PLAN

Conceptual Mitigation Plan for the Harris Expansion Project Brazoria County, Texas

Prepared for

The Dow Chemical Company

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ch2m

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Acronyms and Abbreviations

Cardno	Cardno ENTRIX, Inc. or Cardno
CH2M	CH2M Hill Engineers, Inc.
CFR	Code of Federal Regulations
CWA	Clean Water Act
District	U.S. Army Corps of Engineers Galveston District
Dow	The Dow Chemical Company
iHGM	interim hydrogeomorphic model
OHWM	Ordinary High Water Mark
PEM	palustrine emergent wetlands
PFO	palustrine forested wetlands
PUB	palustrine unconsolidated bottom wetlands
WOUS	waters of the United States
USACE	U.S. Army Corps of Engineers

SECTION 1

Introduction

At the request The Dow Chemical Company (Dow), CH2M HILL Engineers, Inc. (CH2M) prepared this conceptual mitigation plan (the Plan) in accordance with the U.S. Army Corps of Engineers (USACE) Regulatory Program regulations 33 *Code of Federal Regulations* (CFR) 320-331 and 40 CFR 230 for the compensation of unavoidable impacts to Waters of the United States (WOUS) associated with the proposed Harris Expansion Project (Project), in Brazoria County, Texas. This Plan is intended as a supplement to the Clean Water Act (CWA) Section 404/Rivers and Harbors Appropriation Act Section 10 Individual Permit application to be submitted for the project to USACE Galveston District (District).

A preliminary application meeting was held with the U.S. Army Corps of Engineers (USACE) Galveston District (District) on December 11, 2017, to review the proposed project elements and alternatives, as well as the approach for permitting and potential mitigation for impacts to WOUS. Cardno ENTRIX, Inc. (Cardno) biologists conducted two field surveys of the project site from February 28 to March 5, 2012 and April 13 and April 27, 2017. CH2M biologists conducted wetland and stream assessment evaluations of the project site from April 11 to April 14, 2016 and from April 13 to April 27, 2017. The purpose for the project site field surveys was to assess and quantify the ecological functions of the WOUS present at the site to help the project planning and development to identify an alternative site design to avoid and minimize environmental impacts, while still meeting the project's purpose and need. The ecological functions of the resources at potential and final onsite mitigation locations were also assessed so that any loss of ecological functions from the unavoidable impacts from the proposed project could be compensated.

1.1 Mitigation Goals and Objectives

The goal for the development of project-specific mitigation strategies is to fully compensate the unavoidable impacts from the proposed project and to provide an overall improvement to the Oyster Creek watershed near the project. Compensatory mitigation strategies presented in this plan follow 33 *Code of Federal Regulations* (CFR) 320-331 and 40 CFR 230 guidance provided in the District's "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" (2013), and Guidance Letter 08_03 (2008). USACE guidelines define the strategies as follows:

> ***Restoration*** *– the reestablishment of aquatic resource characteristics and functions at a site where they have ceased to exist or exist in a substantially degraded state.*
>
> ***Enhancement*** *– an activity conducted in existing aquatic resources that increases or improves one or more aquatic functions or characteristics.*
>
> ***Creation*** *– the establishment of an aquatic resource where one did not formerly exist.*
>
> ***Preservation*** *– the conservation or dedication of ecologically important existing aquatic resources in perpetuity through the implementation of appropriate legal and physical mechanisms to prevent its destruction or degradation in the future.*

The development of mitigation strategies includes specific objectives that serve to ensure that there is "no net loss" of ecological functions of aquatic resources. The following are the federal objectives:

- The qualification of ecological functions lost at the project site and gained at the mitigation site(s)
- The replacement of lost functions by identification of potential onsite and in-kind mitigation opportunities prior to seeking offsite and/or out-of-kind opportunities
- The development of mitigation strategies that are easily implementable and sustainable

- The establishment of a monitoring program that includes specific success criteria, ensuring that mitigation strategies are effective
- The establishment of legal instruments to provide permanent protection of mitigation activities

1.2 Project Description

The proposed Project includes expanding water supply storage capacity by adding a new off-channel upland reservoir and associated infrastructure immediately north of the existing Harris Reservoir. The site is located within the reach of the Brazos River from which Dow is authorized to divert its existing surface water right. The Project site is an approximately 2,200-acre tract of land acquired by Dow from the Texas Departmental of Criminal Justice in 2011 and additional acreage along Oyster Creek just north of the proposed Project. The off-channel reservoir would include a 1,929-acre impoundment with nominal storage capacity of about 50,000 acre-feet, an intake and pump station to divert Dow's existing surface water rights from the Brazos River, an outlet to Oyster Creek and an emergency spillway. The Project also includes floodplain enhancements in Oyster Creek and stream restoration (296 acres) and temporary construction staging and laydown areas (78 acres). Figure 1 in Attachment A provides a conceptual layout of the off-channel reservoir site and associated Project components.

SECTION 2

Impact Site

2.1 Site Description

In general, the proposed Project site is located on the Brazos River, between the Brazos River and Oyster Creek, north of The Dow Chemical Company's (Dow) existing Harris Reservoir in Brazoria County in Texas. It is located within the 100-year floodplains of the Brazos River and Oyster Creek, with designated special flood hazard Zones AE and AO on Brazoria County Flood Insurance Rate Map (FIRM) panels 48039C0410H, 48039C0245H, 48039C0240H, and 48039C0405H, dated June 5, 1989. The Project area is drained by a series of man-made ditches that were historically used for agricultural purposes.

