Deepwater Horizon Natural Resource Damage Assessment (NRDA) Monitoring Plan

Phase III Early Restoration

Louisiana Outer Coast Restoration Project

Prepared by: Louisiana Trustees, NOAA and DOI[1]

February 6, 2017

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[1] The Trustees include the Louisiana Coastal Protection and Restoration Authority (CPRA); Louisiana Department of Environmental Quality (LDEQ); Louisiana Department of Wildlife and Fisheries (LDWF); Louisiana Department of Natural Resources (LDNR); Louisiana Oil Spill Coordinator's Office (LOSCO); Department of the Interior (DOI), and the National Oceanic and Atmospheric Administration (NOAA).

1 Introduction

The Trustees developed this monitoring plan (Plan) for the Louisiana Outer Coast Restoration Project (Project). This Project was included as a Phase III *Deepwater Horizon* early restoration project and is intended to contribute to making the environment and public whole for injuries to beach, dune, and back-barrier marsh habitats in Louisiana, as well as brown pelicans, terns, skimmers, and gulls (Deepwater Horizon Natural Resource Trustees, 2014). The purpose of this Plan is to describe monitoring activities that will be conducted to evaluate and document restoration effectiveness, including performance criteria for determining the success of restoration or need for interim corrective action (15 CFR 990.55(b)(1)(vii)). This Plan will be implemented by the Louisiana Trustees, NOAA and DOI (Trustees) and may be modified over time, based on the management needs of the Project.

1.1 Project Overview

The Project would restore beach, dune, and back-barrier marsh habitats at four barrier island locations (referred to as "project components" in this Plan) along Louisiana's outer coast (Figure 1). From west to east, the four project components are Caillou Lake Headlands (also known as Whiskey Island), Chenier Ronquille, Shell Island (West Lobe and portions of East Lobe), and North Breton Island. The restoration work proposed at each location involves placement of appropriately sized sediments to create or enhance beach, dune, and back-barrier marsh areas; installation of sand fencing to trap and retain wind-blown sediments and promote dune development; and planting of appropriate native species in dune and back-barrier marsh habitats. Sediments will be pumped from appropriate borrow area locations specific to each island and conveyed to the restoration sites through temporary pipeline corridors.

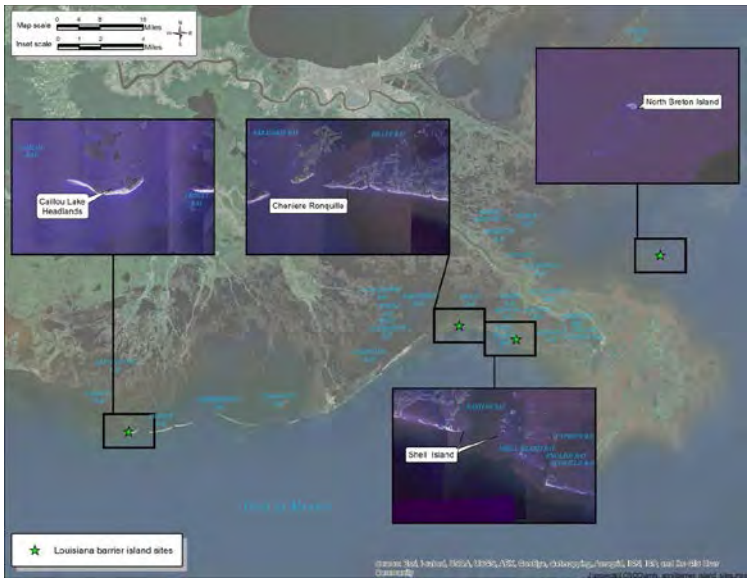

Figure 1. Louisiana Outer Coast Restoration Project. From west to east: Caillou Lake Headlands component (also known as Whiskey Island), Chenier Ronquille component, the West Lobe and portions of the East Lobe of Shell Island component, and North Breton Island component.

1.2 Restoration Objectives and Performance Criteria

The following restoration objectives and performance criteria are provided to facilitate evaluation of project performance. Performance of barrier island habitat and avian production will be evaluated across the Project. Measurement against performance criteria will determine restoration success or the need for corrective action (15 CFR 990.55(b)(1)(vii)).

Objectives

1) Restore barrier island habitats that will contribute to making the environment and the public whole for spill-related injuries to these habitats;
2) Support nesting activity for brown pelicans, terns, skimmers, and gulls that will contribute to making the environment and the public whole for spill-related injuries to these species.

