two market to watch for commercial real estate.
 - Proposed service area has experienced significant stream and wetland function losses with limited to no stream mitigation banking options.
 - As a result, mitigation requirements have had to depend on out-of-kind mitigation and permittee responsible mitigation.
- Proposed service area is necessary for the economic viability of the Bank.

2 AUTHORITIES

2.1 PURPOSE

The purpose of the MBI is to detail the methods for the establishment, use, operation, and continued maintenance of the Bank, as well as the obligations and commitments of the Sponsor. The Bank will be used to generate and sell credits commercially for compensatory mitigation for unavoidable impacts to wetlands and streams, which result from activities authorized under Section 404 of the Clean Water Act and approved by the USACE. Once a permittee has secured the appropriate number and resource type of credits from the Bank, the Sponsor assumes responsibility for a permittee's compensatory mitigation requirement.

The TBMB's purpose is to provide the necessary resources to allow for compensation of authorized/unavoidable impacts to aquatic resources and meet the need for wetland and stream mitigation credits within the geographic service areas of the Bank. Credits generated by the Bank will: (a) reduce uncertainties on behalf of the USACE when gauging the ecological benefit and success of required mitigation; (b) decrease the time necessary to permit projects with aquatic resource impacts; and (c) reduce the strain on the limited resources of the agencies for review and compliance monitoring for non-bank mitigation credits.

2.2 REGULATORY AUTHORITIES

The establishment, use, and operation of the Bank will be carried out in accordance with the following authorities:

- Clean Water Act [33 U.S. Code (USC) 1251 et. seq.]
- Rivers and Harbors Act (33 USC 403)
- Fish and Wildlife Coordination Act (16 USC 661 et. seq.)
- Regulatory Programs of the USACE, Final Rule [33 Code of Federal Regulations (CFR) 320-330]
- Guidelines for Specification of Disposal Sites for Dredged and Fill Materials (40 CFR 230)
- Memorandum of Agreement between the U.S. Environmental Protection Agency (EPA) and the Department of the Army concerning Determination of Mitigation Under the Clean Water Act, Section 404(b) 1 Guidelines (February 6, 1990)
- Final Rule for the Compensatory Mitigation for Losses of Aquatic Resources issued by the USACE and the EPA (April 10, 2008)
- Section 7 of the Endangered Species Act (16 USC 1531-1544)
- Section 106 of the National Historic Preservation Act (16 U.S.C. 470f)
- Texas State Water Quality Certification [(30 Tex. Admin. Code §279.12 (2001))]
- Texas State Water Quality Standards [30 Tex. Admin. Code §307 (2000)]
- Texas Parks and Wildlife Code Chapter 14 Powers and Duties Concerning Wetlands

2.3 INTERAGENCY REVIEW TEAM

Multiple state and federal agencies participated in the development of this MBI as members of the Interagency Review Team (IRT). The IRT is comprised of the members listed in Table 3 and is chaired by the USACE Galveston District representative, Ms. Lynne Ray. The designees from the IRT agencies are subject to change.

TABLE 3: INTERAGENCY REVIEW TEAM MEMBERS

US Army Corps of Engineers

SWG-RD-P
 2000 Fort Point Road
 Galveston, TX 77553
 IRT Chair: Diana L. Ray- Diana.L.Ray@usace.army.mil
 Sam J. Watson – Sam.Watson@usace.army.mil

Fax: 409-766-3931
 Phone: 409-766-6322
 Phone: 409 766-3946

US Fish & Wildlife Service

17629 El Camino Real, Suite 211
 Houston, TX 77058

Phone: 281 286-8282
 Fax: 281 488-5882

EPA, Region 6

Wetlands Section (6WQ-EM) - Houston Lab
 10625 Fallstone Road
 Houston TX 77099
 Paul Kaspar - Kaspar.Paul@epa.gov

Phone: 214-665-7459
 Fax: 281-983-2124

Texas Parks & Wildlife Department

TPWD-Dickinson Marine Lab
 1502 East FM517
 Dickinson, Texas 77539
 Mike Morgan - Mike.Morgan@tpwd.texas.gov

Phone: 281 534-0146
 Fax: 281 534-0122

Texas General Land Office

Coastal Coordination Council
 1700 North Congress Avenue
 Austin, TX 78701-1495
 Carla Kartman – Carla.Kartman@glo.tx.gov

Phone: 512 463-5055
 Fax: 512 475-0680

Texas Commission on Environmental Quality

Water Planning & Assessment Division
 P.O. Box 13087, Mail Code 150
 Austin, TX 78711-3087
 Brittany Lee - Brittany.Lee@tceq.texas.gov

Phone: 512 239-4583
 Fax: 512 239-4420

Natural Resources Conservation Service

USDA-NRCS Texas
 101 South Main Street
 Temple, TX 76501
 Dan Keesee – Dan.Keesee@tx.usda.gov

Phone: 254-742-9833

National Marine Fisheries Service

4700 Avenue U
 Galveston, TX 77550
 Charrish Stevens - Charrish.Stevens@noaa.gov

Phone: 409 766-3699
 Fax: 409 766-3575

2.4 LEGAL RESPONSIBILITY STATEMENT

The Sponsor assumes all legal responsibility for satisfying the mitigation requirements (i.e. the implementation, performance, and long-term management of the compensatory mitigation project approved under this agreement) of Department of the Army or State permits for which the Bank has been utilized or fees have been accepted. The transfer of liability from permittee to the Sponsor is established by: 1) the approval of this MBI by the Sponsor and the District Engineer, 2) receipt of a credit transaction report by the District Engineer signed and dated by the Sponsor, and 3) the transfer of fees required from the permittee to the Sponsor.

The responsibility for financial success and risk to the investment initiated by the Sponsor rests solely with the Sponsor. The regulatory agencies party to this agreement administer their regulatory programs to best protect and serve the public's interest, and not to guarantee the financial success of banks, specific individuals, or entities. Accordingly, there is no guarantee of profitability for any individual mitigation bank. As such, the Sponsor does not construe this agreement as a guarantee the agencies will ensure sale of credits or the agencies will forgo other mitigation options that may also serve the public interest. Since the agencies do not control the number of banks proposed or the resulting market impacts upon success or failure of individual banks, in-depth market studies of the potential and future demand for bank credits are the sole responsibility of the Sponsor.

2.5 FORCE MAJEURE

The Sponsor shall be responsible to maintain the TBMB and perform remedial action as described herein except for damage or non-compliance caused by events of *force majeure* or unlawful acts. In order for such exception to apply, the Sponsor shall reasonably demonstrate the damage or non-compliance could not have been reasonably foreseen or prevented. For this to apply, the USACE must concur in writing a *force majeure* event has occurred and any failure or non-compliance is the result of such an event. The Sponsor recognizes *force majeure* does not include natural weather events predictable and normal for the area.

2.6 DISPUTE RESOLUTION

Should a dispute arise between the Sponsor and the USACE/IRT as to the application of this MBI, then the dispute resolution process outlined in 33 CFR 332.8 (e) will be followed.

2.7 VALIDITY, MODIFICATION, AND TERMINATION OF THE BANK

This MBI will become valid upon signature by the USACE and the Sponsor. This MBI may be amended, altered, released, or revoked only by written agreement among the parties hereto or their heirs, assigns, or successors-in-interest. Any amendment must follow the appropriate procedures listed in 33 CFR 332.8(d), unless the District Engineer determines the streamlined review process described in 33 CFR 332.8(g)(2) is warranted.

2.8 CONTROLLING LANGUAGE

To the extent specific language in this document changes, modifies, or deletes terms and conditions contained in those documents that are incorporated in the MBI by reference, and are not legally binding, the specific language within the MBI shall be controlling.

3 MITIGATION PLAN

3.1 OBJECTIVES

The primary goals of TBMB are to protect the water quality of the downstream San Jacinto system, including Tarkington Bayou, Luce Bayou, and Lake Houston; provide habitat and refuge to wildlife; establish a dynamically stable forest both resistant and resilient to disturbance events; and to ensure the longevity and function of the system through long-term conservation measures. These goals will be achieved through the attainment of the following objectives:

- Place the entire 1,438.5 Ac bank under a perpetual conservation easement held by Bayou Land Conservancy;
- Establish 56.9 Ac of herbaceous wetland and 79.9 Ac of forested wetland through construction of a berm to increase wetland hydrology.
- Re-Establish a significant hydrologic connection between 45.4 Ac of herbaceous wetlands (including unique depressional wetlands), 20.1 Ac of scrub/shrub wetlands, and 35.6 Ac of forested wetlands to the Long Branch and the Luce Bayou system through adjacent wetland hydrology enhanced by a berm;
- Restore 62.4 Ac of forested wetland with significantly altered hydrology and vegetative community resulting from intensive silvicultural activities;
- Enhance the vegetative community of 394.0 Ac of silviculturally impaired wetland forests through selective planting and forest management;
- Enhance and protect 26.4 Ac of emergent wetland impaired by adjacent silviculture management and invasive species invasion.
- Improve the function of the 20,444 linear feet (Lf) of perennial streams and 8,097 Lf of intermittent streams through 145.1 Ac of light buffer planting and noxious species removal.
 - It should be noted that more streams were identified on-site (see baseline), but enhancement activities within the buffer of ephemeral streams and intermittent streams that don't flow directly into a perennial stream are credited toward wetlands, and not stream buffer enhancement.

The TBMB has the additional goal of providing flexible and economically efficient mitigation opportunities to compensate for losses in aquatic resource function resulting from unavoidable impacts within the watershed. The holistic goal is to maintain or improve aquatic ecosystem function and water quality within the catchment.

3.2 SITE SELECTION

The selection of the proposed Bank incorporated a tiered approach to provide the most effective and efficient methodologies to identify and evaluate suitable sites that would provide the highest yields of ecological functional gain. First, a landscape-level Geographic Information System (GIS) evaluation focusing on soils, hydrology, floral/faunal community assessments, rare and endangered species, critical habitat, etc. was performed to select the site and determine potential feasibility. After the site selection process identified a potential area, an in-depth analysis to determine the Bank's restoration, enhancement, and preservation potential was completed.

The Bank is located near Sam Houston National Forest, the Lake Houston Wilderness Park, and the U.S. Fish and Wildlife Service (USFWS) Trinity River Wildlife Refuge. This strategic location provides another "stepping stone" or point of refuge for migrating wildlife between these preservation areas. The TBMB is

unique in its proximity to other major areas of conservation, both along Luce Bayou and in series with several other national forests and protected areas (100,000+ Ac). Starting with Lake Houston Wilderness Park, the East Fork San Jacinto River and Tarkington Bayou (a tributary of Luce Bayou) flow on either side of the parent tract and create a wildlife pathway north to the Sam Houston National Forest. From there, a connection is made to Davy Crockett National Forest via Lake Livingston and its tributaries. The Neches River connects Davy Crockett National Forest with the Angelina National Forest, and Lake Sam Rayburn and its tributaries provide a connection to the Sabine National Forest.

3.3 SITE PROTECTION INSTRUMENT

A conservation easement will act as a real estate instrument to ensure the land will remain in a state of conservation in perpetuity. The proposed conservation easement holder is Bayou Land Conservancy, which is an Accredited Land Trust by the Land Trust Accreditation Commission, a national accreditation organization. The conservation easement is provided in Appendix C and will be filed upon execution of the MBI.

If the Sponsor requests transfer of sponsorship of the Bank, the Sponsor recognizes such a transfer will require supplying the pertinent third-party entity information to the IRT. Further, the USACE, in coordination with the IRT retains the right to approve, and/or modify any agreements to transfer the Bank sponsorship from the Sponsor to another entity or organization.

3.4 BASELINE INFORMATION

A preliminary site feasibility and resources determination was performed utilizing field surveys and remote-sensing infrared (IR) ortho-imagery, desktop elevation reconnaissance using 7.5 minute USGS topographic information, USFWS National Wetland Inventory (NWI) maps, and Natural Resource Conservation Service (NRCS) soil survey data. Appendix A, Exhibits 5 through 10 are aerial photographs that show the land use changes on the property over time. Beginning in 1938, a transition is shown from primarily unaltered mixed hardwood pine forest to commercial pine production. The herbaceous depressions are also clearly shown and are a unique topographic and ecological feature to this region.

The USFWS and the TPWD were also contacted regarding any unique, threatened, or endangered species on-site, and a comprehensive cultural resources survey was conducted. These results are discussed in greater detail further in this section, and the full reports can be found in Appendices D and E, respectively.

Field surveys were conducted to gather on-site information regarding the vegetative community structure, the in-channel stream conditions, and the potential for success from the proposed mitigation activities. Primary focus was placed upon wetland and riparian communities. The following sections detail the existing site conditions as seen during previous field surveys and prior to any proposed restorative efforts.

Vegetation

The site consisted of three distinct habitat types that included depressional areas, flats, and riparian areas. The depressional areas were either forested or emergent wetlands periodically ponded throughout the year. Forested depressions within the Bank were typically represented by laurel oak (*Quercus laurifolia*), Drummond's maple (*Acer rubrum* var. *drummondii*), Chinese tallow (*Triadica sebifera*), sweetgum

(*Liquidambar styraciflua*), loblolly pine (*Pinus taeda*), common buttonbush (*Cephalanthus occidentalis*), and dwarf palmetto (*Sabal minor*). The “flat” communities were low-lying wetland areas of less than 1 percent slope and were dominated by laurel oak, loblolly pine, Drummond’s maple, Chinese tallow, and dwarf palmetto. The riparian and floodplain systems associated with Tarkington Bayou consisted of a mixture of large pine and hardwoods, including water oak (*Quercus nigra*), laurel oak, swamp chestnut oak (*Quercus michauxii*), cherrybark oak (*Quercus pagoda*), red maple (*Acer rubrum*), sweetgum, Chinese tallow, dwarf palmetto, and various understory species tolerant to moist environments (*Cephalanthus spp.*, *Vaccinium spp.*, *Viburnum spp.*, *Morella spp.*, etc.). Also within this area were pockets of bald cypress (*Taxodium distichum*) swamp. These swamps were in relatively good condition, ecologically, as the soils were too moist for commercial forestry.



FIGURE 1: REPRESENTATIVE DEPRESSIONAL FORESTED WETLAND VEGETATION ON TBMB

Much of the existing habitats located within the Bank have been altered by previous agriculture and/or intensely managed pine plantation silvicultural practices and do not optimally function as compared to similarly classified reference ecosystems within the region. Commercial pine plantation is evidenced in Exhibits 9 and 10 (Appendix A) with the presence of rows.

Hydrology

The hydrology of the Bank is driven by perennial, intermittent, and ephemeral streams making up the Tarkington Bayou drainage system as well as precipitation driven wetland flats and depressions. Tarkington Bayou flows in a southeasterly direction into Luce Bayou and sequentially into Lake Houston then Galveston Bay.

Distinct hydrologic types on-site included depressional areas, flats, and riparian floodplain areas. Depressional areas were loess blowouts commonly associated with the Lissie Formation, or the relic depressions of former oxbow lakes. Flats were broad areas of less than 1 percent slope not directly adjacent to a stream, and both depressions and flats had hydrology driven by precipitation and groundwater influx rather than overbank flooding of an adjacent waterway. These flats and depressions were situated in the western portion of the bank and were separated from the Tarkington Bayou floodplain by a north/south trending ridge. The easternmost portion of the bank was comprised of the Tarkington Bayou Floodplain. Wetlands in this area were flood driven, and the area was dissected by numerous stream channels.

The 2008 Houston Galveston Area Council (HGAC) Light Detecting and Ranging (LiDAR) data verify the drainage patterns as described by the USGS topographic maps but with greater detail (Appendix F, WOUS

Delineation). The digital terrain model and 1-ft contours derived from the LiDAR data clearly define the boundaries of the valley and relic channels, as well as the depressions depicted on the USGS topographic maps. In addition, the LiDAR data reveals the micro-topography of the flats and upland mounds occurring across the site.

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate map for the project area indicates the 100-year floodplain extends through an appreciable portion of the site (FEMA, 2014). The remainder of the project site is shown to be located within Zone X. Zone X is described as those areas outside the 0.2 percent chance of annual flooding (500-year floodplain). The 100-year floodplain is shown in Appendix F.

Historic agricultural and silvicultural practices have adversely affected the natural hydrologic regime of portions of the site. Specifically, the alteration to topographic elevations via bedding and/or roller chopping site preparation and the alteration of the native vegetation for intensive pine plantation management have altered the natural hydrology of the Bank.

Hydrologic alterations and native vegetative community manipulation have rendered the majority of existing streams and wetlands within TBMB unable to function as optimal sources of natural conveyances, hydrologic storage, aquatic filters, or suitable aquatic habitat normally associated with the natural and unaltered system.

Soils and Topography

TBMB is characterized by relatively low relief, sloping on the western portion of the Bank to the south and on the eastern portions east towards the floodplains of Tarkington Bayou. The 7.5' quadrangle (Plum Grove) lists the property elevation to be consistently between 95 and 120 ft North American Vertical Datum (NAVD) above Mean Sea Level (MSL) (USGS, 2014).

A review of the NRCS Soil Survey of Liberty County, Texas (USDA NRCS, 1996) indicates the site contains six (6) soil mapping units (Table 4). All of the soils on the property are listed as hydric and all are poorly drained with the exception of Otanya fine sandy loam, which is moderately well drained, but is only found in a small portion of the tract's uplands. Appendix F contains maps and figures that show the locations and relative distributions of the soil types on-site.

Soils of the proposed Bank are classified as loamy fluviomarine depositions from the early Pleistocene era. These depositions are characterized as having a loamy surface layer of siliceous or smectitic mineralogy (USDA, 2006). According to the Geologic Atlas of Texas map (Beaumont sheet), the majority of the site lies in an outcrop area of the Lissie Formation along the western side of a north-south trending ridge dividing the East Fork San Jacinto River and Tarkington Bayou (USDA, 2006). The Pleistocene age Lissie Formation conformably overlies the Willis Formation and includes the age-equivalent Montgomery and Bentley Formations. The formation is considered fluvial with suggested thicknesses from approximately 200 ft (Barnes, 1992) to 1,000 ft in near coast sections (Doering, 1935).

The Upper Lissie (formerly Montgomery Formation in southeast Texas) consists of clayey sands with silt, and minor amounts of siliceous gravel of granule and pebble sizes. The upper portion may be locally calcareous and commonly contains concretions of calcium carbonate, iron oxide, and iron-manganese oxides in the zone of weathering. The lower Lissie contains slightly coarser gravel and is non-calcareous with slightly more abundant iron/iron-manganese concretions. In outcrop, surface expression is fairly flat and featureless, except for numerous, rounded, shallow depressions and pimple mounds (Barnes, 1992). Soils with the primary hydric soil indicator A16 (Coastal Prairie Redox) occur mainly on depressions and portions of the inter-mound landforms of the Lissie Formation.

TABLE 4: CHARACTERISTICS OF INDIVIDUAL SOIL MAPPING UNITS WITHIN BANK

Map Unit Symbol	Soil Name	Acres - Within Bank	Acres - Percent of Total	Drainage	Hydric Component	Hydric Component Percent	Permeability	Erosion Hazard	Depth to Water Table
Kr	Kirbyville fine sandy loam	543.69	38%	Somewhat poorly	Waller	5%	Moderate	Slight	18 - 30 in
Wa	Waller loam	475.92	33%	Poorly	Waller	80%	Slow	Slight	0 - 30 in
Wk	Waller-Kirbyville complex	244.70	17%	Poorly	Waller	50%	Slow	Slight	0 - 30 in
Ma	Mantachie loam, frequently flooded	75.17	5%	Somewhat poorly	Sourlake	90%	Moderate	Slight	12 - 18 in
					Pluck	5%			
					Simelake	5%			
OyB	Otanya very fine sandy loam	47.77	3%	Moderately well	Waller	1%	Moderately slow	None	36 - 60 in
Wc	Waller loam, depressional	53.19	4%	Poorly	Lelavale	100%	Slow	Slight	0 - 12 in

National Hydric Soils List (NRCS, 2016)

3.4.1 Threatened and Endangered Species

Federally listed or candidate threatened or endangered species occurring or potentially occurring within Liberty County include the red-cockaded woodpecker (*Picoides borealis*), interior least tern (*Sterna antillarum*), piping plover (*Charadrius melodus*), and red knot (*Calidris canutus*) (USFWS, 2016). There are no federally listed threatened, endangered, or candidate species for mussels or other invertebrates within the Bank watershed (USFWS, 2016) (USFWS, 2009) (USFWS, 2011). The USFWS Information for Planning and Conservation (IPaC) Trust Resources Report for the Bank is found in Appendix D.

The red-cockaded woodpecker nests in old-growth pine forest generally maintained by frequent, low-intensity burns to limit hardwood encroachment and to maintain an open “savannah” like habitat. Suitable foraging habitat can be younger than nesting habitat; however little to no mid-story is still required to provide an abundance of native bunchgrass and forb groundcover (USFWS, 2003). TBMB does not contain nesting or foraging habitat and therefore no effects to the red-cockaded woodpecker are anticipated.

The interior least tern, piping plover and red knot are shore birds known to winter along the Texas Gulf Coast. TBMB may provide stopover habitat during migration for these species, but due to the distance from the coast and other habitat factors, would not provide nesting or breeding habitat for these species. As a result, the restoration activities at TBMB will not have an effect on these species.