Years of agricultural land use throughout the area removed much of the forested habitat and considerably altered the hydrology. The Project site was previously owned by the State of Texas as part of the Ramsey Unit State prison farm; Dow purchased 2,200 acres immediately north of the existing Harris Reservoir specifically for increasing the water supply storage available for the Texas Operations and reducing impacts to private property owners. As such, it has been used for livestock grazing and farming for more than 35 years and land cover on the site is primarily pasture grasses with scattered or clustered trees (HDR 2014). Approximately 60 percent of the Project site is used for agriculture and 40 percent as pasture (Cardno 2014). These prolonged agricultural practices at the site and north along both the Brazos River and Oyster Creek as well as related intensive land use practices, have led to stream bank erosion, destruction of riverine wetlands and riparian areas, increased stormwater runoff, and contributed to high degrees of sediment load in the two watersheds. The current status of water features on the property are degraded and low function.

Within the proposed Project boundary, there are eight man-made agricultural ditches, seven ephemeral streams, four intermittent streams, and three perennial streams, totaling 65,949.7 linear feet of water features (22,785 linear feet of agricultural ditches and 43,164.7 linear feet of streams). The locations of each water body are shown in Figure 2. Also within the proposed Project site, 17 wetland areas occupying 19.57 acres were identified and delineated. Wetland types included palustrine forested wetlands (PFO) totaling 4.14 acres, palustrine emergent wetlands (PEM) totaling 13.51 acres, and palustrine unconsolidated bottom wetlands (PUB) totaling 1.92 acres. The locations of each water body are shown in Figure 2. A summary of wetland and water features identified and mapped within the proposed Project boundary is presented in Table 1-1.

Table 1-1. Total Wetland and Water Features within the Project Boundary
Harris Expansion Project

Feature	Resource Type	Length (ft.)	Acre(s)
PEM#1	PEM	-	6.51
PEM#2	PEM	-	1.85
PEM#3	PEM	-	0.69
PEM#4	PEM	-	0.25
PEM#5	PEM	-	2.89
PFO#1	PFO	-	1.88
PFO#2	PFO	-	1.41
PFO#3	PFO	-	0.86

Table 1-1. Total Wetland and Water Features within the Project Boundary

Harris Expansion Project

Feature	Resource Type	Length (ft.)	Acre(s)
Wetland 1B	PEM	-	1.135
Wetland 2B	PEM	-	0.0003
Wetland 3B	PEM	-	0.036
Wetland 4B	PEM	-	0.059
Wetland 5B	PEM	-	0.04
Wetland 7B	PEM	-	0.046
PUB#1	PUB	-	0.60
PUB#2	PUB	-	0.64
PUB#3	PUB	-	0.68
Ephemeral Drainage #1	ES	6,129.5	-
Ephemeral Drainage #3	ES	2,450.4	-
Ephemeral Drainage #6	ES	135.9	-
Ephemeral Drainage #7	ES	160.0	-
S06	ES	77.0	-
S07	ES	79.0	-
S13	ES	195	-
Ephemeral Drainage Total		**9,226.8**	**-**
S09	IS	123.0	-
S11	IS	442.0	-
S14	IS	124.0	-
Intermittent Stream #1	IS	10,997.9	-
Intermittent Stream		**11,686.9**	**-**
S02	PS	14,773.0	-
S03	PS	3,680.0	-
S08	PS	3,798.0	-
Perennial Stream		**22,251.0**	-
Agricultural Drainage #1	AD	512	-
Agricultural Drainage #2	AD	3,359	-
Agricultural Drainage #3	AD	699	-
Agricultural Drainage #4	AD	3,752	-
Agricultural Drainage #5	AD	6,794	-
Agricultural Drainage #6	AD	824	-

Table 1-1. Total Wetland and Water Features within the Project Boundary
Harris Expansion Project

Feature	Resource Type	Length (ft.)	Acre(s)
Agricultural Drainage #7	AD	4,636	-
Agricultural Drainage #8	AD	2,209	-
Agricultural Drainage		**22,785**	**-**
Total		**65,949.7**	**19.57**

Notes:
[1] Resource Type: PEM = Palustrine Emergent; PFO = Palustrine Forested; ES = Ephemeral Stream; IS = Intermittent Stream; PS = Perennial Stream; AD = Agricultural Ditch

2.2 Impact Areas Descriptions

A request for an approved jurisdictional determination was submitted to the Galveston District on August 27, 2017, and is currently under review by the District. Preliminary jurisdictional boundaries of areas identified as WOUS, along with the unavoidable proposed project impacts are shown in Figure 2.

Impacts to WOUS identified onsite include PEM and PFO wetlands, ephemeral streams, one intermittent stream, and the Brazos River. A summary of potential impacts to WOUS as a result of the proposed Project is presented in Table 2-1. Detailed fill volumes and fill materials are presented in Table 2-2. Photographs taken during field surveys of each of the impact area locations are provided in the 2017 Cardno Wetland Delineation Report and 2017 CH2M Level 1 Stream Assessment and interim hydrogeomorphic model (iHGM) wetland analysis reports.

Impacts to wetlands were tabulated in acres and impacts to streams were tabulated in linear feet.