Performance Criteria

1) Survival of vegetative plantings and/or vegetative percent cover in areas conducive to supporting barrier island plant communities are consistent with other barrier island restoration projects in coastal Louisiana three years after construction.
2) In 2026, habitat acreage across the Project will be at least 60% of the constructed habitat acreage. If habitat acreage is less than 60%, then island breaches should not be present and the gulf-side shoreline change rate should not exceed either the short-term historical shoreline change rate, as referenced in the scientific literature (e.g. Byrnes et al. In press), or the contemporary regional shoreline change rate as determined from data collected along adjacent barrier shorelines during a similar timeframe as the Project. If habitat acreage is less than 60% and island breaches are present or the gulf-side shoreline change rate exceeds the threshold, then volumetric analyses will be conducted and a numeric target will be developed for further evaluating performance.
3) Estimates of brown pelican, tern, skimmer and gull fledglings indicate that the various species are colonizing the Project area.

1.3 Conceptual Model

Table 1 provides a conceptual model of the relationship between the restoration actions and goal of the Project.

Table 1. Conceptual Model for Louisiana Outer Coast Restoration.

Restoration Actions	As-Built	Interim	Restoration Goal
• Place dredged sediments along beach, dune, and back-barrier marsh areas • Install sand fencing • Plant native back-barrier marsh and dune vegetation	• Acreage of beach, dune and back-barrier marsh areas is increased • Volume of littoral material (sediments) is increased • Native dune and back-barrier marsh plants are present • Potential for dune development is enhanced • Acreage of potential avian habitat is increased	• Fill sediments compact and dewater • Coastal processes transport and redistribute fill sediments • Native dune and back-barrier marsh vegetation become established • Sand fencing and dune vegetation trap wind-blown sediments • Avian species utilize restored habitats	• Barrier island habitat and avian species are enhanced and provide ecological services and resources that contribute to making the environment and the public whole for Spill-related injuries to these habitats and species

2 Performance Monitoring

Successful implementation of the Project will be measured by assessing the performance of the restored barrier island habitat, as well as the productivity of the restored habitat areas as it relates to brown pelicans, terns, skimmers, and gulls. Performance will be evaluated using both qualitative and quantitative measures related to the project goals and objectives. Project monitoring is organized by restoration objective, with each objective having one or more monitoring parameters. Each parameter provides information on the monitoring methods, timing and frequency of sampling, sample size, sampling sites, performance criteria, and potential corrective actions.

Objective #1: Restore barrier island habitats that will contribute to making the environment and the public whole for spill-related injuries to these habitats

This objective includes a parameter for vegetation survival and/or percent cover (Parameter 1) and a nested set of parameters for habitat acreage and geomorphic structure (Parameters 2-5). Parameter 1 will be measured to quantify planting survival and/or percent cover of dune and back-barrier marsh habitats and evaluate whether additional plantings are needed to promote and establish appropriate vegetation communities. Parameter 2 is designed to evaluate project performance based on habitat acreage. If the performance target for Parameter 2 is not met, evaluations related to the geomorphic structure of the individual project components might be conducted (Parameters 3-5). Performance evaluations for this restoration objective will inform the potential need for corrective actions. Monitoring data collected for Parameters 2 and 4 will also be used to inform potential adaptive management at North Breton Island relating to bird production.

- **Parameter 1: Survival of Plantings and/or Percent Cover of Vegetation (% survival and % cover)**

  Method: Systematically count live and dead plantings and/or estimate percent cover within the project areas to determine if vegetation is becoming established.

  Timing and Frequency:

  At least three planned events after sediment placement.

  Sample Size: A minimum of 5 randomly selected vegetation stations would be established along or in the vicinity of topographic transects previously established by the Louisiana Barrier Island Comprehensive Monitoring (BICM) Program. The number of stations per component, dune or back-barrier marsh, will be dependent on the width at each transect and established prior to sampling.[2]

  Sites: Vegetation sampling plots will be established along transects within the project areas of the Caillou Lake Headlands, Chenier Ronquille, Shell Island and North Breton Island Project components.

  Performance Criterion:

  Survival of vegetative plantings and/or percent cover of vegetation is similar to that of other restored barrier islands in the same regions or basins within coastal Louisiana for the same time period after a project's construction has been completed.