Review of the literature provided by TPWD indicates several state listed threatened and endangered species may benefit from the proposed Bank site. Surveys of the wildlife on the parent tract were conducted, and a more detailed discussion of species found. Their relevance is reviewed in Appendix D. Existing bird populations on-site are impressive, with 43 different species observed during a 140-man-hour study conducted on the parent tract. Additionally, habitat within the bank will be improved during bank



FIGURE 2: TBMB INHABITANT, A CAROLINA WOLF SPIDER (*HOGNA CAROLINENSIS*); THE LARGEST SPECIES OF WOLF SPIDER IN NORTH AMERICA

establishment by increasing vegetative species composition and diversity, which will likely increase bird species and abundance.

Although not a requirement for permitting of an MBI, state listed and candidate species were evaluated, and the establishment of the TBMB will not adversely impact these species, but rather will improve habitat and resource availability for some. TPWD state listed or candidate species include:

- American Peregrine Falcon (*Falco peregrinus anatum*)
- Piping Plover (*Charadrius melodus*)
- Red-cockaded Woodpecker (*Picoides borealis*)
- Bachman's Sparrow (*Aimophila aestivalis*)
- Red Knot (*Calidris canutus rufa*)
- Paddlefish (*Polyodon spathula*)
- Creek Chubsucker (*Erimyzon oblongus*)
- Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*)
- Houston Toad (*Anaxyrus houstonensis*)
- White-faced Ibis (*Plegadis chihi*)
- Wood Stork (*Mycteria americana*)
- Swallow-tailed Kite (*Elanoides forficatus*)
- Bald Eagle (*Haliaeetus leucocephalus*)
- Peregrine Falcon (*Falco peregrinus*)

- Red Wolf (*Canis rufus*)
- Black Bear (*Ursus americanus*)
- Louisiana Black Bear (*Ursus americanus luteolus*)
- Alligator Snapping Turtle (*Macrochelys temminckii*)
- Texas Horned Lizard (*Phrynosoma cornutum*)
- Northern Scarlet Snake (*Cemophora coccinea copei*)
- Timber Rattlesnake (*Crotalus horridus*)
- Texas Pigtoe (*Fusconaia askewi*)
- Sandbank Pocketbook (*Lampsilis satura*)
- Louisiana Pigtoe (*Pleurobema riddellii*)
- Texas Heelsplitter (*Potamilus amphichaenus*) (TPWD, 2016).

The Bank, as proposed, will provide a beneficial wildlife corridor and complimentary wildlife habitat to the nearby Sam Houston National Forest, the Lake Houston Wilderness Park, and USFWS Trinity River Wildlife Refuge. Further, it will provide permanent and perpetual benefit to the State-listed species that require aquatic, mesic, and riparian habitat dominated by climax hardwood species, such as the timber rattlesnake, white-faced ibis, wood stork, as well as the Townsend's big-eared bat (*Corynorhinus townsendii*) and southeastern myotis bat (*Myotis austroriparius*).

3.4.2 Cultural Resources Assessment

In compliance with the National Historic Preservation Act of 1966, a literature review of the documented historical sites, buildings, or other objects included (or eligible to be included) in the *National Register of Historic Places* was performed to verify no documented sites or objects are located within the boundaries of the TBMB. No historic sites were found to be registered within the Bank boundaries. The full report is located in Appendix E. In addition to the normal literature review, an intensive archeological survey including shovel testing was conducted in the area of berm construction, and no items of significance were found. This comprehensive report is also found in Appendix E.

There are no documented sites associated with the Bank, but if any archeological objects are discovered during the course of this process, the Sponsor will terminate construction activities in the immediate area and disseminate all information to the Texas Historical Commission for further review.

3.4.3 Delineation of Waters of the U.S., Including Wetlands

Characteristics for waters of the U.S. (WOUS), including wetlands, as defined by 33 CFR § 328 (33 CFR Part 328, 1986), were evaluated for ephemeral, intermittent, and perennial streams; navigable and non-navigable waterways; deep-water habitats; wetlands; and other special aquatic sites. Hydrex completed a delineation of all WOUS, including wetlands, and their reports are located in Appendix F. This report contains a history of the property's land use, soil data and maps, vegetation surveys, and hydrologic data. Historical aerial maps are also included to confirm previous land use changes. Two delineation reports are present; one for "Block 1," a 430 Ac delineation performed on the western portion of TBMB in 2011, and the remainder of TBMB which was delineated in 2015.

Following Hydrex's delineations, KSA Engineers, Inc. was engaged to perform a formal boundary survey on the bank, and the property boundary was slightly adjusted. Because of this change, small differences will be noted between the final total wetland acreages discussed in this text and those in Hydrex's delineation report. Additionally, acreages in this section reflect total wetland area within the bank boundary. Subsequent discussion regarding the functional assessment and mitigation plan include acreages in which a 200-ft buffer of acreage around the Bank's stream channels (riparian buffer) has been removed. That buffer acreage is considered independently within discussion of stream buffer and stream buffer enhancement for those sections.

Based upon the information collected during the delineation and functional assessment of the Bank, the proposed TBMB possesses:

- 675.5 Ac of wetland
- 36,489 Lf of channel possessing a definitive ordinary high water mark (OHWM)
 - 20,589 Lf of perennial channels
 - 11,833 Lf of intermittent channels
 - 4,067 Lf of ephemeral channels

These amounts were finalized after site visits with the IRT and the USACE as well as guidance from the USACE. The wetland and stream delineation results summary can be seen in Table 5 and Appendix A, Exhibits 11 and 12.

TABLE 5: TBMB WETLAND AND STREAM DELINEATION RESULTS

Wetland ID	Total Acreage	Wetland Percentage	Wetland Acreage	Stream ID	Stream Type	Length (Ft)	OHWM Width	OHWM Depth
Block 1				Stream-1	Perennial	17,150	26.4	3.2
1A	16.8	100%	16.8	Stream-2	Perennial	3,439	40.0	2.5
1b	24.1	91%	21.9	Stream-3	Ephemeral	602	6.0	0.5
1C	4.7	100%	4.7	Stream-4	Intermittent	4,356	5.2	0.3
1D	2.6	100%	2.6	Stream-5	Ephemeral	300	4.0	0.3
1H	175.4	93%	163.6	Stream-6	Intermittent	2,334	4.2	0.5
Non-Block 1				Stream-7	Intermittent	1,273	5.4	0.4
A	407.1	87%	354.2	Stream-8	Ephemeral	448	4.1	0.3
B	70.3	47%	33.4	Stream-9	Ephemeral	375	2.0	0.2
C	0.8	100%	0.8	Stream-10	Ephemeral	115	2.5	0.2
D	12.6	100%	12.6	Stream-11	Ephemeral	314	2.4	0.2
E	35.9	95%	33.9	Stream-12	Ephemeral	139	3.4	0.3
F	7.2	100%	7.2	Stream-13	Ephemeral	231	5.2	0.2
G	4.0	100%	4.0	Stream-14	Ephemeral	125	2.2	0.2
H	2.0	100%	2.0	Stream-15	Ephemeral	281	2.7	0.2
I	3.6	100%	3.6	Stream-16	Intermittent	907	4.7	0.2
J	5.0	100%	5.0	Stream-17	Ephemeral	107	2.7	0.2
K	9.3	100%	9.3	Stream-18	Intermittent	419	4.0	0.4
TOTAL Wetland	781.2	86%	675.5	Stream-19	Intermittent	345	2.9	0.2
Stream	15.6		15.6	Stream-20	Intermittent	266	2.6	0.3
Upland	591.4		697.1	Stream-21	Ephemeral	92	2.7	0.2
Exclusion	50.2		50.2	Stream-22	Intermittent	236	3.4	0.2
TOTAL BANK	1438.5		1438.5	Stream-23	Intermittent	584	2.9	0.2
Includes 105.7 acres of upland inclusions within wetland boundaries.				Stream-24	Ephemeral	139	2.3	0.2
				Stream-25	Ephemeral	193	3.5	0.2
				Stream-26	Ephemeral	301	3.6	0.3
				Stream-27	Ephemeral	209	2.0	0.3
				Stream-28	Ephemeral	96	2.6	0.2
				Stream-29	Intermittent	537	2.7	0.2
				Stream-30	Intermittent	576	4.0	0.4
				TOTAL	Perennial	20,589		
				TOTAL	Intermittent	11,833		
				TOTAL	Ephemeral	4,067		
				TOTAL		36,489		

3.4.4 Functional Assessment of Wetlands and Streams

The Riverine Forested and Riverine Herbaceous/Shrub Interim Hydrogeomorphic Method (iHGM) provided by the USACE Galveston District, as derived from (Ainslie, et al., 1999), was used to evaluate the ecological quality and function of the wetlands on-site. The Galveston District's Level 1 Stream Condition Assessment (Galveston SOP) (USACE Galveston District, 2013) was used for evaluating all stream channels and associated riparian buffers, in-stream habitat, as well as any anthropogenic alterations to the channel or hydrologic regime. Detailed results of this study can be found within the Functional Assessment Report (Appendix G). Note acreages in this section have the 200 ft riparian buffer (200 ft on either side of creditable stream channels) removed for the purposes of credit generation and will differ from the WOUS delineation.

RS&H identified 30 wetland assessment areas (WAAs), totaling 554.4 Ac, within the data collection boundary, and these areas were broadly divided into the three types based upon hydrologic regime identified; depressions, flats, and floodplains. The complete baseline functional assessment report is provided in Appendix G. Table 6 shows the Functional Capacity Index (FCI) the Functional Capacity Units (FCU), and the score multiplied by the acreage of each WAA, for the wetlands identified within TBMB.

TABLE 6: RESULTS FOR THE WETLAND FUNCTIONAL ASSESSMENT BY WETLAND ASSESSMENT AREA

WAA ID	HGM Class	TSDSW	MPAC	RSEC	Wetland Acreage	TSDSW Units	MPAC Units	RSEC Units
1	Depression - Herbaceous	0.57	0.62	0.67	20.9	11.91	12.89	13.93
2a	Depression - Scrub/Shrub	0.70	0.83	0.84	1.0	0.71	0.85	0.85
2b	Depression - Scrub/Shrub	0.70	0.83	0.79	2.5	1.78	2.12	2.01
3a	Depression - Pine Plantation - 25YO	0.75	0.60	0.88	3.0	2.23	1.79	2.61
3b	Depression - Pine Plantation - 25YO	0.75	0.56	0.78	9.3	7.02	5.21	7.27
3c	Depression - Pine Plantation - 25YO	0.69	0.68	0.79	0.8	0.58	0.57	0.67
4a	Depression - Pine Plantation - Clear-Cut	0.62	0.67	0.49	4.2	2.62	2.82	2.07
4b	Depression - Pine Plantation - Clear-Cut	0.70	0.67	0.51	2.6	1.83	1.73	1.32
5a	Depression - Young Hardwood	0.89	0.67	0.93	4.7	4.23	3.16	4.39
5b	Depression - Young Hardwood	0.75	0.52	0.82	2.9	2.17	1.49	2.36
6	Depression - Mature Mixed Pine/Hardwood	0.79	0.82	0.83	2.0	1.56	1.61	1.64
7	Flat - Herbaceous	0.81	0.75	0.72	26.4	21.45	19.77	18.89
8	Flat - Young Hardwood	0.76	0.57	0.83	32.9	25.17	18.67	27.46
9a	Flat - Mature Hardwood - Thinned	0.70	0.62	0.71	12.1	8.45	7.47	8.64
9b	Flat - Mature Hardwood - Thinned	0.78	0.69	0.75	3.0	2.35	2.08	2.24
10a	Flat - Pine Plantation - 25YO	0.71	0.64	0.80	42.4	29.98	27.20	33.92
10b	Flat - Pine Plantation - 25YO	0.74	0.64	0.81	103.0	76.38	66.08	83.76
11	Flat - Pine Plantation - 10YO	0.76	0.49	0.76	32.0	24.30	15.76	24.35
12	Flat - Pine Plantation - Clear-Cut	0.70	0.75	0.55	13.8	9.71	10.34	7.63
13a	Flat - Maintained Herbaceous	0.68	0.62	0.51	0.9	0.61	0.55	0.45
13b	Flat - Maintained Herbaceous	0.76	0.62	0.53	0.9	0.67	0.54	0.47
14a	Floodplain - Young Hardwood	0.70	0.70	0.75	36.9	25.77	25.99	27.55
14b	Floodplain - Young Hardwood	0.71	0.73	0.80	8.4	5.91	6.13	6.69
15	Floodplain - Pine Plantation - 25YO	0.74	0.72	0.81	26.6	19.72	19.17	21.63
16	Floodplain - Pine Plantation - Clear-Cut	0.75	0.58	0.56	8.0	6.00	4.67	4.45
17a	Floodplain - Mature Hardwood - Thinned	0.78	0.71	0.75	40.2	31.46	28.47	30.01
17b	Floodplain - Mature Hardwood - Thinned	0.78	0.74	0.75	109.6	85.78	81.29	81.84
18	Floodplain - Cypress	0.75	0.73	0.88	1.4	1.08	1.05	1.27
19a	Floodplain - Mature Mixed Pine/Hardwood	0.74	0.79	0.81	0.8	0.58	0.62	0.64
19c	Floodplain - Mature Mixed Pine/Hardwood	0.76	0.82	0.82	1.2	0.88	0.94	0.95

Hydrologic alterations, native vegetative community manipulation, and commercial silviculture operations at TBMB have reduced the function to the majority of the existing streams and wetlands limiting their ability to serve as optimal sources of natural conveyance, hydrologic storage, biogeochemical filtration, and/or preferred aquatic habitat.

Wetlands - Depressions

Herbaceous depressions within the bank were primarily intact, high-quality wetland acres. These herbaceous depressions possessed the most unique ecosystems on-site (evidenced in independent biological surveys provided in Appendix H). Forested depressions within the Bank were impacted by silviculture activities as most were various age classes of pine plantation. These areas are periodically ponded throughout the year through precipitation and groundwater influences. These depressions were loess blowouts and relic oxbow lakes, uniquely characteristic of the Lissie Formation, which can form the headwaters to streams. Representative soils for these depressional areas were Waller loam depressional (Wc), Waller loam (Wa), and Kirbyville fine sandy loam (Kr) (Appendix E). Figure 1, Figure 8, and Figure 10 are examples of depressional wetlands on-site.

Wetlands - Flats

The “flat” communities at TBMB were low-lying forested and herbaceous wetland areas of less than 1 percent slope and were dominated by laurel oak, loblolly pine, Drummond’s maple, Chinese tallow, and dwarf palmetto. Historically, flats were usually ancient abandoned river terraces with alluvial soils and diverse topography. The mima mounds, hillocks of former point bars, and depressions of former channels created a diverse and heterogeneous landscape where water from precipitation ponds for extended periods during the growing season. Water on-site flowed slowly in a southeasterly direction from the “flat” communities, both as surface flows and as groundwater atop an argillic horizon, until it eventually entered Long Branch, a tributary to Luce Bayou. Representative soils for the flats were Waller loam depressional (Wc), Waller loam (Wa), and Kirbyville fine sandy loam (Kr) (Appendix E). Except for the herbaceous flats (WAA 7), most wetlands considered “flats” have been significantly impacted by silviculture activities. Various age classes of pine plantation are represented, and an area with raised beds and significantly altered hydrology (WAAs 11 and 13a) was within this area. Figure 3 is an example of a “flats” wetlands on-site.



FIGURE 3: 25 YEAR-OLD PINE PLANTATION IN PRECIPITATION DRIVEN FLATS WETLAND

Wetlands - Floodplain

The riparian and floodplain systems were associated directly with Tarkington Bayou and were within the 100-year flood return interval area. The WAAs closer to Tarkington Bayou were separated out as they had an even more

frequent return interval, and therefore different soil profiles and hydrologic regimes. The floodplain wetlands, in general, consisted of a mixture of large pine and hardwoods. Although a desirable species composition was seen within the majority of the wetlands within the floodplain, a recent timber harvest had reduced overstory coverage and tree abundance within the majority of these areas. Some exotic invasives were also noted. However, within this area was a pocket of bald cypress swamp, and it was in relatively good condition, ecologically, as the soils were too moist for commercial forestry.

Streams

A survey of the proposed bank included 30 separate streams with a defined OHWM for a total of 36,489 Lf of channel. Of these channels, 20,589 Lf were perennial streams, 11,833 Lf were intermittent streams, and 4,067 Lf were ephemeral channels. Generally, channels were C5 streams with sand dominated beds, but with definite gravel component. Soils became sandier toward Tarkington Bayou as older alluvial deposits gave way to the active floodplain and recently deposited alluvial sand. All streams possessed a forested buffer for 200 ft on either bank, with the exception of two pipeline rights-of-way, but some forests were under active timber management. These management practices and forest life histories were reflected in the scores for the riparian buffer assessment.

The Level 1 Stream Condition Assessment for All Ephemeral and Intermittent Streams and for Impacts Less Than 500 Linear Feet to Intermittent Streams with Perennial Pools, Perennial Streams, and Wadeable Rivers (Level 1 Assessment) (USACE, 2013) was used for the evaluation of stream function with some modifications. The perennial reaches of Tarkington Bayou as well as some of the tributaries to the mainstem were longer than 500 Lf, but the bank sponsor is only proposing buffer restoration (no in-channel work). After consultation with the USACE Galveston District, it was decided the Level 1 Assessment was sufficient, if evidence of channel stability was provided. To satisfy this requirement, Bank Erosion Hazard



FIGURE 4: AN EXAMPLE PERENNIAL REACH OF STREAM-1 OR TARKINGTON BAYOU

Index (BEHI) evaluations were conducted to determine overall channel erosional stability (USACE Galveston District, 2014) (Rosgen D. , Applied River Morphology, 1996).

For the Aquatic Use Variable Score, Tarkington Bayou was evaluated by the TCEQ, which gave the Aquatic Life Use (ALU) score of intermediate. Using the Level 1 Assessment, the Intermediate score is 3 points for Aquatic Use Variable (UV). As all other reaches were not evaluated by TCEQ, the guidelines in the Level 1 Assessment were followed, which ascribes a score of 4 to unevaluated, perennial channels, a score of 2 to

unassessed, intermittent channels with perennial pools, and a score of 1 to all unevaluated intermittent and ephemeral channels (USACE, 2013) (TCEQ, 2014).

TABLE 7: AVERAGE STREAM FUNCTIONAL ASSESSMENT RESULTS BY REACH AND VARIABLE

Name	Linear Feet (Lf)	BEHI	Channel Condition (CV)	Riparian Buffer (BV)	Aquatic Use (UV)	Channel Alteration (AV)	Channel Condition Index (CI)	Flow Regime
Stream-1 (Tarkington Bayou)	17,150	MODERATE	4.00	4.80	3.00	4.88	4.17	Perennial
Stream-2	3,439	MODERATE	3.71	4.83	4.00	5.00	4.39	Perennial
Stream-3	602	LOW	4.00	3.81	1.00	3.00	2.95	Ephemeral
Stream-4	4,356	MODERATE	3.38	4.54	1.63	5.00	3.63	Intermittent
Stream-5	300	MODERATE	5.00	4.48	1.00	4.00	3.62	Ephemeral
Stream-6	2,334	MODERATE	3.00	4.67	1.20	4.80	3.42	Intermittent
Stream-7	1,273	MODERATE	2.67	4.53	1.33	3.67	3.05	Intermittent
Stream-8	448	HIGH	5.00	4.50	1.00	5.00	3.88	Ephemeral
Stream-9	375	MODERATE	5.00	5.00	1.00	5.00	4.00	Ephemeral
Stream-10	115	MODERATE	5.00	5.00	1.00	5.00	4.00	Ephemeral
Stream-11	314	MODERATE	5.00	5.00	1.00	5.00	4.00	Ephemeral
Stream-12	139	MODERATE	5.00	5.00	1.00	5.00	4.00	Ephemeral
Stream-13	231	HIGH	5.00	4.50	1.00	5.00	3.88	Ephemeral
Stream-14	125	MODERATE	5.00	4.50	1.00	5.00	3.88	Ephemeral
Stream-15	281	MODERATE	4.00	4.50	1.00	4.00	3.38	Ephemeral
Stream-16	907	MODERATE	3.00	4.50	1.00	5.00	3.38	Intermittent
Stream-17	107	MODERATE	4.00	4.50	1.00	5.00	3.63	Ephemeral
Stream-18	419	MODERATE	3.00	4.50	1.00	5.00	3.38	Intermittent
Stream-19	345	MODERATE	4.00	4.88	1.00	5.00	3.72	Intermittent
Stream-20	266	HIGH	2.00	4.50	1.00	5.00	3.13	Intermittent
Stream-21	92	LOW	3.00	4.50	1.00	5.00	3.38	Ephemeral
Stream-22	236	MODERATE	3.00	4.50	1.00	5.00	3.38	Intermittent
Stream-23	584	MODERATE	3.50	4.50	1.00	5.00	3.50	Intermittent
Stream-24	139	MODERATE	5.00	4.50	1.00	5.00	3.88	Ephemeral
Stream-25	193	MODERATE	5.00	4.50	1.00	5.00	3.88	Ephemeral
Stream-26	301	MODERATE	4.00	4.84	1.00	5.00	3.71	Ephemeral
Stream-27	209	LOW	5.00	4.78	1.00	5.00	3.94	Ephemeral
Stream-28	96	MODERATE	3.00	5.00	1.00	5.00	3.50	Ephemeral
Stream-29	537	MODERATE	3.00	4.50	1.00	5.00	3.38	Intermittent
Stream-30	576	MODERATE	3.00	4.50	1.00	5.00	3.37	Intermittent

» Channel Condition

The channel condition metric evaluates the cross-section of the channel to assess the stream's ability to access the floodplain during flood stage events. The general trend throughout the tract was for the channel condition to decrease as the tributaries approached Tarkington Bayou, but Tarkington Bayou itself remained the same. This is a result of Tarkington Bayou being at a lower elevation with significantly greater channel capacity. As streams near the confluence with Tarkington, they have to downcut to reach the appropriate channel elevation. A comprehensive analysis of all stream reaches is provided in the functional assessment report (Appendix G).