Table 2-1. Potential WOUS Impacts
Harris Expansion Project

Waterbody ID	Resource Type [1]	Area [2] (acres)	Length [3] (feet)
PEM #1	PEM	6.51	-
PEM #2	PEM	1.85	-
PEM #3	PEM	0.69	-
PEM #4	PEM	0.25	-
PEM #5	PEM	2.89	-
PFO #1	PFO	1.88	-
PFO #2	PFO	1.41	-
PFO #3	PFO	0.86	-
Wetland 1B	PEM	0.00	-
Wetland 7B	PEM	0.00	-
Ephemeral Drainage #1	ES	-	6,129.5
Ephemeral Drainage #3	ES	-	2,450.4
Ephemeral Drainage #6	ES	-	135.9

Table 2-1. Potential WOUS Impacts
Harris Expansion Project

Waterbody ID	Resource Type [1]	Area [2] (acres)	Length [3] (feet)
Intermittent Stream #1	IS	-	10,997.9
S03 (Brazos River)	PS	-	772.6
S06	ES	-	0.0
S07	ES	-	0.0

Notes:
[1] Resource Type: PEM = Palustrine Emergent; PFO = Palustrine Forested; ES = Ephemeral Stream; IS = Intermittent Stream; PS = Perennial Stream
[2] Acreage rounded to the nearest 0.01; measurement is the area of impact
[3] Linear feet measurement rounded to nearest 0.1; measurement is the length of impact

Table 2-2. Type of Fill Material Being Discharged
Harris Expansion Project

	Type and Amount of Fill (yd^3)				
Location	**Sand**	**Soil**	**Riprap**	**Other**	**Total**
PEM#5		35,800			35,800
Ephemeral Drainage #3		7,100			7,100
Intermittent Stream #1		80,600			80,600
S03 (Brazos River)		7,745		330	8,075
Project Total	**0**	**98,945**	**0**	**330**	**99,275**

2.2.1 Wetlands

A total of 16.34 acres of potential jurisdictional wetlands (12.19 acres of PEM wetlands and 4.15 acres of PFO wetlands) would be permanently impacted by the proposed project. These wetlands are described in the 2012 Cardno Wetland Delineation Report and evaluated in the 2017 CH2M iHGM Report.

2.2.2 Intermittent Streams

A total of 10,997.9 linear feet of intermittent stream would be permanently impacted by the proposed project. The stream is described in the 2012 Cardno Wetland Delineation Report and 2017 CH2M Level 1 Stream Assessment Report.

2.2.3 Ephemeral Streams

A total of 8,715.8 linear feet of ephemeral streams would be permanently impacted by the proposed project. These streams are described in the 2012 and 2017 Cardno Wetland Delineation Reports and 2017 CH2M Level 1 Stream Assessment Report.

2.2.4 Brazos River

The proposed project would permanently impact a total of 772.6 linear feet of the Brazos River. The river is described in the 2017 Cardno Wetland Delineation Report and 2017 CH2M Level 1 Stream Assessment Report.

2.3 Ecological Functions and Values Lost

2.3.1 Wetlands

The District's standard operating procedure for assessing ecological value lost for PEM wetlands is to follow the iHGM protocol. An iHGM analysis was completed for each palustrine emergent (PEM) and palustrine forested (PFO) wetland within the 2,200-acre survey area, considering current conditions and expected conditions following reservoir construction. The analysis yielded the existing physical, biological, and chemical Functional Capacity Index (FCI) of each wetland. Calculated using the impacted acreage presented in Table 2-1 and the FCI for each wetland, the number of Functional Capacity Units (FCUs) for each wetland within the Project that would need to be replaced by mitigation are presented in Table 2-3.

Table 2-3. Functional Assessment Results for Wetland Features on the New Harris Reservoir Site
HarrisExpansion Project

Feature	Potential Function Capacity Impacts (Physical)	Potential Function Capacity Impacts (Biological)	Potential Function Capacity Impacts (Chemical)
PEM #1	0.337	3.037	-1.627
PEM #2	0.096	0.865	-0.463
PEM #3	0.036	0.321	-0.172
PEM #4	0.001	0.033	-0.037
PEM #5	0.150	1.351	-0.724
PEM Total	**0.620**	**5.607**	**-3.023**
PFO #1	0.879	1.258	0.438
PFO #2	0.513	0.871	0.080
PFO #3	0.129	0.595	-0.066
PFO Total	**1.521**	**2.724**	**0.452**
Total	**2.141**	**8.331**	**-2.571**

2.3.2 Other WOUS

Per the District's standard operating procedure, loss of stream function was analyzed using 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" (USACE 2013). Stream Assessment forms documenting current conditions (actual) were compared to post-construction Theoretical Stream Assessment forms (theoretical) for each transect for the entire 2,200-acre survey area. The change in the Reach Conditional Index (dRCI) between the actual and theoretical stream assessments, the linear feet of stream within the 2,200-acre survey area, and an impact factor for the type and magnitude of impact were utilized to calculate the compensation requirement or number of stream credits needed for impacts to each stream. Level 1- Stream Condition Data Forms are included in Appendix B

and Table 2-4 summarizes the results of the Level 1 Stream Assessment and estimated compensation requirements for each stream.