[2] Suggested citation:

Rodriguez, L.B., G.P. Curole, D.M. Lee, and D.A. Dearmond. 2008. 2008 Operations, Maintenance, and Monitoring Report for Isles Dernieres Restoration, Phase 0, Trinity Island (TE-24) Project. Coastal Protection and Restoration Authority of Louisiana, Thibodaux, Louisiana. 26 pages plus appendices.

Potential Corrective Action: Re-plant vegetation, dike gapping.

- **Parameter 2: Habitat Acreage**

  Method:
  - Acquire high-resolution, near-vertical aerial imagery and real-time kinematic (RTK) GPS ground surveys.
  - Habitat acreage will be evaluated based on the current method utilized by Louisiana's Barrier Island Comprehensive Monitoring Program administered by the Coastal Protection and Restoration Authority (CPRA) at the time of assessment. RTK GPS ground survey analyses may also be used for evaluating subtidal areas.
  - Best available science and methods will be used to evaluate changes in habitat acreage.

  Timing and Frequency:
  - **As-built Imagery (once)**. Aerial imagery and RTK GPS ground survey data will be acquired shortly after fill placement is completed at each project component and serve as baseline for determining habitat acreage across the Project. The precise calendar year of data collection will depend on the construction schedule of each Project component.
  - **Post as-built Imagery (at least twice)**. If practicable, post as-built imagery will be acquired as part of an existing regional monitoring effort through the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), Coast-wide Reference Monitoring System – Wetlands program (CRMS). Aerial imagery will be targeted for acquisition per the Monitoring Schedule (Table 2). Unscheduled acquisitions may also be conducted.

  Sample Size: The highest resolution aerial imagery will be collected given budgeted amounts for image acquisition per period. Ground sample distance (GSD) for the aerial imagery may be as high as 6 inches, but no greater than 1 meter. Subsequent imagery collections (i.e., 2021 and 2024) will be acquired either at the same GSD for 2018 aerial imagery or lower (i.e., higher resolution). While lower GSD imagery may also be used to help guide the classification, for consistency lower GSD imagery will be resampled to match the GSD of the 2018 imagery. Classification of imagery may use an object-based approach or imagery may be resampled to a coarser resolution for analysis.

  Sites: Caillou Lake Headlands, Chenier Ronquille, Shell Island and North Breton Island.

  Performance Criterion:

  In 2026, habitat acreage across the Project will be at least 60% of the constructed habitat acreage or commensurate with regional contemporary changes.

  Potential Corrective Actions:
  - No corrective action is tied to the habitat acreage parameter alone.
  - Corrective action may be necessary if the Project fails to meet Parameters 2 -5 of Objective #1.

- **Parameter 3: Presence of Island Breaches (only applicable if criterion for habitat acreage is not met)**

  Method:
  - Presence of island breaches will be detected via high-resolution, near-vertical aerial imagery and qualitative assessments during site visits.
  - Best available science and methods will be used to identify the location and spatial extent of island breaches at each Project component.

  Timing and Frequency:
  - **Post-construction (at least twice**). The 2018, 2021, and 2024 aerial imagery acquisition will serve as the data set for determining whether island breaches are present. The Trustees may acquire additional aerial imagery if breaches are identified to monitor their development. Unscheduled aerial imagery acquisitions may also be conducted after the passage of a tropical storm or hurricane when breaches are more likely to develop.

  Sample Size: See Sample Size of aerial imagery under Parameter 2 (Habitat Acreage).

  Sites: Caillou Lake Headlands, Chenier Ronquille and Shell Island.

  Performance Criterion:

  In 2026, island breaches should not be present (only applicable if criterion for habitat acreage is not met).

  Potential Corrective Actions:
  - No corrective action is tied to this parameter alone.
  - A corrective action might be triggered if the Project fails to meet the performance criteria for parameters 2-5 under this objective (see parameter #5 for more information on potential corrective actions).

- **Parameter 4: Shoreline Position (only to be analyzed if criterion for habitat acreage is not met)**

  Method:
  - Shoreline position will be derived from high-resolution, near-vertical aerial imagery, RTK GPS topographic/bathymetric survey data and/or LIDAR topography collected as part of Project monitoring.
  - An annualized shoreline change rate will be determined for each Project component.
  - Best available science and methods will be used to evaluate changes in shoreline position at each Project component. Several options for assessing shoreline position exist. Any or all of these methods could be used to determine whether the parameter is met depending on available budget. In addition, other methodologies, not included here, could be identified as project design is finalized.