» Riparian Buffers

The Galveston Method scores for percent cover and quality of cover within the riparian zone, which is defined as a 100 ft buffer around the channel. The majority of the riparian buffer area is within thinned hardwood habitat. These native stands are more desirable than the pine plantation; however signs of previous silvicultural management resulted in a score of 4 out of 5.

» Aquatic Use Variable

Tarkington Bayou was the only stream on-site to be evaluated by TCEQ for aquatic life use. According to the Galveston SOP, intermittent and ephemeral streams which have not been assessed are also assumed to have an Aquatic Life Score of Minimal and a score of 1, but unassessed perennial channels score a 4 to account for the positive habitat benefits of year round inundation.

» Channel Alteration

Channel alteration refers to anthropogenic factors that directly affect stream channel function, its capacity to move an appropriate amount of sediment, or the sediment supplied to the channel by its watershed. These can include, but are not limited to, road crossings, riprap, concrete, gabions, channelization, embankments, spoil piles, constriction, and livestock access. For the streams on-site, there was the occasional dirt road crossing, sometimes associated with a culvert, and the overall area impacted was less than 30 percent. In a few instances on Streams 3 and 7, the area affected was 30 to 60 percent, but these were the worst cases observed.

3.5 REFERENCE SITES

In addition to the data provided by the iHGM regional models, RS&H identified five (5) high quality wetland areas (i.e. reference sites) within the parent tract to use as support for the FCI lift potential within TBMB (Appendix I). The wetland reference sites consisted of the following habitats: mature mixed hardwood/pine forested wetland, mature cypress dominated forested wetland, scrub/shrub depression wetland, herbaceous depression wetland, and herbaceous beaver pond wetland. The herbaceous depression wetland reference is a typical loess blowout depressional wetland system with a semi-perched water table and sandy outer rim/berm. The semi-permanently inundated wetland whose hydrology is driven by the presence of a beaver dam is representative of the type of wetland to be established closest to the proposed berm. None of the reference sites were located within the TBMB; one (1) was located within the HCMB (i.e. herbaceous "beaver pond" wetland). The remaining four (4) were located within the mitigation bank parent tract. The reference sites are discussed further below:

Mature Mixed Hardwood/Pine Forested Wetland

Located in a wetland flat area within the central portion of the parent tract and between the TBMB and HCMB sites, this area scored very well from an iHGM perspective. Frequency and duration of flooding were suboptimal due to the topographic setting of the site (wetland flat) not due to anthropogenic activities. Tree density was slightly low due to the large, mature nature of the site, and the absorptive soil properties variable was low due to the natural parent material of the soil. All other variables were optimal for this site when evaluated with iHGM. The site's dominant vegetation includes water oak, swamp chestnut oak, white oak (*Quercus alba*), cherrybark oak, southern arrowwood (*Viburnum dentatum*), slender wood oats (*Chasmanthium laxum*), and dwarf palmetto.

Mature Cypress Dominated Forested Wetland

This site is located in a depressional area near the southern boundary of the parent tract between HCMB and TBMB. This area did not score as well from an iHGM perspective as the Mixed Hardwood/Pine wetland due to natural characteristics of the site. The topographic complexity was minimal due to the depressional nature of the area. The amount of coarse woody debris was less due to the long-lived nature of Bald Cypress. Species richness and tree density were less due to the near monoculture conditions bald cypress stands result in. Lastly, the mid-story and herbaceous variables were sub-optimal due to a limited mid-story component and heavy (>30% coverage) herbaceous layer. Dominant vegetation includes bald cypress, red maple, sweetgum, lizard's tail (*Saururus cernuus*), and switchgrass (*Panicum virgatum*).

Scrub/Shrub Depression Wetland

Data for this reference habitat type was collected in a depressional area abutting the eastern boundary of HCMB. Using the Herbaceous/Shrub iHGM, this wetland site scored very well. The topographic complexity was suboptimal due to the depressional nature of the area. The amount of woody vegetation and midstory coverage was suboptimal due to having gaps in the midstory/shrub layer, which is natural for these wetland types. Lastly, the absorptive soil properties variable was low due to the natural parent material of the soil. The dominant vegetation for this site included green ash (*Fraxinus pennsylvanica*), American snowbell (*Styrax americanus*), maidencane (*Panicum hemitomon*), and giant sedge (*Carex gigantea*).

Herbaceous Depression Wetland

This site is located in a depressional area near the southern boundary of the parent tract near the southwest portion of TBMB. Using the Herbaceous/Shrub iHGM, this wetland site scored marginal with the iHGM due to the natural lack of woody species and other natural characteristics of the site. The topographic complexity was suboptimal due to the depressional nature of the area. The amount of woody vegetation and midstory coverage was poor due to the natural lack of a midstory/shrub layer. Lastly, the absorptive soil properties variable was low due to the natural parent material of the soil. The vegetation association in this area is a probable G1 Imperiled Community (See Appendix H) with dominant species including sticky hedgehyssop (*Gratiola brevifolia*), and hairy primrose-willow (*Ludwigia pilosa*), with substantial, but not dominant, inclusions of maidencane, combleaf mermaidweed (*Proserpinaca pectinata*), and Drummond's yelloweyed grass (*Xyris drummondii*).

Herbaceous "Beaver Pond" Wetland

This site is located in a depressional area influenced by beaver impoundment activity within the West Fork portion of the HCMB. Using the Herbaceous/Shrub iHGM, this wetland site scored marginal with the iHGM due to the natural lack of woody species and other natural characteristics of the site. The amount of woody vegetation and midstory coverage was poor due to the limited amount of woody species coverage because of increased hydrology due to the impounded nature of the site. Lastly, the absorptive soil properties variable was low due to the natural parent material of the soil. The midstory or shrub/scrub strata was sparse but consisted of scattered Chinese tallow. The herbaceous strata was dominated by common rush (*Juncus effusus*) and sticky hedgehyssop,

with inclusions of maidencane, silver plumegrass (*Saccharum alopecuroides*), and hairy primrose-willow.

3.6 MITIGATION WORK PLAN

The mitigation work plan encompasses the overall design of the establishment/restoration/enhancement of wetlands and stream buffers. Maps of the proposed work can be found in Appendix A, Exhibits 13 and 14. Table 8 below shows a summary of the mitigation plan and post-construction habitats and acreages.

TABLE 8: MITIGATION WORK PLAN SUMMARY

Mitigation Plan	HGM Classification (Wetlands Only)	Post Construction Habitat	Acres
Wetland Establishment	Flat	Herbaceous Wetland	56.9
Wetland Establishment	Flat	Forested Wetland	79.9
Wetland Re-Establishment	Depression	Herbaceous Wetland	20.9
Wetland Re-Establishment	Depression	Scrub/Shrub Wetland	20.1
Wetland Re-Establishment	Depression	Forested Wetland	4.7
Wetland Re-Establishment	Flat	Herbaceous Wetland	24.5
Wetland Re-Establishment	Flat	Forested Wetland	30.9
Wetland Restoration	Flat	Forested Wetland	62.4
Wetland Enhancement	Flat	Herbaceous Wetland	26.4
Wetland Enhancement	Flat	Forested Wetland	152.7
Wetland Enhancement	Depression	Forested Wetland	8.3
Wetland Enhancement	Floodplain	Forested Wetland	233.0
Riparian Buffer Light Buffer Planting		Hardwood/Pine Forest	145.1
Upland Buffer Enhancement		Hardwood/Pine Upland Buffer	499.6
Stream Beds			15.6
Exclusions			50.2
Berm			7.2
TOTAL TBMB			1438.5

Due to the large size, complexity, and varying temporal requirements of restoration strategies, the bank has been split into three "Monitoring Units" (MU) so work, and associated credit releases can be phased over time. These MUs can be seen in Exhibits 11-14 (Appendix A) and are summarized below. The detailed mitigation work plan has been organized by MU in Sections 3.6.1 - 3.6.3.

Monitoring Unit 1 Overview

MU1 consists of 628.5 Ac most closely associated with the floodplain of Tarkington Bayou. This is also the only monitoring unit containing stream credits. The overall mitigation plan for this MU is primarily enhancement of a vegetative community that has been impacted by silvicultural activities. Monoculture pine plantation will be removed (where applicable), noxious/invasive species will be eradicated, and supplemental planting (along with natural regeneration) will be utilized to promote a natural vegetative community.

Monitoring Unit 2 Overview

MU2 consists of 464.5 Ac located in the central portion of the bank. The MU is bound by MU1 to the east and MU3 to the west. This is a large area of “flat” wetlands that constitute the headwaters to Long Branch, a tributary to Luce Bayou. This MU will require more intensive restoration activities than MU1. Most wetlands with MU2 are in various stages of pine silviculture, including intensively site prepped, bedded pine plantation. The monoculture pine will be removed (where applicable), hydrology restored by removing pine plantation beds (where applicable), noxious/invasive species will be eradicated, and supplemental planting (along with natural regeneration) will be utilized to promote a natural vegetative community.

Monitoring Unit 3 Overview

MU3 consists of 345.5 Ac located in the western portion of the bank. This MU will require the most intensive restoration/construction. Most wetlands within MU3 have been impacted by pine silviculture, which both impaired the vegetative community and reduced the wetland acreage. A berm will be constructed to establish additional wetlands and re-establish a hydrologic connection with verified adjacent wetlands. The general mitigation plan sequence for this MU is to remove the monoculture pine plantation, eradicate noxious/invasive species, construct the berm, and supplemental planting (along with natural regeneration) to promote a natural vegetative community.

Vegetation Plan Overview

All MUs will require vegetation manipulation and improvement. Supplemental plantings, along with natural regeneration, will be utilized to establish the appropriate vegetative community for each area. The IRT has expressed concerns about the overall hardiness of planted trees purchased from distant sources. Saplings will be purchased from a reputable, local source to ensure optimal survivorship.

The species in Table 9 through Table 12 represent desirable species present on-site during the functional assessments, identified at reference locations, recommended by TPWD (TPWD, 2004) (TPWD, 2015), and listed in *Ecoregions of Texas* (Griffith, Bryce, Omernik, & Rogers, 2007), as well as other regional sources. The wetland indicator status (WIS) and corroboration of occurrence in Liberty County, Texas was provided by the USACE 2014 National Wetland Plant List (NWPL version 3.2) (USACE, 2014). No more than 25 percent of any one tree species will be planted. Bare root, or containerized seedlings, purchased from a local source, will be used for planting to ensure establishment and rapid successional development. Trees, shrubs, and herbaceous plants may be planted in densities to promote the development of vegetative communities significantly similar to the reference communities when combined with the individuals and seed banks currently present.

TABLE 9 : PREFERRED TREE SPECIES

Trees					
Scientific	Common	WIS	Scientific	Common	WIS
<i>Acer rubrum</i>	Red Maple	FAC	<i>Nyssa biflora</i>	Swamp Tupelo	OBL
<i>Acer saccharum</i>	Southern Sugar Maple	FAC	<i>Nyssa sylvatica</i>	Blackgum	FAC
<i>Asimina triloba</i>	Common Pawpaw	FAC	<i>Ostrya virginiana</i>	Eastern Hop Hornbeam	FACU
<i>Betula nigra</i>	River Birch	FACW	<i>Pinus echinata</i>	Shortleaf Pine	FACU
<i>Carpinus caroliniana</i>	American Hornbeam	FAC	<i>Pinus palustris</i>	Longleaf Pine	FAC
<i>Carya aquatica</i>	Water Hickory	OBL	<i>Pinus taeda</i>	Loblolly Pine	FAC
<i>Carya cordiformis</i>	Bitternut Hickory	FAC	<i>Planera aquatica</i>	Planertree	OBL
<i>Carya tomentosa</i>	Mockernut Hickory	FACU	<i>Prunus caroliniana</i>	Carolina Laurel Cherry	FACU
<i>Celtis laevigata</i>	Sugarberry	FACW	<i>Prunus serotina</i>	Black Cherry	FACU
<i>Cercis canadensis</i>	Eastern Redbud	UPL	<i>Quercus alba</i>	White Oak	FACU
<i>Cornus florida</i>	Flowering Dogwood	FACU	<i>Quercus falcata</i>	Southern Red Oak	FACU
<i>Crataegus opaca</i>	Mayhaw	OBL	<i>Quercus laurifolia</i>	Laurel Oak	FACW
<i>Diospyros virginiana</i>	Common Persimmon	FAC	<i>Quercus lyrata</i>	Overcup Oak	OBL
<i>Fagus grandifolia</i>	American Beech	FACU	<i>Quercus macrocarpa</i>	Bur Oak	FACU
<i>Fraxinus pennsylvanica</i>	Green Ash	FACW	<i>Quercus michauxii</i>	Swamp Chestnut Oak	FACW
<i>Fraxinus profunda</i>	Pumpkin Ash	OBL	<i>Quercus nigra</i>	Water Oak	FAC
<i>Ilex opaca</i>	American Holly	FAC	<i>Quercus pagoda</i>	Cherrybark Oak	FACW
<i>Juglans nigra</i>	Black Walnut	UPL	<i>Quercus phellos</i>	Willow Oak	FACW
<i>Juniperus virginiana</i>	Eastern Red Cedar	FACU	<i>Quercus shumardii</i>	Shumard Oak	FAC
<i>Magnolia grandiflora</i>	Magnolia	FAC	<i>Quercus stellata</i>	Post Oak	UPL
<i>Magnolia virginiana</i>	Sweetbay	FACW	<i>Taxodium distichum</i>	Baldcypress	OBL
<i>Morus rubra</i>	Red Mulberry	FACU	<i>Ulmus alata</i>	Winged Elm	FACU
<i>Nyssa aquatica</i>	Water Tupelo	OBL	<i>Ulmus americana</i>	American Elm	FAC

TABLE 10: PREFERRED SHRUB SPECIES

Shrubs					
Scientific	Common	WIS	Scientific	Common	WIS
<i>Alnus serrulata</i>	Hazel Alder	FACW	<i>Lindera benzoin</i>	Common Spicebush	FACW
<i>Amorpha fruticosa</i>	False Indigo Bush	FACW	<i>Morella cerifera</i>	Southern Wax Myrtle	FAC
<i>Baccharis halimifolia</i>	Eastern Baccharis	FAC	<i>Prunus angustifolia</i>	Chickasaw Plum	NL/FAC
<i>Callicarpa americana</i>	American Beautyberry	FACU	<i>Prunus mexicana</i>	Mexican Plum	NL/FAC
<i>Cephalanthus occidentalis</i>	Buttonbush	OBL	<i>Rhododendron canescens</i>	Wild Azalea	FACW
<i>Chionanthus virginicus</i>	White Fringetree	FACU	<i>Rhododendron canescens</i>	Wild Azalea	FACW
<i>Cyrtilla racemiflora</i>	White Titi	FACW	<i>Salix nigra</i>	Black Willow	OBL
<i>Euonymus americanus</i>	Strawberry Bush	FAC	<i>Sambucus canadensis</i>	American Elderberry	FAC
<i>Hibiscus aculeatus</i>	Big Thicket Hibiscus	FACW	<i>Styrax americanus</i>	American Snowbell	FACW
<i>Hibiscus coccineus</i>	Texas Star Hibiscus	OBL	<i>Styrax grandifolius</i>	Big Leaf Snowbell	FACU
<i>Hibiscus grandiflorus</i>	Swamp Rosemallow	OBL	<i>Symphoricarpos orbiculatus</i>	Coralberry	FACU
<i>Hibiscus laevis</i>	Rosemallow	OBL	<i>Vaccinium arboreum</i>	Farkleberry / Huckleberry	FACU
<i>Hypericum hypericoides</i>	St. Andrew's Cross	FAC	<i>Viburnum dentatum</i>	Southern Arrowwood	FACU
<i>Ilex coriacea</i>	Sweet Gallberry	FACW	<i>Viburnum nudum</i>	Possum-Haw Viburnum	FACW
<i>Ilex glabra</i>	Gallberry	FACW			

TABLE 11: PREFERRED HERBACEOUS SPECIES

Herbs					
Scientific	Common	WIS	Scientific	Common	WIS
<i>Andropogon gerardii</i>	Big Bluestem	FAC	<i>Eleocharis obtusa</i>	Blunt Spike Rush	OBL
<i>Andropogon glomeratus</i>	Bushy Bluestem	FACW	<i>Eleocharis palustris</i>	Common Spikerush	OBL
<i>Carex caroliniana</i>	Carolina Sedge	FACW	<i>Eleocharis tortilis</i>	Twisted Spike Rush	FACW
<i>Carex cherokeensis</i>	Cherokee Sedge	FACW	<i>Hydrocotyle verticillata</i>	Pennywort	OBL
<i>Carex crebriflora</i>	Coastal Plain Sedge	FACW	<i>Hymenocallis liriosme</i>	Spring Spider Lily	OBL
<i>Carex gigantea</i>	Giant Sedge	OBL	<i>Hymenocallis occidentalis</i>	Carolina Spider Lily	OBL
<i>Carex glaucescens</i>	Southern Waxy Sedge	FACW	<i>Juncus brachycarpus</i>	White Root Rush	FACW
<i>Carex intumescens</i>	Great Bladder Sedge	FACW	<i>Juncus bufonius</i>	Toad Rush	FACW
<i>Carex louisianica</i>	Louisiana Sedge	OBL	<i>Juncus effusus</i>	Lamp Rush	OBL
<i>Chasmanthium latifolium</i>	Broadleaf Woodoats	FAC	<i>Juncus marginatus</i>	Bog Rush	FACW
<i>Chasmanthium laxum</i>	Slender Woodoats	FACW	<i>Persicaria hydropiperoides</i>	Swamp Smartweed	OBL
<i>Chasmanthium sessiliflorum</i>	Narrowleaf Woodoats	FAC	<i>Polygonatum biflorum</i>	King Solomon's Seal	FACU
<i>Cyperus erythrorhizos</i>	Red-Root Flat Sedge	OBL	<i>Saururus cernuus</i>	Lizardstail	OBL
<i>Cyperus esculentus</i>	Yellow Nutsedge	FAC	<i>Schizachyrium scoparium</i>	Little False Bluestem	FACU
<i>Cyperus flavescens</i>	Yellow Flat Sedge	OBL	<i>Schoenoplectus americanus</i>	Olney Bulrush	OBL
<i>Cyperus rotundus</i>	Purple Flat Sedge	FAC	<i>Scirpus cyperinus</i>	Cottongrass Bulrush	OBL
<i>Cyperus virens</i>	Green Flat Sedge	FACW	<i>Sesbania macrocarpa</i>	Coffee Bean	FACW
<i>Eleocharis microcarpa</i>	Small Fruit Spike Rush	OBL	<i>Sorghastrum nutans</i>	Yellow Indiangrass	FACU

TABLE 12: PREFERRED VINE SPECIES

Vines					
SCIENTIFIC	COMMON	WIS	SCIENTIFIC	COMMON	WIS
<i>Ampelopsis arborea</i>	Peppervine	FAC	<i>Parthenocissus quinquefolia</i>	Virginia Creeper	FACU
<i>Berchemia scandens</i>	Alabama Supplejack	FAC	<i>Rubus spp.</i>	Blackberries	FAC
<i>Campsis radicans</i>	Common Trumpet Creeper	FAC	<i>Smilax glauca</i>	Cat Greenbriar	FAC
<i>Cocculus carolinus</i>	Red-berried Moonseed	FAC	<i>Smilax rotundifolia</i>	Common Greenbriar	FAC
<i>Gelsemium sempervirens</i>	Carolina Jasmine	FAC	<i>Vitis rotundifolia</i>	Muscadine Grape	FAC

3.6.1 Mitigation Work Plan - Monitoring Unit 1

MU1 consists of 628.5 Ac most closely associated with the floodplain of Tarkington Bayou. This is also the only monitoring unit containing stream credits. The overall mitigation plan for this MU is primarily enhancement of a vegetative community that has been impacted by silvicultural activities. Wetland enhancement, totaling 235.0 Ac within this MU includes WAAs 6, 14a, 14b, 15, 16, 17a, 17b, 18, 19a, and 19c. There are also 145.1 Ac of stream buffers that will be enhanced, as well as 207.4 acres of upland that will be enhanced. Remaining acreage consists of stream channels (15.6 Ac), and areas such as roads, pipeline rights-of-way, that are excluded from credit generation (25.4 Ac)

TABLE 13: MONITORING UNIT 1 MITIGATION WORK PLAN SUMMARY

WAA ID	Pre-Construction Habitat	HGM Classification		Post-Construction Habitat	Acreage
		(Wetland Only)	Mitigation Plan		
6	Hardwood/Pine Wetland	Depression	Enhancement	Hardwood/Pine Wetland	2.0
14a	Young Hardwood Wetland	Floodplain	Enhancement	Hardwood/Pine Wetland	36.9
14b	Young Hardwood Wetland	Floodplain	Enhancement	Hardwood/Pine Wetland	8.4
15	25-Year Pine Plantation Wetland	Floodplain	Enhancement	Hardwood/Pine Wetland	26.6
16	Clear-Cut Pine Plantation Wetland	Floodplain	Enhancement	Hardwood/Pine Wetland	8.0
17a	Thinned Mature Hardwood Wetland	Floodplain	Enhancement	Hardwood/Pine Wetland	40.2
17b	Thinned Mature Hardwood Wetland	Floodplain	Enhancement	Hardwood/Pine Wetland	109.6
18	Cypress Wetland	Floodplain	Enhancement	Cypress Wetland	1.4
19a	Hardwood/Pine Wetland	Floodplain	Enhancement	Hardwood/Pine Wetland	0.8
19c	Hardwood/Pine Wetland	Floodplain	Enhancement	Hardwood/Pine Wetland	1.2
TOTAL WETLAND					235.0
Riparian Buffer	Impaired Forest		Light Buffer Planting	Hardwood/Pine Forest	145.1
Upland	Pine Silviculture		Enhancement	Hardwood Pine Forest	207.4
Stream Beds					15.6
Exclusions					25.4
TOTAL MU1					628.5

3.6.1.1 Monitoring Unit 1 Mitigation Work Plan - Wetland Enhancement

WAAs 6, 19a, and 19c are mature mixed hardwood/pine wetlands (2.0 Ac, 0.8 Ac, and 1.2 Ac, respectively). The acreage of these areas is small because most of the area is being counted toward stream buffer and not wetland enhancement. Despite being among the highest quality wetlands on the parent tract, the areas still have encroachment from noxious species and pine, as well as an overall species assemblage in need of improvement. Because of the high quality of these WAAs, noxious species removal will be implemented cautiously with exceptional effort being made not to damage or kill desired species. The same is true of supplemental planting, if undertaken. Supplemental plantings may occur to meet the Year 2 Performance Standard (See Section 3.9) but may not be necessary due to the potential for extensive natural regeneration. An assessment of the amount of desirable natural regeneration will be made after initial clearing and/or invasive species treatment to guide any plantings necessary.