Table 2-4. Estimated Compensation Requirements (Credits) for Stream and Drainage Features within the 2,200-Acre Harris Reservoir Site Based on Level 1 Stream Assessment
Harris Expansion Project

Feature	Reach Conditional Index (RCI)	Change in Reach Conditional Index (dRCI)	Impact Factor	Linear Feet of Impact	Compensation Requirement (Stream Credits)
Ephemeral Drainage #1	2.64	1.44	1	6,129.5	8,826.5
Ephemeral Drainage #3	3.05	1.70	1	2,450.4	4,165.7
Ephemeral Drainage #6	2.94	1.94	1	135.9	263.6
Ephemeral Drainage Total					**13,255.8**
Intermittent Stream #1	2.94	1.94	1	10,997.9	21,335.9
Intermittent Stream Total					**21,335.9**
Total					**34,591.7**

Ecological functions and values of the existing ephemeral streams are poor. The channels are primarily narrow and shallow and exhibit a discontinuous Ordinary High Water Mark (OHWM). The riparian corridors are dominated by grazed pastureland or cropland and aquatic life use is poor. Benefits to local watershed water quality are also limited due to the low density of vegetation to uptake nutrients and filter particulates along with the lack of upland and wetland soils to aide in nutrient cycling and metals uptake.

The intermittent stream provides poor to moderate ecological functional values to the immediate project area and to habitats downstream. The reduced ecological function stems primarily from the intermittent stream's hydrology, including the varying frequency of inundation from Oyster Creek and the Brazos River. While some aquatic organisms were observed during field surveys, the available habitat for species that would be expected to occur was poor. The ecological functions that the intermittent stream impact area provides the following:

- Limited in-stream habitats for aquatic fauna
- Nutrient sources to the Brazos River from the surrounding watershed
- Foraging areas for wading birds and terrestrial species

SECTION 3

Mitigation Strategy

Mitigation strategies to compensate for the unavoidable impacts to WOUS from the proposed Harris Expansion Project were developed through onsite field surveys and a detailed design analysis. The implementation of mitigation strategies is designed to address the federal objective of "no net loss" of ecological functions of aquatic resources. During the site selection process, several options for providing compensatory mitigation for the unavoidable impacts proposed by the Project were considered. The 2008 Final Compensatory Mitigation Rule states that mitigation options should be considered based on the following hierarchy:

- Purchasing credits from an operational mitigation bank
- Purchasing credits from an approved in-lieu fee program
- Permittee-responsible mitigation under a watershed approach
- Permittee-responsible mitigation through on-site, in-kind mitigation
- Permittee-responsible mitigation through off-site and/or out-of-kind mitigation

The Project site is located within the primary and secondary service areas of multiple mitigation banks; therefore, this option was selected for mitigation of loss of wetlands on the Project site. The Project site is outside of the primary and secondary service areas for any mitigation banks or in-lieu fee programs that offer stream credits; therefore, permittee-responsible mitigation through on-site, in-kind mitigation was selected for stream mitigation. These strategies provide the most direct compensation to lost ecological functions at the Project site and are consistent with USACE guidance.

Mitigation of lost ecological wetland function through mitigation banking is described in Section 3.1. Stream mitigation projects are described in Section 3.2. cross-sections for each of the onsite locations are presented in Appendix A. The sheets include a plan view with aerial mitigation extent and a typical cross section. Photographs taken during field surveys of each of the impact area locations are provided in the 2012 and 2017 Cardno Wetland Delineation Reports and the 2017 CH2M Level 1 Stream Assessment and iHGM Wetland Analysis Reports.

3.1 Proposed Wetland Mitigation

The proposed project is within the primary service area of several approved wetland mitigation banks. The proposed mitigation for unavoidable loss of wetlands is to purchase credits from approved mitigation banks.

3.2 Proposed Onsite Mitigation

Onsite locations were evaluated to assess the potential to meet the Project's compensatory mitigation goals for impacts to linear water features (Figure 2). Priority was given to onsite mitigation that would provide the most direct compensation (location and in-kind) for project impacts.

The goals of the mitigation strategies proposed to be implemented onsite include re-establishment, restoration, and enhancement of the ecological functions of the aquatic resources at the project site so that the resources will increase their values within the surrounding watershed and the Oyster Creek corridor. The mitigation strategies will accomplish the following:

- Rehabilitate or enhance ecological functions of a stable bank and riparian buffers to improve and support in-stream functions.

- Re-establish streams within the Oyster Creek floodplain to provide an increase in aquatic resource area.
- Create sustainable mitigation designs.

3.2.1 Oyster Creek-Project 1

Project 1 begins in northern reaches of Oyster Creek and rehabilitates and enhances 3,621 linear feet of Oyster Creek. The segment of Oyster Creek within Project 1 currently has a mature riparian buffer out to 100 feet and has instream structure in the form of vegetation and root wads. Project 1 activities will include 2,356 feet of bankfull benching, 3,621 feet of buffer preservation of the existing 100-foot buffer, and buffer re-establishment out to 200 feet (Figures 3 and 4).

3.2.2 Oyster Creek-Project 2

Project 2 begins immediately south of Project 1 and rehabilitates and enhances 12,868 linear feet of Oyster Creek. The segment of Oyster Creek within Project 2 currently has a mature riparian buffer out to 100 feet within the northern portion of the project and is heavily impacted by farming activities in the southern portion with a much narrower riparian buffer. Project 2 activities will include 7,768 feet of bankfull benching, 12,868 feet of buffer preservation of the existing 100-foot buffer, and 12, 868 feet of buffer re-establishment out to 200 feet where possible (Figures 5 and 6).

3.2.3 Oyster Creek-Project 3

Project 3 will be located on the southeast boundary of the Harris Expansion Project embankment. Project 3 will reestablish an ephemeral drainage within the Oyster Creek floodplain through construction of 5,522 feet of channel. The project will also reestablish 5,522 feet of buffer out to 200 feet and preserve 5,522 feet of buffer. Hydrology of the channel will be influenced by the flow of Oyster Creek (Figures 7 and 8).