  Timing and Frequency:
  - **As-built**. The as-built shoreline position at each Project component will serve as the initial (Year 0) shoreline position for determining shoreline change across the Project.
  - **Post-construction (analyzed per Project schedule as needed**). RTK GPS topographic/bathymetric survey data, LIDAR topography and/or aerial imagery will serve as the data set(s) for comparison to the initial (Year 0) shoreline position.

Sample Size: See Sample Size of aerial imagery under Parameter 2 (Habitat Acreage). For LIDAR and topo/bathy surveys, sample size will depend on point density of ground surveys and LIDAR acquisition.

Sites: Caillou Lake Headlands, Chenier Ronquille, Shell Island, and North Breton Island

Performance Criterion:

The gulf-side shoreline change rate should not exceed either the short-term historical change rate as referenced in the scientific literature (e.g. Byrnes et al. In press) or the regional contemporary change rate as determined from data collected along adjacent barrier shorelines during a similar timeframe as the Project (only applicable if criterion for habitat acreage is not met).

Potential Corrective Actions:

- No corrective action is tied to this parameter alone.
- A corrective action might be triggered if the Project fails to meet the performance criteria for parameters 2-5 under this objective (see Parameter 5 for more information on potential corrective actions).

- **Parameter 5: Sediment Volume (only to be analyzed if criterion for habitat acreage, presence of island breaches, and shoreline position criterion are not met).**

Method:

- Sediment volume will be derived from RTK GPS topographic/bathymetric survey data and/or LIDAR topography, acoustic single and multibeam profiles and/or another equivalent method collected as part of Project monitoring.
- Topographic/bathymetric survey data and LIDAR topography will have a vertical accuracy (RMS) of less than 15 cm.
- An annualized volumetric change rate will be determined for each Project component.
- Volumetric change analyses will be conducted to evaluate whether sufficient sediment remains in the littoral transport system for enhancing sand supply to individual Project components. Other data sources may also be used to evaluate project performance in the context of regional trends and sediment budget.
- Best available science and methods will be used to conduct volumetric change analyses.

Timing and Frequency:

- **As-built** (**once**). The as-built RTK GPS topographic/bathymetric survey at each island component will serve as the initial (Year 0) survey for determining volumetric change rates at each Project component.
- **Post-construction (analyzed per Project schedule as needed**). The as-built and post-construction RTK GPS topographic/bathymetric surveys and/or LIDAR topography will be used for determining volumetric change rates at each Project component. RTK GPS topographic/bathymetric surveys collected in interim years between as-built survey and post-construction surveys may be used as needed.

Sample Size: RTK GPS topographic/bathymetric survey data will be collected along survey transects at each Project component during the as-built and post-construction monitoring events. LIDAR topography will also be collected. Sample size will depend on point density of ground surveys and LIDAR acquisition.

Sites: Caillou Lake Headlands, Chenier Ronquille and Shell Island

Performance Criteria:

A performance criterion for sediment volume may be established from either existing reliable littoral transport estimates or an operational sediment budget to evaluate observed versus expected sediment transport rates for Project components that fail to meet Parameters 2-4. Because developing performance targets for sediment volume is complex and time intensive, and may not be needed for evaluating performance as described in this Plan, a performance criterion for this Parameter will be developed at a later time if needed. This criterion is only applicable if criteria for habitat acreage, presence of island breaches, and shoreline position are not met.

Potential Corrective Actions:

No corrective action is tied to this parameter alone. The Trustees will determine appropriate correctives actions, if any, based on the data results and feasible restoration opportunities available at the time. These may include actions such as: 1) adding sediment to the restored areas to renourish the littoral drift system and 2) adding sediment to areas outside the Project to create additional barrier island habitat.

Objective #2: Support nesting activity for brown pelicans, terns, skimmers, and gulls that contributes to making the environment and the public whole for spill-related injuries to these species.