WAAs 14a (36.9 Ac) and 14b (8.4 Ac) are young hardwood stands to be converted to mature, hardwood/pine forest. These stands are monocultures with highly branched, small diameter trunks. A thinning of the population followed by select plantings of desired, hard-mast species, and other obligate/facultative wetland species, will create a more robust and resilient system with a greater abundance of food for wildlife. Supplemental plantings may occur to meet the Year 2 Performance Standard (See Section 3.9) but may not be necessary due to the potential for extensive natural regeneration. An assessment of the amount of

desirable natural regeneration will be made after initial clearing and/or invasive species treatment to guide any plantings necessary.

WAA 15 (26.6 Ac) is currently 25-year-old pine plantation to be enhanced by vegetation manipulation to a desirable mixed hardwood/pine wetland. Most of pines will be harvested but some will be felled or treated with herbicide and left on-site to provide habitat and sources of coarse woody debris. Some pines sufficient in size (15 in to 20 in or greater DBH) contribute greater ecological value and will remain intact. Once the area is cleared of the majority of the pines, supplemental plantings may occur to meet the Year 2 Performance Standard (See Section 3.9) but may not be necessary due to the potential for extensive natural regeneration. An assessment of the amount of desirable natural regeneration will be made after initial clearing and/or invasive species treatment to guide any plantings necessary.

WAA 16 (8.0 Ac) is currently clear-cut and will be enhanced by vegetation manipulation to a desirable mixed hardwood/pine wetland. As stated above, native herbaceous and shrub species were shaded out of the clear-cut pine plantation, and thinning cycles have removed hard-mast tree species. The removal of the canopy has led to an abundance of noxious and primary succession species (e.g. tallow, *Rubus* sp., sweetgum, etc.). By the time restoration begins, it will have been 3 to 4 years since the clear-cut, so removal of undesirable saplings followed by an herbicide treatment for noxious species will occur first. Supplemental plantings may occur to meet the Year 2 Performance Standard (See Section 3.9) but may not be necessary due to the potential for extensive natural regeneration. An assessment of the amount of desirable natural regeneration will be made after initial clearing and/or invasive species treatment to guide any plantings necessary.

WAAs 17a (40.2 Ac) and 17b (109.6 Ac) are mature, hardwood, wetland forests that have been recently thinned. These areas already possess many mature individuals of obligate and facultative wetland species, so many of these individuals will be left on-site. Due to the previous thin, there is overcrowding in the understory and in gaps in the canopy. Thinning has led to an excess of early successional and less than desirable species (predominately Chinese Tallow). Noxious/invasive species will be controlled to release desirable natural regeneration. Supplemental plantings may occur to meet the Year 2 Performance Standard (See Section 3.9) but may not be necessary due to the potential for extensive natural regeneration. An assessment of the amount of desirable natural regeneration will be made after initial clearing and/or invasive species treatment to guide any plantings necessary.

WAA 18 (1.4 Ac) is a high quality bald cypress dominated stand situated in the floodplain of Tarkington Bayou. The area is inundated for long portions of the year due to overbank flooding as well as precipitation. Species diversity was not substantial in this area, but that is likely due to the long-term inundation and not a sign of recent disturbance. As is the case with almost the entire tract, there is some encroachment by tallow and other undesirable species. The enhancement strategy for this WAA is similar to WAAs 8 and 5b, which is a highly selective and cautious removal of noxious species. Supplemental plantings may occur to meet the Year 2 Performance Standard (See Section 3.9) but may not be necessary due to the potential for extensive natural regeneration. An assessment of the amount of desirable natural regeneration will be made after initial clearing and/or invasive species treatment to guide any plantings necessary.

3.6.1.2 Monitoring Unit 1 Mitigation Work Plan - Upland Enhancement

Upland acreage (207.4 Ac) will be included in MU1 to provide a buffer for the wetland resources on-site. The predominant source of uplift will come from improvement of the vegetative community. Uplands within MU1 are currently in various stages of pine silviculture. The pine plantation will be thinned aggressively and natural regeneration, along with supplemental planting if needed, will be utilized to establish a mixed pine/hardwood community. Chemical and mechanical control mechanisms (such as manual cutting or herbicide appropriate for aquatic systems) will be used to control noxious species during the initial thinning and during the monitoring period as needed to meet the performance standards.

3.6.1.3 Monitoring Unit 1 Mitigation Work Plan - Stream Buffer Enhancement

The riparian buffer is the forest within 200 ft perpendicularly adjacent to the stream channels (100 ft of inner buffer and 100 ft of outer buffer). These areas, and the floodplain wetlands within them, are critical for water quality through their biogeochemical processing of materials in stormwater runoff. The riparian buffer is shown in Exhibit 14 within Appendix A.

The predominant tree species within the riparian zones were laurel oak and water oak as the habitat types were thinned mature hardwood, 25-year-old pine plantation, and young hardwood stands. There were some patches of forest with no apparent signs of thinning in recent years. The favorable species composition in much of the riparian zone to be enhanced justifies the rationale to refrain from extensive (more than 400 stems-per-acre) artificial planting. Light buffer planting (more than 200 stems-per-acre) will occur along all creditable stream lengths, but all efforts will be extended to ensure minimal damage and that as much of the native seed bank is utilized as possible. For the thinned, mature hardwood stands, the predominant management strategy will be controlling invasive species to release the native seedbank and supplemental plantings. The 25-year-old pine plantations will be treated much the same as the wetland enhancement areas; the pines will be harvested, and invasive species will be controlled to release the native seedbank and supplemental plantings will occur. The young hardwood stands will be thinned as necessary to remove the monoculture laurel oak habitat and supplemental planting will be used to increase species diversity.

3.6.2 Mitigation Work Plan - Monitoring Unit 2

MU2 consists of 464.5 Ac located in the central portion of the bank. The MU is bound by MU1 to the east and MU3 to the west. This is a large area of "flat" wetlands that constitute the headwaters to Long Branch, a tributary to Luce Bayou. This MU will require more intensive restoration activities than MU1. WAAs 11 and 13b have been significantly impacted by intensive site preparation methods (bedding) that have reduced the wetland acreage in these areas. The hydrology to these WAAs will be restored by removing these pine plantation beds, and vegetation enhanced back to a native community. Additional WAAs within MU2 (3c, 4b, 5b, 7, 8, 9b, 10b, and 12) will consist of enhancement of a vegetative community that has been impacted by silvicultural activities and invasive species encroachment. Additionally, 194.7 acres of upland buffer/inclusions will be enhanced.

TABLE 14: MONITORING UNIT 2 MITIGATION WORK PLAN SUMMARY

WAA ID	Pre-Construction Habitat	HGM Classification		Mitigation Plan	Post-Construction Habitat	Acreage
		(Wetland Only)				
3c	25-Year Pine Plantation Wetland	Depression		Enhancement	Hardwood/Pine Wetland	0.8
4b	Clear-Cut Pine Plantation Wetland	Depression		Enhancement	Hardwood/Pine Wetland	2.6
5b	Young Hardwood Wetland	Depression		Enhancement	Cypress Wetland	2.9
7	Herbaceous Wetland	Flat		Enhancement	Herbaceous Wetland	26.4
8	Young Hardwood Wetland	Flat		Enhancement	Cypress Wetland	32.9
9b	Thinned Mature Hardwood Wetland	Flat		Enhancement	Hardwood/Pine Wetland	3.0
10b	25-Year Pine Plantation Wetland	Flat		Enhancement	Hardwood/Pine Wetland	103.0
11	10-Year Pine Plantation Wetland	Flat		Restoration	Hardwood/Pine Wetland	60.7
12	Clear-Cut Pine Plantation Wetland	Flat		Enhancement	Hardwood/Pine Wetland	13.8
13b	Maintained Herbaceous Wetland	Flat		Restoration	Hardwood/Pine Wetland	1.7
TOTAL WETLAND						247.8
Upland	Pine Silviculture			Enhancement	Hardwood Pine Forest	194.7
Exclusions						22.0
TOTAL MU2						464.5

3.6.2.1 Monitoring Unit 2 Mitigation Work Plan - Wetland Restoration

As previously stated, WAAs 11 and 13b have been significantly impacted by intensive loblolly pine site preparation methods (bedding) that have reduced the wetland acreage in these areas. WAA 11 is 67.5 Ac in total size (wetland and upland inclusion combined) but only contains 32.0 Ac (47% of total area) wetland. WAA 13b is 1.8 Ac total, but only 0.9 Ac (also 47% of total area) wetland. After implementation of the mitigation plan, it is anticipated these areas will be 90% wetland for a wetland acreage of 60.7 and 1.7 respectively.

Typical logging equipment (e.g. harvester, bulldozer, skidder, loader, and log trucks) will be utilized to harvest the existing pine timber. The harvester and skidder will use the raised earth beds for travel, which will begin the reduction of the overall height of the beds.

Once the timber harvest is complete, earthmoving equipment (i.e. bulldozer with V-blade) will be utilized to further reduce the height of the beds and depth between the beds, thereby creating a slightly undulating surface that matches and/or mimics natural ground elevations prior to bed installation. The bulldozer with V-blade will also exhume most of the pine stumps while removing beds. The pine stumps and residual slash will be left in-place to produce additional roughness and coarse woody debris alongside the micro depressions and mounds created. The residual slash will also reduce potential erosion and protect planted seedlings. Where necessary, ditch plugs may be used at the ends of bed rows to prolong the residence time of precipitation runoff. Collectively, these operations will also simulate a more native topography and mimic the mima mounds and gentle sloughs/troughs found within the adjacent wetland areas.

Herbicide will be applied to noxious and invasive tree and shrub species once the bedded areas and stumps have been removed / reduced. Foliar application of herbicide will be implemented for undesirable shrubs and herbaceous vegetation. Any undesirable saplings and trees remaining will be treated with a "hack and squirt" herbicide application.

Planting of desirable bare root or containerized seedlings will commence once beds are removed and a herbicide application is complete where needed. The initial planting density will be 200 stems / Ac with no more than 20% of any one species represented. Although earthmoving will occur in these areas, it's

anticipated natural recruitment from the existing seed bank will be sufficient to promote a desirable herbaceous and shrub layer as well as additional tree species.

Heavy equipment use and placement on the landscape will be carefully chosen to minimize soil compaction and other negative effects. The bulldozer utilized for pine bed and stump removal will be equipped with tracks which distribute the weight over a wider area, thus minimizing soil compaction. As an example, A Caterpillar D-9 bulldozer, which has an operating weight of approximately 105,600 pounds, has a ground pressure rating of 16.1 pounds per square in (psi); the average human foot produced approximately 16 psi. Whereas this exact equipment may not be used, similar equipment with a similar impact will be used.

The pine bed and stump removal will alleviate any prior soil compaction which may have occurred during previous pine management activities. Equipment will be taken off-site to a staging area within uplands when not actively in use or being serviced. The timber loading area will be located in the upland north of the current bedded pine area. Also, an existing access road will be utilized as the main travel corridor between timber loading area and timber harvest area. No additional fill or dredging will be used in the bed manipulation.

3.6.2.2 Monitoring Unit 2 Mitigation Work Plan - Wetland Enhancement

WAAs 3c, 4b, 5b, 7, 8, 9b, 10b, and 12 within MU2 (184.5 Ac total) will consist of enhancement of a vegetative community that has been impacted by silvicultural activities and invasive species encroachment.

WAAs 3c, 4b, 9b, 10b, and 12 (0.8, 2.6, 3.0, 103.0, and 13.8 Ac respectively) have all been impacted by various silviculture and will be enhanced. Enhancement of these WAAs will follow the same prescription described in MU1 (Section 3.6.1.1), with the monoculture pine being removed with care taken to leave any understory hardwoods and noxious/invasive species eradicated. Supplemental plantings may occur to meet the Year 2 Performance Standard (See Section 3.9) but may not be necessary due to the potential for extensive natural regeneration. An assessment of the amount of desirable natural regeneration will be made after initial clearing and/or invasive species treatment to guide any plantings necessary.

WAAs 5b (2.9 Ac) and 8 (32.9 Ac) and are much more wet (frequently inundated at 6 in. to 1 ft.) than other young hardwood stands within the bank. WAA 8 is adjacent to an herbaceous enhancement area (i.e. WAA 7), and WAA 5b looks like it may have been a Waller depression, although some of the features have been lost. For these reasons and based upon other reference sites in the area, these WAAs will be transitioned to a wetland with a substantial component of bald cypress. The final planting strategy for these WAAs includes an abundance of cypress and possibly other obligate or facultative wetland species as cherrybark oak, overcup oak, or mayhaw (*Crataegus opaca*). Many of the existing tree species (early successional species such as red maple and sweetgum) will need to be removed, and planting densities of 200+ stems per acre) to achieve establishment. Invasive species removal and maintenance will also occur.

WAA 7 (26.4 Ac) represents herbaceous dominated wetland that has been negatively impacted by silviculture activities and encroachment of invasive species. This is not a characteristic loess blowout or Waller depression, but is rather a low, broad flat with precipitation driven hydrology that eventually drains into Long Branch and Luce Bayou. The area has experienced some impact from the managed pipeline right-

of-way, shooting lanes dissecting the WAA, and the effects of adjacent pine plantation management. The recent drought of record allowed noxious species encroachment along with invasion of young pine onto the tops of mima mounds and the fringes of the wetland, which need to be addressed. A selective and careful noxious and undesirable species removal will take place, followed by the judicious planting of some native woody scrub/shrub species to offset the undesirable species removed.

3.6.2.3 Monitoring Unit 2 Mitigation Work Plan - Upland Enhancement

Upland acreage (194.7 Ac) will be included in MU2 to provide a buffer for the wetland resources on-site. The predominant source of uplift will come from improvement of the vegetative community. Uplands within MU2 are currently in various stages of pine silviculture. The pine plantation will be thinned aggressively and natural regeneration, along with supplemental planting if needed, will be utilized to establish a mixed pine/hardwood community. Chemical and mechanical control mechanisms (such as manual cutting or herbicide appropriate for aquatic systems) will be used to control noxious species during the initial thinning and during the monitoring period as needed to meet the performance standards.

3.6.3 Mitigation Work Plan - Monitoring Unit 3

MU3 consists of 345.5 Ac located in the western portion of the bank. This MU will require the most intensive restoration/construction. Most wetlands within MU3 have been impacted by pine silviculture, which both impaired the vegetative community and reduced the wetland acreage. A berm will be constructed to establish 136.8 Ac of additional wetlands and re-establish a hydrologic connection to 101.1 Ac with verified adjacent wetlands. The general mitigation plan sequence for this MU is to remove the monoculture pine plantation, eradicate noxious/invasive species, construct the berm, and supplemental planting (along with natural regeneration) to promote a natural vegetative community. Additionally, 97.5 Ac of uplands will be enhanced within MU 3.

TABLE 15: MONITORING UNIT 3 MITIGATION WORK PLAN SUMMARY

WAA ID	Pre-Construction Habitat	HGM Classification		Post-Construction Habitat	Acreage
		(Wetland Only)	Mitigation Plan		
1	Herbaceous Wetland	Depression	Re-Establishment	Herbaceous Wetland	20.9
2a	Scrub/Shrub Wetland	Depression	Re-Establishment	Scrub/Shrub Wetland	1.0
2b	Scrub/Shrub Wetland	Depression	Re-Establishment	Scrub/Shrub Wetland	2.5
3a	25-Year Pine Plantation Wetland	Depression	Re-Establishment	Scrub/Shrub Wetland	3.0
3b	25-Year Pine Plantation Wetland	Depression	Re-Establishment	Scrub/Shrub Wetland	9.3
4a	Clear-Cut Pine Plantation Wetland	Depression	Re-Establishment	Scrub/Shrub Wetland	4.2
5a	Young Hardwood Wetland	Depression	Re-Establishment	Hardwood/Pine Wetland	4.7
9a	Thinned Mature Hardwood Wetland	Flat	Re-Establishment	Hardwood/Pine Wetland	12.1
10a	25-Year Pine Plantation Wetland	Flat	Re-Establishment	Herbaceous Wetland	24.5
10a	25-Year Pine Plantation Wetland	Flat	Re-Establishment	Hardwood/Pine Wetland	17.9
13a	Maintained Herbaceous Wetland	Flat	Re-Establishment	Hardwood/Pine Wetland	0.9
20	Upland	Flat	Establishment	Herbaceous Wetland	56.9
21	Upland	Flat	Establishment	Hardwood/Pine Wetland	79.9
TOTAL WETLAND					237.9
Upland	Pine Silviculture		Enhancement	Hardwood Pine Forest	97.5
Exclusions					2.9
Berm					7.2
TOTAL MU3					345.5

3.6.3.1 Monitoring Unit 3 Mitigation Work Plan – Wetland Establishment

A berm will be constructed on-site to provide a significant hydrologic connection to verified adjacent wetlands as well as inundate associated uplands, thereby establishing additional wetlands. The overall increase in wetland acreage with a significant nexus to Long Branch and Luce Bayou will provide substantial benefits in water quality and habitat availability to the Lake Houston system. A detailed and complete design and hydrology study by 303 Engineering is provided in Appendix J.

Berm construction will require approximately 62,400 cubic yards of fill (Appendix J; Sheets: Grade-B1). The berm will impound approximately 182.3 acre-feet (Ac-ft) of water at maximum capacity. The berm design has a spillway elevation of 120 ft, 4.2 ft above natural ground at the spillway, which will result in an approximate 5,300 Lf of berm (Appendix J; Sheets: Grade-B1 – Grade-B4, Spillway-A1, and Spillway-A2). The berm will be constructed with a 20-ft. wide, unimproved road on top for access and maintenance; total width at top of berm will be 30 ft. Clay will make up the core of the berm and will begin below the current ground level to maintain structural integrity. The top of berm outside of the spillway will be constructed 1.8 ft higher than the spillway elevation to ensure the berm is not overtopped and to mitigate any potential soil settling issues. The spillway will be constructed with buried weir wall set at the proper elevation followed by a riprap low-water crossing leading to a plunge pool, which will dissipate the overflow velocity before entering adjacent wetland areas (Appendix J; Sheets: Spillway-A1, and Spillway-A2).

Fill for the berm will be excavated from upland areas identified as 'Area in Cut' within Appendix J (Sheets: Grade-B1 – Grade-B4). This excavated land will create more concave areas and topographic variation across the landscape. Excavated material will be evenly distributed within the area identified as 'Area in Fill' within Appendix J (Sheets: Grade-B1 – Grade-B4). The 'Area in Fill' is located adjacent to the upstream portion of the berm. Increasing the elevation to 118 ft within this area ensures inundation over 2 ft in depth will not occur adjacent to the berm. This is to alleviate concerns of excessive water depth relative to desired vegetative community structure. As a beneficial consequence of establishing additional inundated wetlands, the impounded water will condemn three logging roads through the Bank, thereby reducing access to the Bank's interior and the potential for disturbance.