3.3 Native Vegetation Plantings

Native vegetation plantings will occur within the onsite restoration, enhancement and reestablishment Projects 1-3 described in Section 3.2.

Following the selective removal of invasive species and slope stabilization, re-establishment of the riparian buffers will occur through plantings of desirable native plant species. Tree and shrub species will include species native to the local forested riparian habitat, along with less-common species, to increase the overall species diversity of the riparian buffer and to provide increased benefits to wildlife species. Native species plantings will include various size classes planted at densities appropriate for developing stable vegetation stratum, reducing erosion, and improving overall habitat. The range of size classes of planted trees will produce an uneven aged forest canopy when mature. These planted communities should reach maturity within 15 to 30 years. After the 5-year monitoring period, the planted native trees and shrubs communities will be self-sustaining and self-organizing.

The proposed plant species for afforestation have a wetland indicator status of facultative (“FAC”), facultative wetland (“FACW”), or obligate (“OBL”) per the Regional Wetland Plant List for the Atlantic and Gulf Coastal Plain (“AGCP”) Region. Species selected either occur in or have a native range encompassing Brazoria County or adjacent counties. The planting effort will integrate fast-growing soft mast species with slower-growing hard mast species to allow for greater vertical structural diversity, which is a necessary habitat for forest breeding birds. The exact species and quantities for planting will be determined by the availability of the species from commercial nurseries providing seedling. Seedling planting density will be at a rate of at least 538 stems per acre, utilizing 9’x9’ spacing. Seedlings will be planted utilizing raised beds to encourage survival. Single stem planting of PFO species will occur the first planting season (December through February) following site preparation. Selected species will be site-appropriate for habitat design, soil-moisture regime, and species richness that are commercially available. The planted species will include

some or all of the following trees and shrubs: pecan (*Carya illinoinensis*), water oak (*Quercus nigra*), laurel oak (*Quercus laurifolia*), willow oak (*Quercus phellos*), American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), and cedar elm (*Ulmus crassifolia*). Grasses and forbs establishment will take place through the broadcast of a riparian seed mix dominated by species such as: switchgrass (*Panicum virgatum*), busy bluestem (*Andropogon glomeratus*), and Florida paspalum (*Paspalum floridanum*). The riparian seed mix will also include other various grasses, legumes, mints, and rushes to a lesser degree. The species will become established quickly stabilizing bank soils.

Planting to replace dead native vegetation will be a component of the monitoring plan established to support the success of mitigation (See Section 5). The monitoring plan will specify the success criteria for plantings.

3.4 Invasive and Nuisance Species

Invasive plant species such as Chinese tallow (*Triadica sebifera*) and Johnson grass (*Sorghum halepense*) readily occur throughout the onsite and offsite mitigation areas particularly in disturbed areas and throughout the riparian corridor. Invasive plant species will be selectively removed and controlled using chemical methods. Herbicides will be selected based on the type of application procedure and will be in accordance with federal regulations. The invasive plant removal and follow-up herbicide applications will be conducted by experienced contracted personnel. The monitoring plan will specify the success criteria for invasive species and their removal.

For herbicide treatment, the contractor shall abide by the following protocol:

1. The application of herbicide shall be pursuant to the regulations maintained by the Texas Department of Agriculture.
2. Herbicide shall be applied under the direction of a State licensed herbicide applicator.
3. The contractor shall be responsible for acquiring a spray permit through the Texas Department of Agriculture.
4. All herbicides are to be used in accordance with label requirements and/or special use labels. The contractor will be solely responsible for any penalty, fine, or damages resulting from misuse of herbicides. Should damages occur as a result of herbicide misuse, the contractor will replant at their own expense.
5. The contractor shall apply herbicides in a manner to minimize damage to non-target species.
6. The contractor shall be responsible for all herbicide application and handling with “Hold Harmless” protection for the owner.
7. All herbicides shall have a marking dye to show where treatments have taken place.
8. Report and clean-up all spills in accordance with local, county, state, and Federal requirements. All incidences regarding spills of herbicides and/or gasoline shall be immediately reported to TCEQ.
9. Daily log reports shall be kept by the contractor during active treatment periods.
10. No soil herbicides, such as Spike or Velpar, will be utilized.
11. No fuel or herbicide storage shall be allowed onsite.
12. The contractor shall police staging sites and maintain those sites free of trash.

3.5 Ecological Functions and Values Gained

The restoration of forested riparian habitats along the Oyster Creek will provide increases in function and value to wildlife habitats onsite. Preservation of these areas will maintain existing wildlife habitats keeping

them from being lost from future conversions to development or agricultural land uses. Rehabilitation and enhancement of the forested riparian habitats and the re-establishment of degraded stream reach will provide wildlife corridors, nesting, and foraging opportunities along the Creek for such species as white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), fox squirrel (*Sciurus niger*), gray squirrel (*Sciurus carolinensis*), wood duck (*Aix sponsa*), bald eagle (which are known to occur within the vicinity of the Project), pileated woodpecker (*Dryocopus pileatus*), belted kingfisher (*Ceryle alcyon*), herons and egrets, barred owl (*Strix varia*), and red-shouldered hawk. The planting of oak species will increase the available mast for deer, squirrels, mice, and voles. The smaller mammals will then, in turn, provide food sources for larger predators such as bobcats, foxes and coyotes.