Monitoring parameters for this objective include a parameter for colony location mapping (Parameter 1) and estimates of production (Parameter 2) of brown pelicans, terns, skimmers and gulls using habitats produced across the Project. Parameter 1 will be accomplished by mapping approximate colony boundaries of brown pelicans, gulls, terns and skimmers. Parameter 2 will be accomplished by estimating numbers of active nests and/or breeding pairs of each guild on the island in its entirety (i.e., within and outside of the NRDA restoration component) on an annual basis. Parameters 1 and 2 and average productivity rates of each guild will be combined to estimate fledgling production produced by the project. Results of this objective will be evaluated in the context of Objective 1 to facilitate nesting bird habitat association analyses.

- **Parameter 1: Colony Mapping**

Method: Colony boundaries (e.g., complete boundary polygons or estimated boundary points) will be recorded via hand-held GPS units using a NAD-83 UTM projection and hand-drawn maps illustrated while on site. Colony maps will be digitized using a geographic information system (e.g., ArcMap) using the NAD-83 UTM projection, creating a separate shape file for colonies of each of the four bird groups each year (i.e., four shape files for each survey year). Shapefile metadata should include survey date, name of surveyor, estimated nest counts, habitat type (see Section 4.0) and other pertinent notes for each polygon.

Timing and Frequency:

Consistent with and during the same visits for data collection for Parameter #2:

- Beginning in April of each sampling year
- 3 to 8 times total, targeting April-May, June, and early July as three distinct nesting periods.

- Additional surveys (i.e., beyond the three minimum surveys) should be considered following tropical disturbances and prior to when fledglings observed during those surveys would be expected to be able to survive such an event (which could thus drown chicks and should be recorded).

Sites: North Breton Island (surveys may also be conducted at Caillou, Chenier Ronquille, and Shell Island components pending budget availability)

- **Parameter 2: Estimates of production for pelicans, terns, skimmers and gulls**

Method: ***Brown pelicans and gulls***

- Nesting colonies will be located by walking and/or boat surveys of the project component islands with particular emphasis being placed on previous colony locations. Once located, walking surveys will be conducted for each colony in the project area, delineating colonies in historic island habitat vs. colonies in new/restored habitat. Active nests within a minimum of ten percent of each separate colony will be counted. Nests within 10-foot wide belt transects across the entire colony will be counted. For colonies large enough to require more than one transect to record at least ten percent of estimated nests, transects will be at least 100 feet apart. The total number of active nests counted within transects will be multiplied by the ratio of the total size of summed transects to the estimated total size of the colony to produce an estimate of total active nests in the colony. In colonies estimated to contain fewer than 200 nests, attempts should be made to count each active nest. Care should be taken to minimize stress and disturbance to birds, especially when young birds are in the nests by surveying in the cooler morning or late evening hours. Additional information may include the stage of development of young and approximate number of adults present in the area.
- Brown pelican production will be estimated as the product of total number of nests and an assumed fledgling rate of 1.4/nest. For example, total estimated fledglings in a restored area with an estimated 150 nests[3] in a certain year = (150)(1.4) = 210.
- Gull production will be estimated as the product of total number of nests and an assumed fledgling rate of 0.97/nest (Martin et al. 2014). For example, total estimated fledglings in a restored area with an estimated 94 nests in a certain year = (94)(0.97) = 91.
- Monitoring site-specific habitat quality as it relates to supporting nesting pelicans and gulls and the use of habitats by those species is important to facilitate adaptive management of the project components for project success. Visual observations of habitat type used by each nesting brown pelican and gull colony will be categorized following Louisiana Barrier Island Comprehensive Monitoring Program terminology. Data collected under Objective 1 herein will also be used to evaluate production-habitat associations.
- The same personnel should be conduct surveys each year, if possible, to reduce observer variances.

[3] All active nests will be assumed successful pending other available information on chick survival, such as known nest failures or apparent drowning of fledglings (e.g., if post-storm observations indicate that a portion of chicks drowned due to wash-over events, a corresponding portion of fledgling estimates will be removed from estimates of production from otherwise successful nests).