The established wetlands will range from forested wetlands with soils saturated in the top 12 in to herbaceous wetlands with water depths of approximately 2 ft at the spillway (Appendix J; Sheet: Ref. Proposed). Figure 5 shows the herbaceous “beaver pond” reference wetland located on Houston Conroe Mitigation Bank as a conceptual example of how these herbaceous wetlands at the spillway would develop. Plantings will be adjusted along a gradient perpendicular to the berm to account for soil moisture.



FIGURE 5: CONCEPTUAL REPRESENTATION OF HERBACEOUS WETLANDS AT BERM SPILLWAY

WAA 20 (56.9 Ac) is the area nearest to the berm, and areas dredged to create the berm that will become newly established herbaceous wetland. To prepare for construction of the berm, existing upland vegetation, consisting of various ages of pine plantations, will be cleared and/or grubbed to prepare for grading. During grading, some areas will be cut to 1-2 ft. below current grade, while others will be filled by 1-2 ft. as seen in Appendix J. All areas within WAA 20 will be set to an elevation of 118-119 ft. MSL (1-2 ft. of inundation at max pool). After grading, the area will be seeded with temporary stabilization seed as well as a permanent, native seed mix. Native herbaceous plugs and a variety of shrub species listed in Table 10 may also be planted to ensure proper vegetative establishment.

The remaining 79.9 Ac of established wetland areas (WAA 21) are currently upland, in various stages of silviculture management and will become forested wetland (PFO). These areas will be inundated at less than 1 ft. from the berm, although the natural water table and topography may result in additional inundation. Existing pine monocultures will be removed with care taken to protect desirable species present in the understory, and all areas will be treated for noxious/invasive species. Supplemental plantings may occur to meet the Year 2 Performance Standard (See Section 3.9) but may not be necessary due to the potential for extensive natural regeneration. An assessment of the amount of desirable natural regeneration will be made after initial clearing and/or invasive species treatment to guide any plantings necessary.

3.6.3.2 Monitoring Unit 3 Mitigation Work Plan – Wetland Re-Establishment

The WAAs discussed here (WAAs 1, 2a, 2b, 3a, 3b, 4a, 5a, 9a, 10a, and 13a – 101.1 Ac total) are currently wetland in the area to be inundated by the berm but were determined to be hydrologically isolated by an official jurisdictional determination due to a lack of significant nexus with Tarkington Bayou or Long Branch (tributary to Luce Bayou). By re-establishing a robust hydrologic connection through the berm and adjacent wetlands, these wetland resource services will be made available to the downstream reaches of Tarkington Bayou and the Lake Houston watershed. Historical aerial imagery, as well as LiDAR elevation data support the previous existence of much more wetland acreage within the area inundated by the berm, as well as a continuous hydrologic connection with existing, verified wetlands that are adjacent and part of a surface

tributary system. The berm will re-establish this hydrologic connection by creating more wetlands that are directly abutting existing, verified wetlands that are adjacent and part of a surface tributary system.

Re-establishment: Herbaceous and Scrub/Shrub Wetland

WAA 1 (20.9 Ac) represents the herbaceous wetlands in the center of three of the Waller pond/loess blowout systems and is characterized by a diverse assortment of herbaceous vegetation. These areas are truly unique to the Lissie Formation and this region of Texas with an amazing floral diversity and vegetative community. No planting is planned for these areas due to the current species composition. Where necessary, precise and localized herbicide treatments may be necessary to thwart the encroachment from more disturbed adjacent areas of noxious or invasive species.

Among the pre-existing and to be connected wetlands are two zones of scrub/shrub wetland (PSS). One of these areas, WAA 2a, is in the center of a depressional wetland resembling the loess blowout systems seen across the parent tract. It is possible this wetland has begun to fill in through natural, successional processes and has established a more robust woody species community. However, WAA 2b is on the former ridge or fringe of a Waller pond/loess blowout (Appendix A, Exhibit 11), and is the transition community between the exclusively herbaceous, inundated, emergent wetland and the forested, pine-dominated community beyond.

WAAs 3a, and 3b, and 4a (3.0 Ac, 9.3 Ac, and 4.2 Ac, respectively) are currently fringe boundaries around depressional wetlands within established pine plantation. Studies of similar reference systems on-site (see Scrub-Shrub Reference – Appendix I) show these transition zones are usually dominated by scrub/shrub species with inclusions of cypress, maple, sweetgum, and black gum (usually dwarfed in size). The berm will have an influence on these WAAs increasing their overall hydrology. Therefore, the final planting strategy for these WAAs, after removal of the pine plantation and eradicating noxious/invasive species, includes herbaceous and scrub/shrub species with inclusions of cypress and other desirable species.

WAA 10a is currently impaired forested wetland pine plantation, a portion of which (24.5 Ac) will be transitioned to herbaceous wetland with the additional inundation from the berm. This area is currently a 25-year-old pine plantation, and the management strategy will remove monoculture pine and other non-desirable species. Following pine removal, and construction of the berm, planting of an assortment of desirable herbaceous and shrub species, as identified within Table 10 and Table 11, will occur. The density of plantings will be dependent on site specific conditions after construction of the berm but will be targeted to ensure at least 50 percent cover of desirable species within 2 years after construction.

Re-establishment: Mixed Hardwood/Pine Wetland

WAA 5a (4.7 Ac) is currently dominated by a young stand of laurel oak that will be thinned (by chemical or mechanical means) in a way that promotes the growth and development of desired individuals. This will result in an optimal mix of hard mast species and native hardwoods for the new hydrologic regime based upon reference plots. Supplemental plantings may occur to meet the Year 2 Performance Standard (See Section 3.9) but may not be necessary due to the potential for extensive natural regeneration. An

assessment of the amount of desirable natural regeneration will be made after initial clearing and/or invasive species treatment to guide any plantings necessary.

WAA 13a (0.9 Ac) is a maintained herbaceous area for hunting purposes. This area will be abandoned and restored back to native hardwood/pine wetland habitat. Supplemental plantings may occur to meet the Year 2 Performance Standard (See Section 3.9) but may not be necessary due to the potential for extensive natural regeneration. An assessment of the amount of desirable natural regeneration will be made after initial clearing and/or invasive species treatment to guide any plantings necessary.

WAA 9a (12.1 Ac) is a mature, hardwood, wetland forest in the area to be hydrologically connected by the berm already possesses many mature individuals of obligate and facultative wetland species. However, the area has been thinned and there is overcrowding in the understory and in areas exposed to direct sunlight from gaps in the canopy (Figure 9). Thinning has led to an excess of non-desirable species (mainly Chinese Tallow) as opposed to the preferable hard-mast species assemblage. Noxious species control will be necessary to guide the transition to a stable, hardwood/pine forest. Supplemental plantings may occur to meet the Year 2 Performance Standard (See Section 3.9) but may not be necessary due to the potential for extensive natural regeneration. An assessment of the amount of desirable natural regeneration will be made after initial clearing and/or invasive species treatment to guide any plantings necessary.

A portion of WAA 10a (17.9 Ac) will remain forested wetland after construction of the berm. This area is currently 25-year-old pine plantation that has a substantial component of desirable hardwoods in the understory. The mitigation plan is consistent with other similar areas; remove the pine monoculture with care to leave existing understory hardwoods intact and herbicide applied for noxious and invasive species control. Supplemental plantings may occur to meet the Year 2 Performance Standard (See Section 3.9) but may not be necessary due to the potential for extensive natural regeneration. An assessment of the amount of desirable natural regeneration will be made after initial clearing and/or invasive species treatment to guide any plantings necessary.

3.7 DETERMINATION OF CREDITS

The Bank will provide wetland and stream credits for USACE-authorized aquatic resource losses within the defined Geographic Service Areas, or out of service area, if approved by USACE. The proposed Bank will provide credits to the public (private and public sectors) for general use.

Credits were generated for wetlands using the appropriate iHGM Model (Riverine Forested or Riverine Herbaceous/Shrub) depending on the post-implementation condition of the wetland. A summary of the credit generation can be found in the Table 16 below, and credit generation table for each WAA can be referenced in Appendix K. The post-implementation score used to quantify ecological uplift achievable within each WAA was obtained from appropriate reference wetlands found on-site. See Appendix I for reference wetland iHGM scores. Area-specific iHGM variables such as topography (Vtopo) and connectivity to other habitats (Vconnect) were derived for each specific WAA during the baseline functional assessment (Sections 3.4.3 and 3.4.4).

As stated in the Functional Assessment Report (Appendix G) submitted to the USACE on April 11, 2016, for portions of TBMB within flats and depressions outside the Tarkington floodplain, the source of hydrology was likely to be more precipitation driven than flood driven. As a result, during the field assessment, HGM plots within flats and depressions were scored without regard to the source of flooding/ponding rather than modifying the mathematical model used to calculate the overall score. This was done in consultation with the USACE Galveston District and by referencing other HGM models in the area that have evaluated flats and depressions. The HGM developed for use in East Texas did not develop a model for flats or unconnected depressions, but stated “plant community and composition are very similar to the more frequently flooded wetlands on similar sites” and therefore the riverine models could be used if other assessments are not available (Williams, Miller, McNamee, & Kilmas, 2010).

TABLE 16: TOTAL WETLAND CREDIT GENERATION

Total TBMB Credits By Wetland and Mitigation Type							
HGM Class Mitigation Plan	PEM/PSS Establish	PFO Establish	PEM/PSS Re-Establish	PFO Re-Establish	PFO Restore	PEM/PSS Enhance	PFO Enhance
Acreage	56.9	79.9	65.5	35.6	62.4	26.4	394.0
TSDSW Units	34.3	65.6	31.9	45.1	26.5	2.6	65.1
MPAC Units	38.0	74.6	32.2	45.5	42.2	5.7	146.9
RSEC Units	38.5	67.6	33.9	46.7	28.1	4.6	85.5
Total TBMB Credit Summary							
HGM Class Mitigation Plan	PEM/PSS Sub-Total	PFO Sub-Total	PEM/PSS Upland*	PFO Upland*	PEM/PSS TOTAL	PFO TOTAL	
Acreage	148.8	571.9	70.9	428.7	148.8	571.9	
TSDSW Units	68.8	202.3	7.1	42.9	75.9	245.1	
MPAC Units	75.9	309.2	7.1	42.9	83.0	352.1	
RSEC Units	77.0	227.9	7.1	42.9	84.1	270.7	

*Upland Buffer and Inclusions Credited at 10% of Acreage.

3.7.1 Determination of Credits - Monitoring Unit 1

MONITORING UNIT 1 WILL GENERATE A TOTAL OF 239.3 WETLAND FCUS FROM ENHANCEMENT OF 235.0 AC OF WETLANDS AND 207.4 AC OF UPLAND BUFFER AS SEEN IN

Table 17. Monitoring Unit 1 will also generate 17,187 stream credits as detailed in Table 18.

TABLE 17: MONOTRING UNIT 1 WETLAND CREDIT GENERATION

Monitoring Unit 1 Credits By Wetland and Mitigation Type							
HGM Class	PEM/PSS	PFO	PEM/PSS	PFO	PFO	PEM/PSS	PFO
Mitigation Plan	Establish	Establish	Re-Establish	Re-Establish	Restore	Enhance	Enhance
Acreage	0.0	0.0	0.0	0.0	0.0	0.0	235.0
TSDSW Units	0.0	0.0	0.0	0.0	0.0	0.0	38.3
MPAC Units	0.0	0.0	0.0	0.0	0.0	0.0	89.1
RSEC Units	0.0	0.0	0.0	0.0	0.0	0.0	49.7

Monitoring Unit 1 Credit Summary						
HGM Class	PEM/PSS	PFO	PEM/PSS	PFO	PEM/PSS	PFO
Mitigation Plan	Sub-Total	Sub-Total	Upland*	Upland*	TOTAL	TOTAL
Acreage	0.0	235.0	0.0	207.4	0.0	235.0
TSDSW Units	0.0	38.3	0.0	20.7	0.0	59.0
MPAC Units	0.0	89.1	0.0	20.7	0.0	109.9
RSEC Units	0.0	49.7	0.0	20.7	0.0	70.4

*Upland Buffer and Inclusions Credited at 10% of Acreage.

3.7.1.1 Determination of Credits - Monitoring Unit 1 Wetland Enhancement

Wetlands within MU1 have been impacted by silvicultural activities and many wetlands are in a stage of a pine plantation harvest rotation (e.g. clear-cut, 10-year-old, mature 25-year-old). To account for this, all wetlands in need of enhancement on-site due to impacts to silviculture activities were scored with the same baseline for purposes of credit generation. Wetland function measured with iHGM scores was projected by year for the life of a pine plantation rotation (25 years for this site). The average of this projection was used as the baseline for credit generation to account for the average ecological condition of the site given that it is being actively managed for timber production. Data for this projection was derived from on-site measurements of the various age classes represented, primary literature, and consultation with TEP’s forester. The iHGM projection accounts for the clearing of the vegetation during a clear-cut, installation of raised beds, and two “thins” where only roughly 1/3 of the trees are removed. The first thin at year 13 is projected to remove most of the beds installed during plantation establishment, which is evidenced in pine plantations on-site. This model can be referenced in Appendix K. Post implementation iHGM scores were derived from reference wetlands identified within the parent tract.

3.7.1.2 Determination of Credits - Monitoring Unit 1 Upland Enhancement

After implementation, there will be 207.4 Ac of upland habitat enhanced (upland inclusions within wetlands (e.g. mima mounds) are incorporated into this total). To account for the benefits upland buffers and

inclusions provide, credits have been increased for both PEM/PSS and PFO credit types. After consultation with the USACE, the credit generation for uplands is a 0.1 multiplier, or 10 percent of the upland acreage applied to each credit type - TSDSW (temporary storage and detention of storage water), MPAC (maintain plant and animal communities), and RSEC (removal and sequestration of elements and compounds). The distribution of these credits among PEM/PSS and PFO is equivalent to the ratio of PEM/PSS to PFO credits. For example, if PEM/PSS credits represent 20 percent and PFO credits represent 80 percent of the wetland credits generated, then 20 percent of the upland credits will be attributed to PEM/PSS and 80 percent will be to PFO to reflect the relative importance of the upland buffers to the wetlands they protect.

3.7.1.3 Determination of Credits - Monitoring Unit 1 Stream Buffer Enhancement

Credits were generated for streams within Monitoring Unit 1 using the Determination of Compensation (Section 5) portion of the Galveston SOP (USACE Galveston District, 2013). According to Section 5.2.2.1 Riparian Buffer Calculations, light buffer planting generates 0.25 credits per linear foot for the inner 100 ft of buffer and 0.25 credits for the outer 100 to 200 ft of buffer. If only one bank was applicable for a given credit generation method, only half of the possible credit ratio was applied. In addition to the credits generated from light buffer planting, certain adjustment factors (AF) are used to account for exceptional or site-specific circumstances. In the case of buffers containing wetlands, 0.25 credits per linear foot of buffer with wetlands is applied. Using these methods as seen in the tables below, TBMB will generate 17,190 stream credits. Due to USACE and IRT comments, no credits were derived from any ephemeral streams and intermittent streams that do not flow directly into a perennial stream (7,766 Lf total).

TABLE 18: STREAM CREDIT GENERATION FOR TBMB

Stream Number	Credit Reach	Stream Type	Length (ft.)	Average RCI	Light Buffer Planting Credit Ratio				Wetland AF Credit Ratio	Total Credit Multiplier	Credits Generated
					Right Bank		Left Bank				
					Inner Buffer	Outer Buffer	Inner Buffer	Outer Buffer			
Stream-1	1	Perennial	1,421	4.17	0.125	0.125	0	0	0.25	0.5	711
Stream-1	3	Perennial	840	4.17	0.125	0.125	0	0	0.25	0.5	420
Stream-1	4	Perennial	1,259	4.17	0.125	0.125	0.125	0	0.25	0.625	787
Stream-1	5	Perennial	978	4.17	0.125	0.125	0	0	0.25	0.5	489
Stream-1	6	Perennial	8,980	4.17	0.125	0.125	0	0	0.25	0.5	4,490
Stream-1	7	Perennial	565	4.17	0.125	0.125	0.125	0	0.25	0.625	353
Stream-1	8	Perennial	813	4.17	0.125	0.125	0	0	0.25	0.5	407
Stream-1	9	Perennial	189	4.17	0.125	0.125	0	0	0.25	0.5	95
Stream-1	11	Perennial	1,960	4.17	0.125	0.125	0	0	0.25	0.5	980
Stream-2	1	Perennial	497	4.39	0.125	0.125	0.125	0	0.25	0.625	311
Stream-2	2	Perennial	165	4.39	0.125	0.125	0.125	0	0.25	0.625	103
Stream-2	3	Perennial	593	4.39	0.125	0.125	0.125	0.125	0.25	0.75	445
Stream-2	5	Perennial	460	4.39	0.125	0.125	0.125	0.125	0.25	0.75	345
Stream-2	6	Perennial	1,272	4.39	0.125	0.125	0.125	0.125	0.25	0.75	954
Stream-2	7	Perennial	452	4.39	0.125	0.125	0.125	0.125	0	0.5	226
Stream-4	1	Intermittent	4,356	3.63	0.125	0.125	0.125	0.125	0.25	0.75	3,267
Stream-6	1	Intermittent	1,146	3.42	0.125	0.125	0.125	0.125	0.25	0.75	860
Stream-6	2	Intermittent	614	3.42	0.125	0.125	0.125	0.125	0.25	0.75	461
Stream-6	4	Intermittent	537	3.42	0.125	0.125	0.125	0.125	0.25	0.75	403
Stream-16	1	Intermittent	907	3.38	0.125	0.125	0.125	0.125	0.25	0.75	680
Stream-29	1	Intermittent	537	3.38	0.125	0.125	0.125	0.125	0.25	0.75	403
Sub-Total		Perennial	20,444								11,116
Sub-Total		Intermittent	8,097								6,074
TOTAL			28,541								17,190

3.7.2 Determination of Credits - Monitoring Unit 2

MU2 will generate a total of 19.0 non-forested wetland FCUs (PEM/PSS) through enhancement of 26.4 Ac of wetland, and 269.4 forested FCUs through restoration of 62.4 Ac and enhancement of 159.0 Ac. Included in the total credit amounts are credits derived from enhancing 194.7 Ac of upland buffer habitat.

TABLE 19: MONITORING UNIT 2 CREDIT GENERATION

Monitoring Unit 2 Credits By Wetland and Mitigation Type							
HGM Class Mitigation Plan	PEM/PSS Establish	PFO Establish	PEM/PSS Re-Establish	PFO Re-Establish	PFO Restore	PEM/PSS Enhance	PFO Enhance
Acreage	0.0	0.0	0.0	0.0	62.4	26.4	159.0
TSDSW Units	0.0	0.0	0.0	0.0	26.5	2.6	26.8
MPAC Units	0.0	0.0	0.0	0.0	42.2	5.7	57.8
RSEC Units	0.0	0.0	0.0	0.0	28.1	4.6	35.8
Monitoring Unit 2 Credit Summary							
HGM Class Mitigation Plan	PEM/PSS Sub-Total	PFO Sub-Total	PEM/PSS Upland*	PFO Upland*	PEM/PSS TOTAL	PFO TOTAL	
Acreage	26.4	221.4	20.7	174.0	26.4	221.4	
TSDSW Units	2.6	53.3	2.1	17.4	4.6	70.7	
MPAC Units	5.7	100.0	2.1	17.4	7.8	117.4	
RSEC Units	4.6	63.9	2.1	17.4	6.6	81.3	

*Upland Buffer and Inclusions Credited at 10% of acreage.

3.7.2.1 Determination of Credits - Monitoring Unit 2 Wetland Restoration

A portion of the bank’s hydrology was significantly altered due to the construction of raised “beds” used to increase loblolly pine survivorship in wet conditions. The construction of these beds reduced the wetland percentage (wetland vs. upland within the overall WAA area) from roughly 90 percent as seen in adjacent WAAs, to 47 percent. As previously described, these beds will be removed during implementation and the wetland percentage in the WAA will be increased to approximately 90 percent to correspond with surrounding WAAs. The wetland acreage within WAA 13b (currently maintained herbaceous habitat) will be increased from 0.9 to 1.7 Ac. The wetland acreage within WAA 11 (currently 10-year-old pine plantation habitat) will be increased from 32.0 to 60.7 Ac. Pre-implementation iHGM scores were derived from the functional assessment. The post implementation score was derived from a mixed hardwood/pine reference wetland and the iHGM model.

3.7.2.2 Determination of Credits - Monitoring Unit 2 Wetland Enhancement

WAA 7 consists of an emergent wetland area situated in the central portion of the bank. This wetland has been negatively impacted by silviculture activists and encroachment of invasive species. To account for the inadequacies of the iHGM to appropriately value herbaceous wetlands (if there are no woody species or mid-story the scores are reduced), the pre-implementation score for this WAA was the iHGM without considering the aerial coverage of non-desirable and invasive woody species in the score. The post implementation score for these WAAs is the iHGM score anticipated with the removal of noxious species and supplemental scrub/shrub plantings informed by the similar reference sites found on the parent tract.