Forested riparian buffers also promote stable banks and improved water quality. They reduce the velocity of stormwater runoff, allowing sediments to settle that would otherwise enter the surface water system. Canopy trees provide shading and temperature moderation for the adjacent waterway. Large woody debris provides energy dissipation and surface areas for sediment accumulation which can help to stabilize eroding banks. Riparian buffers facilitate recharge and nutrient uptake by vegetation, and increase flood storage capacity.

The stabilization of stream banks and restoration of associated riparian buffers along stream channels will prevent smothering of in-stream habitat substrates from bank erosion. Preserved and restored riparian habitats will provide nesting, foraging, and refuge for wildlife species and connections to adjacent habitats. The habitats for aquatic organisms provided by the preserved and re-established stream channels are limited by the altered hydrologic patterns, but scattered temporary pools may provide breeding areas for aquatic macroinvertebrates and insects. Amphibians such as the northern spring peeper (*Pseudacris crucifer*), American toad (*Bufo americanus*), bullfrog (*Rana catesbeiana*), northern cricket frog, southern leopard frog (*Rana sphenocephala*), and green frog (*Rana clamitans melanota*) may use these areas for breeding and nursery habitat. Intermittent streams are important foraging areas for waterfowl as well as wading birds such as great blue herons (*Ardea herodias*). Mammals expected to use the preserved stream channels include beaver, muskrat, and raccoon.

SECTION 4

Compensatory Mitigation Evaluation

Table 4-1 summarizes the stream credit requirements for impacts to jurisdictional streams within the project site and the stream credits created from Projects 1-4.

Table 4-1. Summary of Stream Credits Required and Proposed Mitigation Credits
Harris Expansion Project

Feature	Compensation Requirements (Estimated Stream Credits Needed)	Estimated Stream Credits Generated
Ephemeral Drainage #1	8,826.5	-
Ephemeral Drainage #3	4,165.7	-
Ephemeral Drainage #6	263.6	-
Intermittent Stream #1	21,335.9	-
Total Mitigation Credits Required	34,591.7	-
Project 1	-	4,411
Project 2	-	21,279
Project 3	-	19,603
Total Mitigation Credits Proposed	-	45,293

SECTION 5

Monitoring Plan

Section 5 addresses proposal monitoring parameters, success criteria and performance standards, techniques, frequency and duration, maintenance and corrective actions, and reporting. The monitoring plan is designed to measure and document the progress, successes, and failures (if any) of the main strategies of the proposed compensatory mitigation plan (previously described). The key mitigation components include riparian buffer restoration, bank stabilization, re-establishment, and preservation of riparian buffer habitats.

5.1 Monitoring Parameters

Ecological and physical parameters to be monitored are site-specific based on the mitigation objectives for each location. A description of each mitigation area and its monitoring parameters is presented in Table 5-1. Specific success criteria and performance standards used to evaluate these parameters are listed in Table 5-2.

Table 5-1. Monitoring Parameters
Harris Expansion Project

	Monitoring Parameters [a]	Success Criterion No. [b]
Projects 1,2	Streambank and streambed improvements along Oyster Creek	
	Bankfull benching	1, 7
Projects 1,2	Preservation of a 100-foot wide forested riparian buffer along Oyster Creek	
	Planting native vegetation in several areas (as applicable to the specific area being restored)	2 or 3, 4, 7
Project 3	Heavy buffer planting from 0-200'	2 or 3, 4, 7
Projects 1,2	Heavy buffer planting 100-200'	
	Intermittent plantings along the shoreline for shading of the River to improve fish habitat	2 or 3, 4, 7
Project 2	Biological rehabilitation	
	Streambank plantings	2 or 3, 4, 7
	Placement of large woody debris (dead trees) submerged within the main stem of the River and embedded along the bank	5, 6, 7
Project 3	Re-establishment of ephemeral channels	
	Channel construction	1, 7

[a] Engineered slopes typically consist of riprap cobble with live willow stakes and rolled coirs with plantings amongst.

[b] Refer to Table 5-2 for correlation by number with each success criterion.

5.2 Success Criteria and Performance Standards

All mitigation areas will be monitored for site-specific parameters during each monitoring event (conducted at a minimum two times each year with subsequent site visits occurring on an annual basis. Applicable success criteria and performance standards will vary between mitigation sites, depending on the restoration or enhancement goal at each site. Some sites will be evaluated against more than one criterion. A photographic log documenting existing conditions and progress made will be maintained and submitted with the annual report to the District. Table 5-2 summarizes success criteria and performance standards.

Table 5-2. Success Criteria and Performance Standards
Harris Expansion Project

Success Criterion No.	Success Criteria and Performance Standards
Streambed and Streambank Improvements/Channel Re-establishment	
1	Bank stabilization areas will score within the risk categories of "very low" or "low" according to the Bank Erosion Hazard Index (BEHI) metric.
Vegetation	
2	Survival of planted woody species. In open areas (for example, agricultural fields) and/or newly graded areas where no tree canopy currently exists, 80 percent (430 stems per acre) survival rate of tree and shrub plantings after 2 years and 75 percent (404 stems per acre) after 5 years per planting zone
3	Survival of planted woody species. In areas where a tree canopy currently exists, 75 percent (404 stems per acre) survival rate of tree and shrub plantings after 5 years per planting zone.
4	Undesirable vegetation less than 5 absolute percent cover of invasive, noxious, or competing vegetation, in particular Johnson grass, in planted areas.
Biological Rehabilitation	
5	Not more than 20 percent loss of established, submerged, or embedded tree trunk fish habitat structures.
6	Edge of abutting or adjacent riverine habitat partially shaded by planted woody vegetation by monitoring year 3 in each mitigation area planted with woody species (yes or no).
Long-Term Legal Protection	
7	Signed and notarized conservation easement and/or deed restriction placed on mitigation area that protects the mitigation goals and objectives in perpetuity.

5.3 Monitoring Techniques

All vegetation data collection and site assessments will be conducted by experienced biologists, using a sampling protocol similar to that recommended for the Comprehensive Method in the 1987 USACE *Wetland Delineation Manual* or other established forestry techniques.

5.3.1 Data Collection

Vegetation monitoring plots (measuring, at a minimum, 50-foot by 100-foot, where possible) will be established in one or more locations within each planted area. Some planted areas will have more than one monitoring plot, set up in representative locations, so as to sample at least 25 percent of the area planted. Monitoring plots will be situated to span all planting zones (Zones 1 – 4) in bank stabilization areas. Plot locations will remain fixed from one monitoring event to the next; and plot corners will be marked in the field by aboveground polyvinyl chloride (PVC) pipe and flagging.

Data collection in each vegetation monitoring plot will include measurements of trees, saplings/shrubs, woody vines, and herbaceous plant species, as appropriate for each mitigation area. Data recorded by species will include measurements such as height class, diameter-at-breast height, basal area, and frequency of occurrence, and number of stems. Data recorded will include also a list of plants that have colonized the mitigation area, an estimated percent cover of desirable native species and that of invasive exotic species. Additionally, general observations, wildlife use, and photographs of the area will be recorded.

From these data, the survival rate per species, density, relative percent cover, and general health of the mitigation areas can be assessed. Percent survivability for each monitoring event will be calculated as:

$$\% \text{ Survivability} = \frac{\text{Existing \# of plantings of Species A in Zone X}}{\text{Original \# of plantings of Species A in Zone X}}$$

The number of remaining viable shrubs, saplings, and trees will be tallied against the total number originally planted and any subsequent replantings. The total recorded will be extrapolated to determine the overall survival rate for the area per planting zone. Canopy percent cover per plot will be estimated and used for annual assessment of health and growth comparisons.

Bank stabilization areas will be evaluated using the BEHI scoring metric (Rosgen, 2001) for estimates of overall bank stability. The BEHI provides a method of assessing stream bank condition about the potential for erosion. The metric assigns risk categories based on a numeric scoring system. The entire length of each bank stabilization area will be assessed in 100-foot increments. The monitored increments will be marked in the field by aboveground PVC pipe and flagging.

5.3.2 General Observation

During each monitoring visit, the biologist will record a general description of the mitigation areas, which will include any wildlife observations and assessment of the vegetation health and growth. Evidence of water flow through the hydrologic connections will be noted and photographed. Observation and photographic evidence of bank stability includes the stability of the submerged or embedded tree trunks in the fish habitat enhancement area, and the percentage of shading provided by planted woody species adjacent to Oyster Creek and stream channels.

Additionally, assessment and photographic documentation of potential problem situations will be made during each monitoring visit. These potential problems might include bank erosion; presence of invasive exotic, noxious vegetation; or significant die-off of planted material.

5.3.3 Photograph Stations

Photographic monitoring will be conducted at each visit to provide a qualitative estimate of changes in dominant vegetation over time. Photographs will be taken from the same location and in the same direction at each visit. Each photograph station, set up during the first monitoring visit, will be marked in the field by above ground PVC pipe and flagging; and its location will be recorded using a handheld GPS unit. A minimum of three photograph stations will be established in each of the planted mitigation areas.

5.4 Monitoring Frequency and Duration

Monitoring events are normally required (by the District) to be conducted a minimum of two times the first year with subsequent site visits occurring on an annual basis. They will be conducted once in spring, summer, and fall, unless directed otherwise in the permit conditions written by the District.

A baseline monitoring event will be performed within each of the mitigation areas following the monitoring frequency and duration described previously, immediately after the mitigation construction period (plantings, banks stabilization). The data collected from the baseline monitoring event will serve as the basis of comparison for future monitoring events and for the calculation of success criteria. During this event, the permanent monitoring plots will be established. This event will also serve to confirm the “as-built” condition of the mitigation areas. Any deficiencies, such as dead or dying plants or bank erosion/failure, noted during the baseline event will be immediately corrected. Any corrections such as replantings or regrading will be considered part of the baseline event and those areas re-evaluated to update the baseline “as-built” conditions.

It is anticipated that the typical 5-year duration of mitigation monitoring will be needed to assess if the woody-species planted areas are trending toward a mature forested riverine buffer.

5.5 Maintenance and Corrective Actions

If any problems are identified during the subsequent monitoring inspections, solution and remediation will occur as soon as practicable. Corrective actions that may be needed could include repair and stabilization of failed slopes, replanting of dead or dying trees or shrubs, herbivory deterrence and control of invasive exotic, noxious or competing vegetation (primarily Johnson grass), which threatens survival of the desired native species.

If any areas require treatment for control of invasive exotic and noxious vegetation, a subsequent site visit would be made as soon as possible to conduct physical removal and/or habitat-appropriate-herbicide spraying of the problem vegetation. Herbicide application treatments will be performed by a licensed professional contractor certified to safely handle and apply herbicides.