Much of the site has been impacted by silvicultural activities and many wetlands are in a stage of a pine plantation harvest rotation (e.g. clear-cut, 10-year-old, mature 25-year-old). To account for this, all wetlands in need of enhancement on-site due to impacts to silviculture activities were scored with the same baseline for purposes of credit generation. Wetland function measured with iHGM scores was projected by year for the life of a pine plantation rotation (25 years for this site). The average of this projection was used as the baseline for credit generation to account for the average ecological condition of the site given that it is being actively managed for timber production. Data for this projection was derived from on-site measurements of the various age classes represented, primary literature, and consultation with TEP’s forester. The iHGM projection accounts for the clearing of the vegetation during a clear-cut, installation of raised beds, and two “thins” where only roughly 1/3 of the trees are removed. The first thin at year 13 is projected to remove the majority of the beds installed during plantation establishment. This model can be referenced in Appendix K. Post implementation iHGM scores were derived from reference wetlands identified within the parent tract.

3.7.2.3 Determination of Credits - Monitoring Unit 2 Upland Enhancement

After implementation, there will be 194.7 Ac of upland habitat enhanced (upland inclusions within wetlands (e.g. mima mounds) are incorporated into this total). To account for the benefits upland buffers and inclusions provide, credits have been increased for both PEM/PSS and PFO credit types as described in Section 3.7.1.2.

3.7.3 Determination of Credits - Monitoring Unit 3

Monitoring Unit 3 will generate a total of 223.9 non-forested (PEM/PSS) wetland FCUs through establishment of 56.9 Ac and re-establishment of 65.5 Ac of non-forested wetland habitat. MU3 will also generate 359.2 forested FCUs through establishment of 79.9 Ac and re-establishment of 35.6 Ac of forested wetland habitat. Included in the total credit amounts are credits derived from enhancing 97.5 Ac of upland buffer habitat.

TABLE 20: MONITORING UNIT 3 CREDIT GENERATION

Monitoring Unit 3 Credits By Wetland and Mitigation Type							
HGM Class	PEM/PSS	PFO	PEM/PSS	PFO	PFO	PEM/PSS	PFO
Mitigation Plan	Establish	Establish	Re-Establish	Re-Establish	Restore	Enhance	Enhance
Acreage	56.9	79.9	65.5	35.6	0.0	0.0	0.0
TSDSW Units	34.3	65.6	31.9	45.1	0.0	0.0	0.0
MPAC Units	38.0	74.6	32.2	45.5	0.0	0.0	0.0
RSEC Units	38.5	67.6	33.9	46.7	0.0	0.0	0.0
Monitoring Unit 3 Credit Summary							
HGM Class	PEM/PSS	PFO	PEM/PSS	PFO	PEM/PSS	PFO	
Mitigation Plan	Sub-Total	Sub-Total	Upland*	Upland*	TOTAL	TOTAL	
Acreage	122.4	115.5	50.2	47.3	122.4	115.5	
TSDSW Units	66.2	110.7	5.0	4.7	71.3	115.4	
MPAC Units	70.2	120.1	5.0	4.7	75.2	124.8	
RSEC Units	72.4	114.3	5.0	4.7	77.4	119.0	

*Upland Buffer and Inclusions Credited at 10% of acreage.

3.7.3.1 Determination of Credits - Monitoring Unit 3 Wetland Establishment

As previously described, a berm will be constructed to impound water and establish wetlands, thereby generating a significant hydrologic connection with a wetland verified as a WOUS. Construction of this berm is anticipated to establish 136.8 Ac of wetlands (79.9 Ac PFO and 56.9 Ac PEM) on what is currently non-jurisdictional, upland habitat. Pre-implementation iHGM scores and wetland acreages were all zero due to currently being upland habitat. The post-implementation score was derived from a mixed hardwood/pine reference wetland and an emergent reference wetland located within the parent tract.

3.7.3.2 Determination of Credits - Monitoring Unit 3 Wetland Re-establishment

After construction of the berm, 101.1 Ac of currently isolated wetlands (35.6 Ac PFO and 65.5 Ac PEM/PSS) will be directly connected to a verified WOUS through the re-establishment of a hydrologic connection. The connection was likely severed through the silvicultural practices historically implemented on-site, and the conversion of uplands to wetlands. These wetlands will thereby have a significant nexus to WOUS through immediate adjacency. As currently isolated wetlands, pre-implementation iHGM scores were set to zero because, even though these wetlands do currently exhibit some ecological functions as isolated wetlands, these functions are locally isolated and not transferred to the watershed as a whole. Post-implementation scores were derived from appropriate reference wetlands identified within the parent tract.

3.7.3.3 Determination of Credits - Monitoring Unit 3 Upland Enhancement

After implementation, there will be 97.5 Ac of upland habitat enhanced (upland inclusions within wetlands (e.g. mima mounds) are incorporated into this total). To account for the benefits upland buffers and inclusions provide, credits have been increased for both PEM/PSS and PFO credit types as described in Section 3.7.1.2.

3.8 MAINTENANCE PLAN

Once initial construction is completed, there should be little maintenance required within the Bank. Wetland assessment will include a plot-based monitoring protocol to capture unintended mortality. Groundwater monitoring wells will be installed to evaluate the efficacy of the berm. During the annual monitoring, streams will be visually assessed to determine if streams are exhibiting excessive or newly developed erosion or other issues regarding dimension, pattern, and profile. If failures occur, the steps outlined in the Adaptive Management Plan will be utilized.

Plantings will be of native species from local stocks, but the predominance of the vegetation within the Bank should come from natural regeneration on-site. Therefore, these species should be adapted to local site conditions and climate, so little to no maintenance is anticipated. To restore/maintain the vegetative community, the following schedule of activities is anticipated:

- Year 0 - 1: Remove monoculture pine plantation and exotic invasive species followed by planting where natural regeneration is insufficient.
- Year 2 to end of monitoring period: Plot-based monitoring to determine success of supplemental plantings and invasive species control.

The vegetative community will be monitored on a yearly basis, and should survivorship and/or species composition requirements not meet the criteria outlined in the performance standards, the steps outlined in the Adaptive Management Plan will be utilized.

After initial clearing of monoculture pine plantation, an herbicide application to control invasive species will be necessary. After this initial application yearly maintenance of invasive species will commence. This yearly maintenance will consist of additional herbicide applications or mechanical removal, and is expected to occur on 10 percent of the land area initially treated per year. This will equate to 100 percent of the land area being treated again by the end of the monitoring period.

The berm is to be constructed with a highly compacted core and multiple layers of compacted earth to prevent the necessity of repair from erosional issues (Appendix J). Herbaceous vegetative plantings will be utilized to provide additional erosional stability through a complex root structure. Upkeep of the berm is anticipated to include yearly mowing to ensure access, and a visual assessment of the spillway structure. Should the berm be breached or compromised, the Adaptive Management Plan protocol will be implemented.

Signs will be placed along the periphery of the bank to discourage trespassing. Should any trespass occur (e.g. dumping of trash), steps will be taken by the Sponsor or their agent to mitigate any damage and to prevent further trespass in the future. The periphery of the bank will be maintained to allow access to the bank by monitoring crews and to ensure boundary continuity. This maintenance may include such activities as replacement of signage, clearing of vegetation, or fence repair. Any clearing of vegetation would solely be on an as needed basis to provide ATV passage at a maximum, but all efforts will be made to minimize impacts wherever possible.

3.9 ECOLOGICAL PERFORMANCE STANDARDS

Performance standards describe the standards of success of the proposed mitigation activities. Performance standards have been split by MU below due to the different mitigation types in each MU. Each MU will be evaluated separately and independently. Construction of all three MUs shall be completed within 5 years of bank approval. Implementation of the mitigation plan for each MU does not depend on other MUs (i.e. success of MU1 is not dependent on MU2 and vice versa), and MUs do not have to be constructed sequentially.

3.9.1.1 Monitoring Unit 1 Performance Standards

Monitoring Unit 1 will consist of forested wetland enhancement, upland buffer enhancement, and stream buffer enhancement. The performance standards for these mitigation types can be seen in Table 21, Table 22, Table 23, and Table 24 below.

3.9.1.2 Monitoring Unit 2 Performance Standards

Monitoring Unit 2 consists of forested wetland enhancement, herbaceous wetland enhancement, forested wetland restoration, and upland buffer enhancement. Forested wetland enhancement and upland buffer enhancement will have the same performance standards as MU1 (see Table 21, Table 22, and Table 23 respectively). Performance standards for herbaceous wetland enhancement and forested wetland restoration can be reference in Table 25 and Table 26 below.

3.9.1.3 Monitoring Unit 3 Performance Standards

Monitoring Unit 3 consists of herbaceous wetland establishment, forested wetland establishment, herbaceous wetland re-establishment, scrub/shrub wetland re-establishment, forested wetland re-establishment, and upland buffer enhancement. These performance standards can be seen in Table 27, Table 28, Table 29, Table 30, Table 31, and Table 23 respectively.

TABLE 21: PERFORMANCE STANDARDS FOR FORESTED WETLAND ENHANCEMENT (HARDWOOD/PINE)

Forested Wetland Enhancement (Hardwood/Pine)	Parameter	Measurement Method	Year 1 (Initial Implementation Completed)	Year 2 (At Least 1 Growing Season After Initial Implementation)	Year 4 (At Least 3 Growing Seasons After Initial Implementation)	Year 7 (At Least 6 Growing Seasons After Initial Implementation)	Year 10 (At Least 9 Growing Seasons After Initial Implementation)	Hardwood/Pine Reference Wetland Data
	Tree Species Density	Stems/Acre	Initial Clearing of monoculture pine and monoculture young hardwood stands	> 400 stems / acre of desired species	> 320 stems / acre desired species	> 250 stems / acre desired species	> 150 trees / acre desired species	140 Trees / Acre
	Woody Species Cover	% Absolute Cover	Monoculture pine is cleared to a density <30%. Monoculture young hardwood stands cleared to a density of <50%.	Native woody community cover is ≥30%	Native woody community cover ≥45%	Native woody community cover is ≥ 60%	Native woody community cover is ≥ 60%	86% Tree Coverage
	Wetland Hydrology and Hydric Soils	Delineation Data Points	Delineation data points, recording wetland hydrology and hydric soil indicators, will be documented within monitoring plots occurring within previously delineated wetlands. Performance standard will be met if there is not an apparent reduction in wetland area.					80% of WAA either floods and/or ponds for at least 7 consecutive days
	Noxious Species	% Absolute Cover	Initial Removal / treatment of noxious and invasive species	Noxious/Invasive Speices <5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.

TABLE 22: PERFORMANCE STANDARDS FOR FORESTED WETLAND ENHANCEMENT (CYPRESS)

Forested Wetland Enhancement (Cypress)	Parameter	Measurement Method	Year 1 (Initial Implementation Completed)	Year 2 (At Least 1 Growing Season After Initial Implementation)	Year 4 (At Least 3 Growing Seasons After Initial Implementation)	Year 7 (At Least 6 Growing Seasons After Initial Implementation)	Year 10 (At Least 9 Growing Seasons After Initial Implementation)	Cypress Wetland Reference
	Tree Species Density	Stems/Acre	Initial Clearing of monoculture hardwood stand	> 400 stems / acre of desired species	> 320 stems / acre desired species	> 250 stems / acre desired species	> 150 trees / acre desired species	480 Trees / Acre
	Woody Species Cover	% Absolute Cover	Monoculture hardwood stand is cleared to a density <50%	Native woody community cover is ≥30%	Native woody community cover ≥45%	Native woody community cover is ≥ 60%	Native woody community cover is ≥ 60%	95% Tree Coverage
	Wetland Hydrology and Hydric Soils	Delineation Data Points	Delineation data points, recording wetland hydrology and hydric soil indicators, will be documented within monitoring plots occurring within previously delineated wetlands. Performance standard will be met if there is not an apparent reduction in wetland area.					80% of WAA either floods and/or ponds for at least 7 consecutive days
	Noxious Species	% Absolute Cover	Initial Removal / treatment of noxious and invasive species	Noxious/Invasive Speices <5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.

TABLE 23: PERFORMANCE STANDARDS FOR UPLAND BUFFER ENHANCEMENT

	Parameter	Measurement Method	Year 1 (Initial Implementation Completed)	Year 2 (At Least 1 Growing Season After Initial Implementation)	Year 4 (At Least 3 Growing Seasons After Initial Implementation)	Year 7 (At Least 6 Growing Seasons After Initial Implementation)	Year 10 (At Least 9 Growing Seasons After Initial Implementation)	Hardwood/Pine Reference Data
	Upland Buffer Enhancement	Tree Species Density	Stems/Acre	Initial Clearing of monoculture pine	> 400 stems / acre of desired species	> 320 stems / acre desired species	> 250 stems / acre desired species	> 150 trees / acre desired species
Woody Species Cover		% Absolute Cover	Monoculture pine is cleared to a density <30%	Native woody community cover is ≥30%	Native woody community cover ≥45%	Native woody community cover is ≥ 60%	Native woody community cover is ≥ 60%	86% Tree Coverage
Noxious Species		% Absolute Cover	Initial Removal / treatment of noxious and invasive species	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.

TABLE 24: PERFORMANCE STANDARD FOR RIPARIAN BUFFER ENHANCEMENT

Riparian Buffer Enhancement	Parameter	Measurement Method	Year 1 (Initial Implementation Completed)	Year 2 (At Least 1 Growing Season After Initial Implementation)	Year 4 (At Least 3 Growing Seasons After Initial Implementation)	Year 7 (At Least 6 Growing Seasons After Initial Implementation)	Year 10 (At Least 9 Growing Seasons After Initial Implementation)	Reference Riparian Buffer (Same as Hardwood/Pine Wetland Reference)
	Tree Species Density	Stems/Acre	Initial Clearing of monoculture pine and monoculture young hardwood stands	> 400 Stems/Acre of desired species	> 320 Stems/Acre desired species	> 250 Stems/Acre desired species	> 150 Trees / Acre desired species	140 Trees / Acre
	Woody Species Cover	% Absolute Cover	Monoculture pine is cleared to a density <30%. Monoculture young hardwood stands cleared to a density of <50%.	Native woody community cover is ≥30%	Native woody community cover ≥45%	Native woody community cover is ≥ 60%	Native woody community cover is ≥ 60%	86% Tree Cover
	Wetland Hydrology and Hydric Soils	Delineation Data Points	Delineation data points, recording wetland hydrology and hydric soil indicators, will be documented within monitoring plots occurring within previously delineated wetlands. Performance standard will be met if there is not an apparent reduction in wetland area.					80% of WAA either floods and/or ponds for at least 14 consecutive days
	Noxious Species	% Absolute Cover	Initial Removal / treatment of noxious and invasive species	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.

TABLE 25 PERFORMANCE STANDARDS FOR HERBACEOUS WETLAND ENHANCEMENT

	Parameter	Measurement Method	Year 1	Year 2	Year 4	Year 7	Year 10	Herbaceous Depression Reference Wetland Data
			(Initial Implementation Completed)	(At Least 1 Growing Season After Initial Implementation)	(At Least 3 Growing Seasons After Initial Implementation)	(At Least 6 Growing Seasons After Initial Implementation)	(At Least 9 Growing Seasons After Initial Implementation)	
Herbaceous Wetland Enhancement	Herbaceous Cover	% Cover	Area seeded with desirable species	Desirable herbaceous coverage is >50%	Desirable herbaceous coverage is >60%	Desirable herbaceous coverage is >75%	Desirable herbaceous coverage is >75%	Desirable herbaceous coverage is >100%
	Wetland Hydrology and Hydric Soils	Delineation Data Points	Delineation data points, recording wetland hydrology and hydric soil indicators, will be documented within monitoring plots occurring within previously delineated wetlands. Performance standard will be met if there is not an apparent reduction in wetland area.					80% of WAA either floods and/or ponds for at least 14 consecutive days
	Noxious Species	% Absolute Cover	Initial Removal / treatment of noxious and invasive species	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.

TABLE 26: PERFORMANCE STANDARDS FOR FORESTED WETLAND RESTORATION

Forested Wetland Restoration	Parameter	Measurement Method	Year 1 (Initial Implementation Completed)	Year 2 (At Least 1 Growing Season After Initial Implementation)	Year 4 (At Least 3 Growing Seasons After Initial Implementation)	Year 7 (At Least 6 Growing Seasons After Initial Implementation)	Year 10 (At Least 9 Growing Seasons After Initial Implementation)	Hardwood/Pine Reference Wetland Data
	Tree Species Density	Stems/Acre	Initial Clearing of monoculture pine	> 400 Stems/Acre of desired species	> 320 Stems/Acre desired species	> 250 Stems/Acre desired species	> 150 Trees / Acre desired species	140 Trees / Acre
	Woody Species Cover	% Absolute Cover	Monoculture pine is cleared to a density <30%	Native woody community cover is ≥30%	Native woody community cover ≥45%	Native woody community cover is ≥ 60%	Native woody community cover is ≥ 60%	86% Tree Coverage
	Wetland Hydrology and Hydric Soils	Wetland Delineation Data Points	Removal of Pine Plantation Beds	Documentation of established wetland boundaries and acreages.	Delineation data points, recording wetland hydrology and hydric soil indicators, will be documented within monitoring plots occurring within previously delineated wetlands. Performance standard will be met if there is not an apparent reduction in wetland area.			80% of WAA either floods and/or ponds for at least 7 consecutive days
	Noxious Species	% Absolute Cover	Initial Removal / treatment of noxious and invasive species	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.

TABLE 27: PERFORMANCE STANDARDS FOR HERBACEOUS WETLAND ESTABLISHMENT

Herbaceous Wetland Establishment	Parameter	Measurement Method	Year 1 (Initial Implementation Completed)	Year 2 (At Least 1 Growing Season After Initial Implementation)	Year 4 (At Least 3 Growing Seasons After Initial Implementation)	Year 7 (At Least 6 Growing Seasons After Initial Implementation)	Year 10 (At Least 9 Growing Seasons After Initial Implementation)	Herbaceous Beaver Pond Wetland Reference
	Herbaceous Cover	% Cover	Area seeded with desirable herbaceous species.	Desirable herbaceous coverage is >50%	Desirable herbaceous coverage is >60%	Desirable herbaceous coverage is >75%	Desirable herbaceous coverage is >75%	Desirable herbaceous coverage is 100%
	Wetland Hydrology and Hydric Soils	Groundwater Monitors	Construction of berm and installation of groundwater monitoring wells.	Documentation of wetland boundaries and verification of connection	Wetland hydrology (inundated and/or saturated within the upper 12" of the soil profile for at least 14 days during growing season) demonstrated using groundwater monitors.			80% of WAA either floods and/or ponds for at least 14 consecutive days
	Noxious Species	% Absolute Cover	Initial Removal / treatment of noxious and invasive species	Noxious/Invasive Speices <5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices (Chinese Tallow) 5% in shrub layer (Performance measures exceed reference data)

TABLE 28: PERFORMANCE STANDARDS FOR FORESTED WETLAND ESTABLISHMENT

Forested Wetland Establishment	Parameter	Measurement Method	Year 1 (Initial Implementation Completed)	Year 2 (At Least 1 Growing Season After Initial Implementation)	Year 4 (At Least 3 Growing Seasons After Initial Implementation)	Year 7 (At Least 6 Growing Seasons After Initial Implementation)	Year 10 (At Least 9 Growing Seasons After Initial Implementation)	Hardwood/Pine Reference Wetland Data
	Tree Species Density	Stems/Acre	Initial Clearing of monoculture pine	> 400 stems / acre of desired species	> 320 stems / acre desired species	> 250 stems / acre desired species	> 150 trees / acre desired species	140 Trees / Acre
	Woody Species Cover	% Absolute Cover	Monoculture pine is cleared to a density <30%	Native woody community cover is ≥30%	Native woody community cover ≥45%	Native woody community cover is ≥ 60%	Native woody community cover is ≥ 60%	86% Tree Coverage
	Wetland Hydrology	Groundwater Monitors	Construction of berm and installation of groundwater monitoring wells.	Documentation of established wetland boundaries.	Wetland hydrology (inundated and/or saturated within the upper 12" of the soil profile for at least 14 days during growing season) demonstrated using groundwater monitors.			80% of WAA either floods and/or ponds for at least 7 consecutive days
	Noxious Species	% Absolute Cover	Initial Removal / treatment of noxious and invasive species	Noxious/Invasive Species < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Species < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Species < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Species < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Species < 1% in tree strata and < 5% in other strata.

TABLE 29: PERFORMANCE STANDARDS FOR HERBACEOUS WETLAND RE-ESTABLISHMENT

Herbaceous Wetland Re-Establishment	Parameter	Measurement Method	Year 1 (Initial Implementation Completed)	Year 2 (At Least 1 Growing Season After Initial Implementation)	Year 4 (At Least 3 Growing Seasons After Initial Implementation)	Year 7 (At Least 6 Growing Seasons After Initial Implementation)	Year 10 (At Least 9 Growing Seasons After Initial Implementation)	Herbaceous Depression Reference Wetland Data
	Herbaceous Cover	% Cover	Desirable herbaceous coverage is >75%	Desirable herbaceous coverage is >75%	Desirable herbaceous coverage is >75%	Desirable herbaceous coverage is >75%	Desirable herbaceous coverage is >75%	Desirable herbaceous coverage is >100%
	Wetland Hydrology and Hydric Soils	Wetland Delineation Data Points	Construction of berm	Documentation of wetland boundaries and verification of connection	Delineation data points, recording wetland hydrology and hydric soil indicators, will be documented within monitoring plots occurring within previously delineated wetlands. Performance standard will be met if there is not an apparent reduction in wetland area.			80% of WAA either floods and/or ponds for at least 14 consecutive days
	Noxious Species	% Absolute Cover	Initial Removal / treatment of noxious and invasive species	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.