If the success criterion for planted species provided in Table 5-2 are not achieved, the applicant will replant to 50 stems per acre over the success criterion to allow for additional mortality with the potential to still meet the final success criteria. If needed, the applicant will replant and continue to monitor the planted enhancement and restoration areas until the permit conditions are met, as determined by the District.

Cumulative rainfall and temperature recorded at the nearest local National Oceanic and Atmospheric Administration station might be obtained from the National Weather Service Office to use in understanding unexpected growth of the planted materials, which would be documented in the monitoring report. In those circumstances where the mitigation sites are not meeting the expected milestones for success, adaptive management will be utilized to take action to adjust to these circumstances to ensure a successful mitigation.

All corrective actions taken at a mitigation site will be described in the annual report to validate the successful completion of the corrective actions.

5.6 Annual Report

Results from each monitoring site inspection will be summarized in a report to be submitted annually to the District, or on another reporting schedule as directed in the permit conditions. All monitoring reports submitted will include the following:

1. Project name and permit number
2. Site aerial showing project location, sampling plots, and photographic station locations
3. Permittee's name, address, and phone number
4. Report preparer's name, address, and phone number
5. Purpose and goals for mitigation site
6. Brief summary of mitigation strategy/actions
7. Date mitigation action commenced
8. Dates of site inspections
9. Dates of any maintenance activities
10. Summary of observations and measurements
11. Assessment of success toward the performance standards or success criteria

12. Observed problems (slope failure, erosion, stressed or dead trees or shrubs, vandalism, invasive plants, storm damage, etc.)
13. Implemented or recommended solutions to correct problems or deficiencies
14. Photos from each of the site inspections by photographic station, location, and date

SECTION 6

Mitigation Work Plan

The schedule for beginning mitigation activities will be coordinated with the initiation of the project construction to minimize the time between project impacts. A detailed mitigation work schedule will be provided in this section as the applicant progresses through the mitigation design process.

SECTION 7

Site Protection

7.1 Legal Protection

The mitigation sites will be protected by being placed into a conservation easement in perpetuity that will be held by a third party land trust. The mitigation sites will be placed into a conservation easement within 180 days of permit issuance. The applicant will establish a non-wasting fund that will provide the sponsor with the resources necessary to monitor and enforce the site protection in perpetuity. Management and stewardship by the sponsor will prohibit all development and other activities except those outlined in this mitigation plan.

7.2 Physical Protection

The Project site and the existing Harris Reservoir located south of the Project site is owned by Dow and is not accessible to the general public. The property to the north of the Project site is owned by the Texas Department of Criminal Justice Department of Corrections Ramsey Unit which also has restricted access. The western boundary of the Project site is bordered by the Brazos River. The applicant will install a fence around the perimeter of the restoration areas to protect the areas from cattle grazing impacts.

SECTION 8

Mitigation Costs

As the applicant progresses through the mitigation design process, the estimated costs including raw materials, earthwork, labor, monitoring, maintenance, reporting, and profit margins, as well as a contingency factor associated with the proposed mitigation strategies will be presented in this section. The estimates for all mitigation activities will be based on 2018 dollars and are subject to change based on the availability of materials and any subsequent changes to the mitigation plan itself. The cost estimate is provided as information only regarding the financial magnitude of the mitigation activities described in this plan and is not intended for any other purposes. The actual implementation costs may vary. Dow's ability to assure the financial responsibility of these mitigation costs is described in Section 10.

SECTION 9

Adaptive Management Plan

Dow is solely responsible for the implementation of the mitigation Plan and the activities it describes, including monitoring, maintenance, and cost. Any remedial measures that may be needed if performance standards defined by the monitoring plan are not met in a timely manner as a result of damages sustained from the herbicide application will be the responsibility of the herbicide contractor. The performance standards will regularly be measured as described in the monitoring plan and mitigation work plan to track deviations from the mitigation goals. The active monitoring will allow for any remedial actions such as replanting or reconstruction to be implemented quickly. The financial assurances provided by the Dow, described in Section 10 meets USACE requirements and provides requisite assurances that any remedial actions needed will be available.

Potential challenges that exist for the proposed mitigation actions include extreme flood events that could impact rehabilitation and re-establishment activities. The design of the mitigation actions will accommodate for infrequent flood events and extreme events outside of design parameters would be unexpected. Regional drought conditions could affect native vegetation plantings, particularly before plants become well established. Watering of plants may be needed and will be determined by Dow or designated contractor if drought conditions persist. As previously discussed, if herbivory of plantings becomes an issue, then plants may be protected with tubes at the discretion of Dow or designated contractor.

If performance standards are not being met after the application of remedial actions, Dow may incorporate additional mitigation strategies, activities, or locations. The additional mitigation may occur onsite or on other lands controlled by Dow or offsite at others location. USACE would be notified and a separate mitigation plan for the additional activities would be developed. The additional activities proposed would supplement for the loss of ecological functions and values from project impacts as described in this mitigation plan. The supplemental mitigation would be submitted to USACE for approval prior to implementation.

SECTION 10

Financial Assurances

Short-term financial assurances in the form of a bond, letter of credit, escrow account, or casualty insurance policy, will be put in place after the permit is issued and within 60-days of the USACE approving financial assurance mechanism language. This financial vehicle will cover costs associated with construction, monitoring, and maintenance during the monitoring period for the restoration site. Financial assurance amounts may be phased down once construction is completed and success is documented. The amount of financial assurances required is under development.

SECTION 11

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