TABLE 30: PERFORMANCE STANDARDS FOR SCRUB-SHRUB WETLAND RE-ESTABLISHMENT

	Parameter	Measurement Method	Year 1	Year 2	Year 4	Year 7	Year 10	Scrub/Shrub Wetland Reference Data
			(Initial Implementation Completed)	(At Least 1 Growing Season After Initial Implementation)	(At Least 3 Growing Seasons After Initial Implementation)	(At Least 6 Growing Seasons After Initial Implementation)	(At Least 9 Growing Seasons After Initial Implementation)	
Scrub/Shrub Wetland Re-Establishment	Scrub/Shrub Cover	% Cover	Initial Clearing of monoculture pine and planting 200+ stems / acre	Desirable Shrub coverage is >20%	Desirable Shrub coverage is >30%	Desirable Shrub coverage is >40%	Desirable herbaceous coverage is >50%	Desirable shrub coverage is 60%
	Wetland Hydrology and Hydric Soils	Wetland Delineation Data Points	Construction of berm	Documentation of wetland boundaries and verification of connection	Delineation data points, recording wetland hydrology and hydric soil indicators, will be documented within monitoring plots occurring within previously delineated wetlands. Performance standard will be met if there is not an apparent reduction in wetland area.			80% of WAA either floods and/or ponds for at least 14 consecutive days
	Noxious Species	% Absolute Cover	Initial Removal / treatment of noxious and invasive species	Noxious/Invasive Speices <5% in tree strata and <15% in other strata.	Noxious/Invasive Speices <5% in tree strata and <15% in other strata.	Noxious/Invasive Speices <1% in tree strata and <5% in other strata.	Noxious/Invasive Speices <1% in tree strata and <5% in other strata.	Noxious/Invasive Speices <1% in tree strata and <5% in other strata.

TABLE 31: PERFORMANCE STANDARDS FOR FORESTED WETLAND RE-ESTABLISHMENT

Forested Wetland Re-Establishment	Parameter	Measurement Method	Year 1 (Initial Implementation Completed)	Year 2 (At Least 1 Growing Season After Initial Implementation)	Year 4 (At Least 3 Growing Seasons After Initial Implementation)	Year 7 (At Least 6 Growing Seasons After Initial Implementation)	Year 10 (At Least 9 Growing Seasons After Initial Implementation)	Hardwood/Pine Reference Wetland Data
	Tree Species Density	Stems/Acre	Initial Clearing of monoculture pine and planting 200+ stems / acre	> 400 stems / acre of desired species	> 320 stems / acre desired species	> 250 stems / acre desired species	> 150 trees / acre desired species	140 Trees / Acre
	Woody Species Cover	% Absolute Cover	Monoculture pine is cleared to a density <30%	Native woody community cover is ≥30%	Native woody community cover ≥45%	Native woody community cover is ≥ 60%	Native woody community cover is ≥ 60%	86% Tree Coverage
	Wetland Hydrology and Hydric Soils	Wetland Delineation Data Points	Construction of berm	Documentation of wetland boundaries and verification of connection	Delineation data points, recording wetland hydrology and hydric soil indicators, will be documented within monitoring plots occurring within previously delineated wetlands. Performance standard will be met if there is not an apparent reduction in wetland area.			80% of WAA either floods and/or ponds for at least 7 consecutive days
	Noxious Species	% Absolute Cover	Initial Removal / treatment of noxious and invasive species	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 5% in tree strata and < 15% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.	Noxious/Invasive Speices < 1% in tree strata and < 5% in other strata.

3.10 MONITORING REQUIREMENTS

In order to provide documentation of success of the restorative efforts, the Bank Sponsor will perform routine monitoring of the ecological conditions of the proposed Bank Site. Monitoring reports will clearly demonstrate whether performance standards are being met and a credit release (if applicable) is warranted. The monitoring schedule and frequency proposed for MUs 1-2 will include annual assessments for a minimum of 10 years. The MU3 monitoring schedule and frequency proposed will include annual assessments for a minimum of 15 years. All reports will be submitted to the USACE by January 31st of each year, or until all Performance Standards are met, whichever is later.

The team will evaluate stems-per-acre of desirable species and evaluate the species dominance within strata for upland and wetland areas and within the bank. Vegetation plots will be established at 1 plot for every 20 Ac for wetlands and 1 plot every 50 Ac for uplands. A functional assessment, utilizing the iHGM, will be conducted to track trends in gains of ecological function a minimum of four (4) times, at approximately years 3, 5, 7, and 10. In riparian buffers used for generation of stream credit through light buffer planting, 1 plot will be established for every 20 acres of buffer regardless of wetland classification. Based simply on acreage, this would be 60 plots, but more plots may be added should areas of concern arise. Plot selection will be semi-randomized, but all credited habitat types will be represented. Parameters such as species composition and species density will be surveyed along with visual assessments of percent cover of the shrub and herbaceous species.

To monitor shallow groundwater levels within the area affected by the berm, 6 monitoring wells will be installed. Engineering 303 determined the monitoring well locations by utilizing the expected inundation depth/area derived from topographic surveys and from geotechnical data obtained from soil bores. This demonstrated the required depth of saturation of surface water within the soils for the appropriate amount of time during the growing season to qualify as wetlands. The majority of the wells will be installed along the periphery of established/re-established wetlands for determination of wetland boundaries, but wells will be installed along the gradient of water depths to get an overall picture of the groundwater levels across the area. This data will be collected and reported along with soil pit data and IHGM scores to corroborate the efficacy of establishment/re-establishment measures.

A common design for monitoring wells are ones installed using direct push technology and constructed of 2 in PVC plastic pipe. These monitoring wells are screened from the ground surface to 5 ft below ground surface. A sand pack is installed around the screen with a 6-in bentonite plug on the surface. This may reflect the monitoring design to be used, but the final decision will be made under the guidance of 303 Engineering's professional recommendations. The soils will be logged for color and texture during installation.

Previous hydrology surveys conducted on-site determined more water could be impounded by the berm than the provided design by Engineering 303 suggests. These water balance calculations can be found along with the engineering specifications and berm design in Appendix J. Field surveys will be conducted after construction activities are complete to verify the total area of soil saturation.

3.11 LONG-TERM MANAGEMENT PLAN

It is the responsibility of the Sponsor to provide a comprehensive, long-term management strategy to reasonably manage the site as a high-quality restoration area, so the ecological benefits generated from the proposed Bank are preserved. Upon the closure of the TBMB (final release of credits and fulfillment of MBI requirements), the responsibility of site maintenance will be retained by the Sponsor. Should the Sponsor sell the property or relinquish responsibility for the site, the IRT will be notified in a timely manner.

At a minimum, annual, random monitoring will be instigated by the Sponsor or their agent to check for trespassing, damage to the property, or other threats that require remedial action. During the annual site visits, the vegetative community will be visually assessed for damage, disease, die-off, and over-abundance of invasive/exotic plant species. If any substantial concerns are noted in regards to the vegetative community, the USACE will be notified, and the appropriate management activity will be agreed upon.

Invasive species eradication will be an integral part of implementing the mitigation bank, and it's expected that during the Bank's 10-year monitoring period, exotic invasive species will be largely eradicated from the bank. However, to account for on-going maintenance of the site, invasive species control for 5 percent of the bank area (72 Ac) is accounted for.

Hunting on the Bank will be allowed given no credit generation related ecological improvements are negatively impacted. The periphery of the Bank will be maintained to allow access to all portions of the Bank by monitoring crews and to ensure boundary continuity. This maintenance may include such activities as replacement of signage, herbicide, mowing, or fence repair. Signage will be placed along the periphery of the Bank to discourage trespassing. Should any trespass occur (e.g. dumping of trash), steps will be taken by the Sponsor or their agent to mitigate any damage and to prevent further trespass in the future.

Prior to the interim credit release for MU3, and in accordance to the timelines established in the table found Table 32, the Sponsor will establish a non-wasting endowment in the amount of \$427,155 for supporting TBMB's long-term maintenance plan. As previously stated, the Sponsor will be the long-term manager of the bank property. Any expenditures must be related to the maintenance of the bank and must be approved by the USACE. Table 33 shows anticipated annual costs, which were used to determine the amount necessary for the long-term, non-wasting endowment. Once fully funded, the endowment is expected to generate \$17,086 per year in revenue assuming a 4 percent return on investment (inflation adjusted) with whatever is not spent being reinvested into the endowment.

TABLE 32: LONG TERM FINANCIAL ASSURANCES SCHEDULE

Milestone	Financial Assurance Funded (%)	Financial Assurance Funded (\$)
Initial Authorization	0%	\$0.00
Initial Construction	20%	\$85,431.00
Interim Credit Release	80%	\$341,724.25
TOTAL	100%	\$427,155.25

TABLE 33: LONG TERM MAINTENANCE COST ESTIMATES

ANNUAL MAINTENANCE COST DISTRIBUTION TARKINGTON BAYOU MITIGATION BANK					
LABOR/EXPENSES	QUANTITY	UNIT	UNIT PRICE	TOTAL	ASSUMPTIONS
Invasive Species Control	72	ACRES	\$ 100.00	\$ 7,202	5% of bank area / year
Consultant	8	HOURS	\$ 75.00	\$ 600	Yearly Inspection
Boundary Line Maintenance			\$ 1,500.00	\$ 1,500	
Property Taxes	1440	ACRES	\$ 5.40	\$ 7,784	\$5.40/Ac Tax Rate
Cost Total				\$ 17,086	
Endowment Total				\$ 427,155	4% yearly return to fund maintenance costs.

3.12 ADAPTIVE MANAGEMENT PLAN

The primary long-term strategy of the Bank is self-sustainability with relatively low maintenance. This management strategy is directly linked to the development stage of the mitigation banking process, particularly in the design and establishment of the Bank. Natural, native, vegetative community restoration and increased flood attenuation from the constructed berm will provide these ecological benefits with minimal routine maintenance or attention after establishment.

The Sponsor recognizes some adaptive management strategies may need to be addressed based on previous knowledge and experiences with other mitigation bank scenarios. If the Bank is underperforming or not meeting the proposed performance standards, the Sponsor will provide additional management designs to address the ecological benefit. These methodologies may include prescribed burn management, riparian buffer vegetative management, or easement enforcement actions. Many of these strategies, however, will need to be tailored to specific disturbances to achieve optimal results. As such, Adaptive Management Plans will be derived at the time of disturbance, based upon data collected at the time, and work plans will be submitted to the IRT and USACE for commentary and guidance prior to implementation.

Possible issues requiring remedial action are poor vegetation establishment, and/or prevalence of exotic invasive species. Should any of these or other issues of significance occur, the Sponsor will develop a management strategy, and with the consultation of the IRT, begin to remediate the area of issue as soon as practicable. During the time of non-compliance, the USACE Galveston District may suspend the sale or use of mitigation credits until efforts to remediate the disturbance have been implemented.

Whereas plants will be chosen based upon their suitability to the soils and climate on-site, unexpected droughts of record, freezes, or other irregular climatological events may dramatically affect recruitment and mortality. An appraisal will be made of the health of surviving individuals, their potential for expansion and recruitment, and the necessity for additional planting should such an event occur. The planting process can be harmful or disruptive to the remaining survivors, so in an effort to prevent habitually resetting the successional clock after every disturbance, the appraisal will be critical regarding the need for replanting. However, should it be determined the community will not survive, invasive species are an immediate threat, or recovery times will be prohibitively long, a replanting regimen with a possible selective herbicide of any invading noxious species will be implemented.

Another possible adaptive management issue is potential for failure of the structural integrity of the berm followed by a loss of wetland hydrology. Should the berm wash out or in any other way be compromised, the Sponsor will arrange for its repair. If this is insufficient to solve the problem, the Sponsor will meet with the USACE and a licensed professional engineer (P.E.) to discuss the implementation of a sustainable solution.

A final consideration, and one much more formidable from a management perspective, is the issue of "biological disturbances." The native vegetative structure is mixed oak and pine dominated for upland areas with a larger mix of oaks in riparian areas, but pines can still be found within the riparian zone. Southern pine beetle (*Dendroctonus frontalis*) and the blue-stain fungi (*Ophiostoma* and *Ceratocystis* genera) are a potential threat in this region of Texas, and with nearby properties still practicing commercial silvicultural activities, infestation is a possibility. In the case of infestation, the use of forestry best management practices would need to be implemented immediately to preserve the resource and prevent spread.

If it becomes apparent performance standards are unachievable under current efforts, the Sponsor may submit a proposal to the USACE to modify the Mitigation Plan after consultation with the IRT. As a final resort, the Sponsor may provide written notice of the intent to discontinue attempting to meet the performance standards for all or a specific aspect of the bank. Once the notice is provided, no further credits can be generated from the particular aspect of the bank.

3.13 FINANCIAL ASSURANCES

The Sponsor will be the responsible party for the financial assurances of the Bank. These assurances will be of sufficient substance to insure the proposed compensatory mitigation will be successfully completed in a manner consistent with the performance standards agreed upon by the IRT and the Bank Sponsor. Any financial instrument will be in place prior to commencement of any permitted activity associated with the Tarkington Bayou Mitigation Bank.

Casualty insurance will be secured by the Sponsor to cover the costs associated with the construction of the bank and the requirements of the subsequent monitoring period. See Appendix L for a draft of this insurance policy. Two separate policies will be taken for MU1/MU2 and MU3. The policies will be renewed as needed until completion of the monitoring period. Approximate, yearly, anticipated expenditures are outlined in Table 34-A and 34-B. These amounts are subject to change based on final bids, inflation, and other market conditions. Financials for the continued, routine maintenance of the property in perpetuity are disclosed in 3.11 Long-term Management Plan.

TABLE 34-A: SHORT TERM COSTS ASSOCIATED WITH BANK ESTABLISHMENT FOR MU1 AND MU2

Tarkington Bayou Mitigation Bank Costs Through Monitoring Period																			
Item	Cost/Unit	Unit	Quantity	TOTAL	YEAR														
					1	2	3	4	5	6	7	8	9	10					
Initial Herbicide Application	\$ 200	Acre	1,094	\$ 218,700		\$ 218,700													
Herbicide Maintenance (10%/YR)	10%	Acre	109.35	\$ 174,960			\$ 21,870	\$ 21,870	\$ 21,870	\$ 21,870	\$ 21,870	\$ 21,870	\$ 21,870	\$ 21,870	\$ 21,870	\$ 21,870	\$ 21,870	\$ 21,870	\$ 21,870
Planting Labor	\$ 65	Acre	1,047	\$ 68,055		\$ 68,055													
Seedlings	\$ 0.30	Seedlings	266,902	\$ 80,071		\$ 80,070.60													
Oversight	\$ 40	Acre	1,047	\$ 41,880		\$ 41,880													
Maintenance Oversight	\$ 4	Acre	1,047	\$ 33,504			\$ 4,188	\$ 4,188	\$ 4,188	\$ 4,188	\$ 4,188	\$ 4,188	\$ 4,188	\$ 4,188	\$ 4,188	\$ 4,188	\$ 4,188	\$ 4,188	\$ 4,188
Silviculture Maintenance	10%			\$ 49,374			\$ 6,172	\$ 6,172	\$ 6,172	\$ 6,172	\$ 6,172	\$ 6,172	\$ 6,172	\$ 6,172	\$ 6,172	\$ 6,172	\$ 6,172	\$ 6,172	\$ 6,172
Annual Monitoring				\$ 156,000	\$ 14,000	\$ 30,000	\$ 14,000	\$ 14,000	\$ 14,000	\$ 14,000	\$ 14,000	\$ 14,000	\$ 14,000	\$ 14,000	\$ 14,000	\$ 14,000	\$ 14,000	\$ 14,000	\$ 14,000
TOTAL				\$ 822,543	\$ 14,000	\$ 438,706	\$ 46,230	\$ 46,230	\$ 46,230	\$ 46,230	\$ 46,230	\$ 46,230	\$ 46,230	\$ 46,230	\$ 46,230	\$ 46,230	\$ 46,230	\$ 46,230	\$ 46,230

TABLE 354-B: SHORT TERM COSTS ASSOCIATED WITH BANK ESTABLISHMENT FOR MU3

Tarkington Bayou Mitigation Bank Costs Through Monitoring Period																			
Item	Cost/Unit	Unit	Quantity	TOTAL	YEAR														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Berm Construction	\$ 10	Cubic Yards	66,000	\$ 660,000	\$ 660,000														
Berm Maintenance	10%			\$ 92,400		\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600
Initial Herbicide Application	\$ 200	Acre	345.5	\$ 69,100	\$ 69,100														
Herbicide Maintenance (10%/YR)	10%	Acre	34.55	\$ 96,740		\$ 6,910	\$ 6,910	\$ 6,910	\$ 6,910	\$ 6,910	\$ 6,910	\$ 6,910	\$ 6,910	\$ 6,910	\$ 6,910	\$ 6,910	\$ 6,910	\$ 6,910	\$ 6,910
Planting Labor	\$ 65	Acre	213	\$ 13,845	\$ 13,845														
Seedlings	\$ 0.30	Seedlings	54,315	\$ 16,295	\$ 16,294.50														
Oversight	\$ 40	Acre	213	\$ 8,520	\$ 8,520														
Maintenance Oversight	\$ 4	Acre	213	\$ 11,928		\$ 852	\$ 852	\$ 852	\$ 852	\$ 852	\$ 852	\$ 852	\$ 852	\$ 852	\$ 852	\$ 852	\$ 852	\$ 852	\$ 852
Silviculture Maintenance	10%			\$ 30,300		\$ 2,164	\$ 2,164	\$ 2,164	\$ 2,164	\$ 2,164	\$ 2,164	\$ 2,164	\$ 2,164	\$ 2,164	\$ 2,164	\$ 2,164	\$ 2,164	\$ 2,164	\$ 2,164
Annual Monitoring				\$ 104,015	\$ 6,000	\$ 20,000	\$ 6,000	\$ 6,000	\$ 6,000	\$ 6,000	\$ 6,000	\$ 6,000	\$ 6,000	\$ 6,000	\$ 6,001	\$ 6,002	\$ 6,003	\$ 6,004	\$ 6,005
TOTAL				\$ 1,103,142	\$ 773,760	\$ 36,526	\$ 22,526	\$ 22,526	\$ 22,526	\$ 22,526	\$ 22,526	\$ 22,526	\$ 22,526	\$ 22,526	\$ 22,527	\$ 22,528	\$ 22,529	\$ 22,530	\$ 22,531

4 BANK OPERATIONS

4.1 CREDIT RELEASE SCHEDULE

Credit releases will follow the schedules proposed in and are split by MU. Each MU will be evaluated separately and independently. Construction of all three MUs shall be completed within 5 years of bank approval. Implementation of the mitigation plan for each MU does not depend on other MUs (i.e. success of MU1 is not dependent on MU2 and vice versa), and MUs do not have to be constructed sequentially.

The initial credit release for the entire bank (all three MUs) is authorized following: 1) the approval of the MBI; 2) the recordation of conservation easements; and 3) execution of the short-term financial assurance requirements. The Sponsor is making all financial assurances and protections on the entire Bank up front, before any construction begins. Due to the significant sequestration of funds and financial risk incurred by the Sponsor, credits will be released upon execution of the MBI and construction/planting. The remainder will be released by credit type as seen in the schedules outlined below. No wetland credits for established wetlands are being requested until construction of the berm is complete. See discussion of monitoring units in Section 3.6 for additional details. An initial credit release of 10 percent for re-established wetlands is warranted due to removing the threat of conversion or loss of these resources by placing the Bank under a conservation easement.

TABLE 36: MONITORING UNIT 1 FORESTED WETLAND CREDIT RELEASE SCHEDULE

MU1 PFO Wetland Credit Release Schedule						
Milestone	Verification Metric	PFO Enhancement	PFO Upland Buffer	TSDSW Units	MPAC Units	RSEC Units
Preconstruction	Execution of MBI*	20%	20%	11.8	22.0	14.1
Initial Implementation	Approval of Implementation/Construction Completion Report.	20%	20%	11.8	22.0	14.1
Yr-2 Monitoring (At Least 1 Growing Season After Initial Implementation)	Approval of monitoring report by USACE. Attainment of Year 2 performance standard.	Credits released based on demonstration of iHGM uplift** if performance standards are met.	20%	To be determined based on iHGM uplift**		
Yr-4 Monitoring (At Least 3 Growing Seasons After Initial Implementation)	Approval of monitoring report by USACE. Attainment of Year 4 performance standard.		20%			
Yr-7 Monitoring (At Least 6 Growing Seasons After Initial Implementation)	Approval of monitoring report by USACE. Attainment of Year 7 performance standard.		10%			
Yr-10 Monitoring (Final Release - At Least 9 Growing Seasons After Initial Implementation)	Approval of monitoring report by USACE. Delivery of long-term endowment. Attainment of Year 10 performance standard.		10%			
MU1 TOTAL			PFO Enhancement	38.3	89.1	49.7
MU1 TOTAL			PFO Upland Buffer	20.7	20.7	20.7
MU1 PFO TOTAL				59.0	109.9	70.4

* Preconstruction task includes the execution of the MBI, delivery of the financial assurances, and documentation of a recorded conservation easement. This is a one time credit release for the entire bank.

** iHGM Uplift measured against baseline and assumptions used in Determination of Credits (Section 3.7). Credits will be released after function has surpassed the preconstruction and initial implementation credit releases.

TABLE 37: MONITORING UNIT 1 STREAM CREDIT RELEASE SCHEDULE

Stream Credit Release Schedule				
Milestone	Verification Metric	Light Buffer Planting	Wetland Adjustment Factor	Credits Released
Preconstruction	Execution of MBI*	20%	20%	3,438
Initial Implementation	Approval of Implementation/Construction Completion Report.	20%	20%	3,438
Yr-2 Monitoring (At Least 1 Growing Season After Initial Implementation)	Approval of monitoring report by USACE. Attainment of Year 2 performance standard.	20%	20%	3,438
Yr-4 Monitoring (At Least 3 Growing Seasons After Initial Implementation)	Approval of monitoring report by USACE. Attainment of Year 4 performance standard.	20%	20%	3,438
Yr-7 Monitoring (At Least 6 Growing Seasons After Initial Implementation)	Approval of monitoring report by USACE. Attainment of Year 7 performance standard.	10%	10%	1,719
Yr-10 Monitoring (Final Release - At Least 9 Growing Seasons After Initial Implementation)	Approval of monitoring report by USACE. Delivery of long-term endowment. Attainment of Year 10 performance standard.	10%	10%	1,719
TOTAL				17,190

* Preconstruction task includes the execution of the MBI, delivery of the financial assurances, and documentation of a recorded conservation easement. This is a one time credit release for the entire bank.

TABLE 38: MONITORING UNIT 2 HERBACEOUS/SHRUB WETLAND CREDIT RELEASE SCHEDULE

MU2 PEM/PSS Wetland Credit Release Schedule						
Milestone	Verification Metric	PEM/PSS Enhancement	PEM/PSS Upland Buffer	TSDSW Units	MPAC Units	RSEC Units
Preconstruction	Execution of MBI*	20%	20%	0.9	1.6	1.3
Initial Implementation	Approval of Implementation/Construction Completion Report.	20%	20%	0.9	1.6	1.3
Yr-2 Monitoring (At Least 1 Growing Season After Initial Implementation)	Approval of monitoring report by USACE. Attainment of Year 2 performance standard.	Credits released based on demonstration of iHGM uplift** if performance standards are met.	20%	To be determined based on iHGM uplift**		
Yr-4 Monitoring (At Least 3 Growing Seasons After Initial Implementation)	Approval of monitoring report by USACE. Attainment of Year 4 performance standard.		20%			
Yr-7 Monitoring (At Least 6 Growing Seasons After Initial Implementation)	Approval of monitoring report by USACE. Attainment of Year 7 performance standard.		10%			
Yr-10 Monitoring (Final Release - At Least 9 Growing Seasons After Initial Implementation)	Approval of monitoring report by USACE. Delivery of long-term endowment. Attainment of Year 10 performance standard.		10%			
MU2 TOTAL		PEM/PSS Enhancement		2.6	5.7	4.6
MU2 TOTAL		PEM/PSS Upland Buffer		2.1	2.1	2.1
TOTAL				4.6	7.8	6.6

* Preconstruction task includes the execution of the MBI, delivery of the financial assurances, and documentation of a recorded conservation easement. This is a one time credit release for the entire bank.

** iHGM Uplift measured against baseline and assumptions used in Determination of Credits (Section 3.7). Credits will be released after function has surpassed the preconstruction and initial implementation credit releases.

TABLE 39: MONITORING UNIT 2 FORESTED WETLAND CREDIT RELEASE SCHEDULE

MU2 PFO Wetland Credit Release Schedule							
Milestone	Verification Metric	PFO Restoration	PFO Enhancement	PFO Upland Buffer	TSDSW Units	MPAC Units	RSEC Units
Preconstruction	Execution of MBI*	20%	20%	20%	14.1	23.5	16.3
Initial Implementation	Approval of Implementation/Construction Completion Report.	20%	20%	20%	14.1	23.5	16.3
Yr-2 Monitoring (At Least 1 Growing Season After Initial Implementation)	Approval of monitoring report by USACE. Attainment of Year 2 performance standard.	Credits released based on demonstration of iHGM uplift** if performance standards are met.		20%	To be determined based on iHGM uplift**		
Yr-4 Monitoring (At Least 3 Growing Seasons After Initial Implementation)	Approval of monitoring report by USACE. Attainment of Year 4 performance standard.			20%			
Yr-7 Monitoring (At Least 6 Growing Seasons After Initial Implementation)	Approval of monitoring report by USACE. Attainment of Year 7 performance standard.			10%			
Yr-10 Monitoring (Final Release - At Least 9 Growing Seasons After Initial Implementation)	Approval of monitoring report by USACE. Delivery of long-term endowment. Attainment of Year 10 performance standard.			10%			
MU2 TOTAL		PFO Restoration			26.5	42.2	28.1
MU2 TOTAL		PFO Enhancement			26.8	57.8	35.8
MU 2 TOTAL		PFO Upland Buffer			17.4	17.4	17.4
		MU 2 PFO TOTAL			70.7	117.4	81.3

* Preconstruction task includes the execution of the MBI, delivery of the financial assurances, and documentation of a recorded conservation easement. This is a one time credit release for the entire bank.

** iHGM Uplift measured against baseline and assumptions used in Determination of Credits (Section 3.7). Credits will be released after function has surpassed the preconstruction and initial implementation credit releases.

TABLE 39: MONITORING UNIT 3 HERBACEOUS/SHRUB WETLAND CREDIT RELEASE SCHEDULE

MU3 PEM/PSS Wetland Credit Release Schedule							
Milestone	Verification Metric	PEM/PSS Establishment	PEM/PSS Re-establishment	PEM/PSS Upland Buffer	TSDSW Units	MPAC Units	RSEC Units
Preconstruction	Execution of MBI	0%	10%	20%	4.2	4.2	4.4
Initial Implementation	Approval of Implementation/Construction Completion Report	20%	20%	20%	14.3	15.0	15.5
Interim Release	Updated Short-term Financial Assurances	40%	30%	20%	24.3	25.9	26.6
Final Credit Release	Achievement of all previously released credits and based on functional uplift determined through iHGM calculations.	40%	40%	40%	28.5	30.1	31.0
<i>PEM/PSS Establishment TOTAL</i>					<i>34.3</i>	<i>38.0</i>	<i>38.5</i>
<i>PEM/PSS Re-establishment TOTAL</i>					<i>31.9</i>	<i>32.2</i>	<i>33.9</i>
<i>PEM/PSS Upland Buffer TOTAL</i>					<i>5.0</i>	<i>5.0</i>	<i>5.0</i>
GRAND TOTAL		100%	100%	100%	71.3	75.2	77.4

TABLE 40: MONITORING UNIT 3 FORESTED WETLAND CREDIT RELEASE SCHEDULE

MU3 PFO Wetland Credit Release Schedule							
Milestone	Verification Metric	PFO Establishment	PFO Re-Establishment	PFO Upland Buffer	TSDSW Units	MPAC Units	RSEC Units
Preconstruction	Execution of MBI	0%	10%	20%	5.5	5.5	5.6
Initial Implementation	Approval of Implementation/Construction Completion Report	20%	20%	20%	23.1	25.0	23.8
Interim Release	Updated Short-term Financial Assurances	40%	30%	20%	40.7	44.4	42.0
Final Credit Release	Achievement of all previously released credits and based on functional uplift determined through iHGM calculations.	40%	40%	40%	46.2	49.9	47.6
<i>PFO Establishment Establishment TOTAL</i>					65.6	74.6	67.6
<i>PFO Re-establishment Re-establishment TOTAL</i>					45.1	45.5	46.7
<i>PFO Upland Buffer Upland Buffer TOTAL</i>					4.7	4.7	4.7
GRAND TOTAL		100%	100%	100%	115.4	124.8	119.0

4.2 ACCOUNTING PROCEDURES

The Sponsor shall be the responsible party for the management of the compensatory mitigation credit accounting system that documents all credit transactions. All credit and debit transactions will be recorded in a ledger database and submitted to the USACE sale/receipt. The ledger will include:

- Permit applicant name, address, and telephone number
- Permit number
- 8-digit HUC and county locations
- Brief description of the project impacts
- Number of credits provided
- Remaining balance of Bank credits
- Date of Transaction

Wetland debits from TBMB will be calculated using the appropriate iHGM model. If a permittee does not wish to run the appropriate iHGM model, they can simply purchase the maximum amount of iHGM units-per-acre of impact (e.g. 1 Ac of impact would require 1 TDSW Unit, 1 MPAC Unit, and 1 RSEC Unit).

Stream debits from TBMB will be calculated using the Galveston SOP, Section 4 (Impact Assessment). The Galveston SOP calculated debits using the following equation:

$$\text{Reach Condition Index Delta} \times \text{Impact Factor} \times \text{Linear Feet of Impact} = \text{Debits}$$

A brief description of impact factors are outlined below:

- Severe-IF Score 5
 - The proposed project will eliminate a stream, or result in a loss function equivalent to a 4-point change in Reach Condition Index.
- Major-IF Score 4
 - The proposed project will result in a loss of function equivalent to a 3-point change in Reach Condition Index.
- Moderate-IF Score 3
 - The proposed project will result in a loss of function equivalent to a 2-point change in Reach Condition Index.
- Minor –IF Score 2
 - The proposed project will result in a loss of function equivalent to or less than a 1-point change in Reach Condition Index.
- Temporary- If Score 1
 - Impacts are temporary and the site will be returned to pre-construction contours and elevations with no permanent loss of aquatic function.

Transactions will be debited at a 1:1 ratio within the primary service area and a 1.5:1 ratio within the secondary service area. The Sponsor shall provide the USACE with a copy of the completed credit transaction within 30 days of transaction. The Sponsor shall provide an annual statement of the ledger to the USACE by January 31st of each year until all credits have been withdrawn and/or the TBMB is closed.

4.3 REPORTING PROTOCOLS

The reporting process is an invaluable component in maintaining effective communication between the Bank management entity (i.e. the Sponsor) and the regulatory agencies. While it does not constitute a replacement for compliance inspections, it does provide the necessary information to the review agencies to monitor the progression of the Bank site as it develops to the desired target resources.

All monitoring reports submitted will comply with the Minimum Requirements for Compensatory Mitigation Projects Involving the Restoration, Establishment, and/or Enhancement of Aquatic Resources (USACE, 2008). The Annual Monitoring Reports will include an evaluation of restoration and enhancement activities to ensure those activities are meeting (at a minimum) the performance standards defined in the MBI. Any recommendations for future evaluations or permit modifications congruent to the regulatory guidance will be included within these reports when appropriate. Reports will be submitted to the USACE for distribution to the IRT each year by 31 January of the year following the monitoring effort, in accordance with Section 3.10.

4.4 CONTINGENCY PLAN/REMEDIAL ACTION

In the event that one or more components of the TBMB does not achieve performance standards or any other requirement specified in the MBI, the following sequence of remedial actions shall be taken.

Once a component of the TBMB is deemed to be non-compliant with the MBI, the Sponsor shall take all appropriate actions to bring that component into compliance as soon as practicable. During the period a specific component of the TBMB is out of compliance, the USACE may suspend its approval of the use of that component's credits as a source of compensatory mitigation for permitted impacts.

If remedial actions taken by the Sponsor are ineffective at bringing an aspect of the TBMB into compliance with the MBI, despite reasonable efforts being made by the Sponsor, the Sponsor may elect to take one of the following courses of action:

1. Submit a proposal to the USACE to modify the Mitigation Plan and/or the appropriate management plan. Any resulting modifications cannot be implemented without approval of the USACE after consultation with the IRT.
2. Provide written notice of the intent to discontinue efforts to meet performance standards for the specific aspect of the TBMB. Once the notice is provided, no further credits can be generated from that aspect of the TBMB. The Sponsor will be released from all future monitoring and maintenance obligations associated with that specific aspect of the TBMB, provided the release of these specific obligations does not adversely affect the remainder of the TBMB. Any unused, previously established credits derived from this aspect shall be removed from the TBMB ledger. Any used previously established credits derived from that aspect shall be replaced with other unused established credits at TBMB. If there are insufficient unused credits to replace those removed credits, the Sponsor shall implement other reasonable appropriate compensatory mitigation approved by the USACE, in coordination with the IRT.

If one or more aspects of the TBMB fails to meet the requirements of the MBI and that failure adversely affects the ability of the TBMB to achieve its goals and objectives, or the Sponsor does not make reasonable

efforts to bring the TBMB into compliance with the Mitigation Plan, the USACE, after coordinating with the IRT and notifying the Sponsor, may terminate the MBI and operation of the TBMB. The Sponsor shall implement all reasonably appropriate compensatory mitigation actions that the USACE, after consultation with the IRT, determines is necessary to compensate for those USACE-authorized impacts that have been compensated for by the TBMB pursuant to the requirements of the MBI.

4.5 PROVISIONS COVERING THE USE OF THE LAND

TBMB shall be protected in perpetuity by a Conservation Easement substantially in the same form as the Conservation Easement found in Appendix C. Land use practices in conflict with the goals of TBMB and not permitted by the Conservation Easement include, but are not limited to, development, commercial/industrial uses, livestock grazing, dumping, surface mining, unauthorized off-road vehicles, new utility conveyances, construction of new roads, other dredge or fill activities, introduction of invasive species, and agricultural uses.

4.6 DEFAULT AND CLOSURE PROVISIONS

Upon the closure of the TBMB (final release of credits and fulfillment of MBI requirements), the responsibility of site maintenance will be maintained by the Sponsor or their agent. Should the Sponsor sell the property or relinquish responsibility for the site, the IRT will be notified in a timely manner.

The USACE may take appropriate action towards compliance enforcement if the USACE, in coordination with the IRT, determines the Sponsor has failed to:

- Meet the required compensatory mitigation performance standards;
- Submit monitoring reports in a timely manner;
- Establish and maintain ledgers and report in accordance with the provisions in this document;
- Or otherwise comply with the terms of the MBI.

Enforcement actions may include suspending credit sales, decreasing available credits, requiring adaptive management measures, utilizing financial assurances or contingency funds, terminating the MBI, or referring the non-compliance with the terms of the instrument to the Department of Justice. Any delay or failure of the Sponsor to comply with the terms of this MBI shall not constitute a default if the delay or failure is the result of any force majeure or other conditions beyond the Sponsor's reasonable control that significantly, adversely affect their ability to perform their obligations herein, such as severe flooding, extreme drought, earthquake, landslide, arson, wild fire, civil disorder, condemnation or other taking by any governmental body. The Sponsor shall give written notice to the USACE and the IRT if the Bank is affected by any such event as soon as reasonably possible in order to restore compliance.

In the event of default, the USACE may provide written notification of non-compliance to the Sponsor, the third party beneficiary, or entity responsible for distributing the funds in accordance with the financial assurances to facilitate required mitigation activities. The third party beneficiary will collect the funds necessary to correct the deficiency and take corrective action.

The Bank shall be closed upon the date the performance standards have been met and documented, and either of the following criteria have been met:

- The last authorized credit has been transferred and the financial assurance is fully funded for all credits sold.
- The Sponsor submits written notice to the USACE stating the Sponsor is closing the Bank and the long-term financial assurance is fully funded for all credits sold.

When the USACE approves of this written notice, the banking project shall be deemed complete and the Bank will be officially closed. Following bank closure, the conservation easement protecting the Bank shall remain effective in perpetuity and long-term stewardship shall commence.

5 ADDITIONAL INFORMATION

5.1 WATER RIGHTS

Water rights within the State of Texas are complex because they recognize both right of capture of groundwater and prior appropriation rights. Texas Water Code, however, does grant the right to provide in-stream flow for environmental protection (Texas State Legislature, 2011). In an effort to provide protection to the Sponsor, the TCEQ does reference the State's climatic conditions do not guarantee any user the rights to surface water if surface waters are unavailable due to inadequate rainfall and/or spring flows (Texas State Legislature, 2011).

Given the variety of enhancement opportunities to multiple areas throughout the project site, the Sponsor proposes to restore ecological value to the habitat and surrounding environment, while minimizing (if affecting at all) the negative impacts to the natural or historic water courses on-site. Any alteration to existing courses of water will only enhance the overall water quality through biogeochemical processing before flowing off-site. Specifically, the constructed berm will have no activities or engineering actions which would affect the in-stream water flow rights of downstream water users or citizens. No diversion of water from the downstream users is proposed under the Bank berm creation, although the surface runoff will be temporarily entrained within wetland complexes, it is released via the spillway into adjacent wetlands and eventually Long Branch and Luce Bayou.

5.2 MINERAL MANAGEMENT PLAN

The Sponsor does not own the mineral resources, such as oil and natural gas, which may be situated beneath the Bank. In the State of Texas, surface owners cannot control a mineral owner's access to subsurface minerals. It is unlikely that any drilling will occur within TBMB in the near future. Surface impacts to the bank could be avoided by utilization of horizontal drilling technologies. With these technologies, drilling pads can be strategically placed in uplands outside of the bank and minerals such as oil and natural gas can still be extracted from under the Bank.

Even though drilling the near future is not likely, 3 pad locations at approximately 3 Ac each for a total of 9.1 Ac in uplands have been reserved for this purpose. These proposed pads are situated as far as possible from wetlands and stream buffers on-site and adjacent to preexisting roads to prevent the need for any new roads to be built (Appendix A, Exhibit 13). In the eventuality that minerals are never found or extracted on-site, these forested areas will still be restored in the same manner as the adjacent uplands. Credits will not be requested for these areas and they are part of the excluded areas aforementioned in this document.

The exploration for, and production and transportation of, subsurface mineral resources beneath the TBMB is acceptable provided: ground disturbing activities and surface alterations are minimized to the maximum extent practicable; activities are conducted in a manner that minimizes adverse environmental impacts; impacted areas are restored to pre-existing conditions as soon as practicable; reasonable and appropriate compensatory mitigation is achieved; and the entity conducting the activities complies with all applicable regulatory requirements, including Section 404 of the Clean Water Act (CWA). The number of credits in the TBMB may be reduced depending on the extent and location of adverse impacts associated with mineral extraction activities. The appropriate compensatory action will be subject to approval by the USACE.

5.3 UTILITY AND TRANSPORTATION CORRIDOR AND EASEMENTS

Certain acreage such as the 7.2 Ac footprint of the constructed berm, 9.1 Ac set aside for mineral extraction activities as laid out in the mineral management plan, and the access roads and pipeline easements on-site totaling 41.1 Ac is from credit generation. These include These exclusions are shown in Appendix A, Exhibits 13 and 14. Several logging roads currently in use will be condemned by the inundation from the berm. For the purposes of maintenance, access across the 1,438.5 Ac is vital, but where possible, pipeline rights-of-way will be used to minimize impacts and the overall footprint within the bank.

5.4 MBI AUTHORIZATION

As components of this revised MBI remain tied to the previous MBI authorization, the previous signature pages for the MBI authorized on July 20, 2018 are included in Appendix M.

6 REFERENCES

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7 SIGNATURE PAGES

Sponsor: Tarkington Bayou Mitigation, LLC

David Tepper
President

Date

U.S. Army Corps of Engineers, Galveston District

Joe A. McMahan
Chief, Regulatory Division
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Date

U.S. Environmental Protection Agency, Region 6

Charles W. Maguire
Director, Water Division

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U.S. Fish and Wildlife Service

Chuck Ardizzone
Project Leader, Texas Coastal Ecological Services Field Office – Houston

Date

USDA – Natural Resources Conservation Service

Salvador Salinas
State Conservationist

Date

Texas Parks and Wildlife Department

Carter Smith
Executive Director

Date

Texas Commission on Environmental Quality

David Galindo
Director, Water Quality Division

Date

Texas General Land Office

George P. Bush
Land Commissioner

Date

APPENDIX A – EXHIBITS

*APPENDIX B – SURVEY TITLE AND OWNERSHIP
INFORMATION*

APPENDIX C – CONSERVATION EASEMENT

*APPENDIX D – THREATENED AND ENDANGERED SPECIES
REPORT*

APPENDIX E – CULTURAL RESOURCES ASSESSMENTS

APPENDIX F – WOUS DELINEATIONS

APPENDIX G – FUNCTIONAL ASSESSMENT

APPENDIX H – BIOLOGICAL SURVEYS

APPENDIX I – REFERENCE WETLAND DATA

*APPENDIX J – BERM CONSTRUCTION PLANS AND
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APPENDIX K – CREDIT DETERMINATION

APPENDIX L –CASUALTY INSURANCE POLICY

APPENDIX M – PREVIOUS SIGNATURE PAGES