Terns and skimmers

- Ground surveys will be used to determine both the number and species of nesting birds in colonies on the island. The number and mobility of individuals within colonies can make counts of individual birds difficult.
- Nesting density of black skimmers is highly variable. Efforts should be made to count all nesting individuals using binoculars from a distance. Care should be taken by observers to verify that skimmers being counted are actually on nests and not merely loafing.
- For Royal and Sandwich terns, estimated breeding pairs (i.e., active nests) will be calculated based on area estimates of colonies and an area occupancy rate of 1.26 square feet per nest for Royal terns and 0.80 square foot per nest for Sandwich terns.
- Walking surveys will be conducted for each colony on the project component island.
- Tern species should be determined using binoculars and field guides and the percent of the colony represented by that species recorded (e.g., a colony containing only royal terns should be recorded as 100% royal tern, a colony estimated to contain 40% royal terns and 60% sandwich terns should be recorded as such).
- Total area covered by the colony will be estimated in square feet by visual estimate or by pacing off its dimensions. Pacing and other activity should be done at a distance and care should be taken to avoid unnecessary disturbance of nesting birds, such as flushing chicks and adults off the nests in order to limit nest predation by gulls.
- The area of the colony used by each species and the number of nests present can then be estimated with the product of the total area of the colony and percent of the colony occupied by each species. The formula for such calculations is expressed as **(A x S%)/CF**, where A equal total colony size in square feet, S% is percent of colony occupied by that species, and CF is the species correction factor (1.26 for Royal terns, 0.80 for sandwich terns). For example: a colony containing 40% royal terns and 60% sandwich terns covers an estimated 1,000 square feet. Number of royal tern nests is then estimated using the above formula, (1,000 x 0.4)/1.26 = 317.46 nests. In this scenario, number of sandwich terns would equal (1,000 x 0.6)/0.8 = 750 nests. Production will be estimated as the product of total number of nests and an assumed fledgling rate of 0.4/nest. For example, total estimated fledglings in a restored area containing 40 nests[4] in a certain year = (40)(0.4) = 16.
- Monitoring site-specific habitat quality as it relates to supporting nesting terns and skimmers and the use of habitats by those species is important to facilitate adaptive management of the project components for project success. Visual observations of habitat type used by each nesting tern and skimmer colony will be categorized following Louisiana Barrier Island Comprehensive Monitoring Program terminology. Data collected under Objective 1 herein will also be used to evaluate production-habitat associations.

[4] See footnote 3.

- The same personnel should be used to conduct surveys each year, if possible, to reduce observer variances.

Timing and Frequency:

Consistent with and during the same visits for data collection for Parameter #1:

- Beginning in April of each sampling year
- 3 to 8 times total, targeting April-May, June, and early July as three distinct nesting periods.
- Additional surveys (i.e., beyond the three minimum surveys) should be considered following tropical disturbances and prior to when fledglings observed during those surveys would be expected to be able to survive such an event (which could thus drown chicks and should be recorded).

Sites: North Breton Island (surveys may also be conducted at Caillou, Chenier Ronquille, and Shell island components pending budget availability)

Performance Criteria:

Estimates of brown pelican, tern, skimmer and gull fledglings indicate that the various species are colonizing the Project area.

Potential Corrective Actions:

- Sand or shell hash renourishment to increase longevity of project components, provide additional nesting habitat for terns or skimmers
- Vegetation management (e.g., additional plantings to support pelican and/or gull nesting, removal of vegetation to support tern and/or skimmer nesting)

3 Monitoring Schedule

Data for all parameters may be derived from various sources including project-specific survey data, the BICM Program, and other regional monitoring programs (e.g., CWPPRA Program). Table 2 provides the anticipated project-specific monitoring and targeted timing of data collection for Parameters related to Objectives 1 and 2.

Table 2. Anticipated Project Specific Monitoring Schedule (orange cells). Cells shaded in blue correspond to scheduled sampling at these locations conducted by the BICM program.

	Year of Field Effort, Analysis, or Report	Caillou Lake Headland	Chenier Ronquille	Shell Island - West	North Breton Island
Monitoring Element: Field Effort					
Percent Survival / Percent Cover (Individual sampling events may be moved forward in the schedule following major storms)	2018		X	X	
	2019	X			X
	2021		X	X	X
	2022	X			
	2024		X	X	X
	2025	X			
	2029				X
LiDAR (Individual sampling events may be moved forward in the schedule following major storms)	2017		X	X	
	2018	X			X
	2019	X	X	X	
	2021				X
	2024		X	X	X
	2025	X			
	2029				X
Bathymetry	2017		X	X	
	2018	X			X
	2019	X			
	2020		X	X	
	2021				X
	2024	X			X
	2025		X	X	
	2029				X
Contingency Storm Events	TBD				
Overwash Evolution (Not specific to any two consecutive years)	20XX	X	X	X	
	20YY	X	X	X	
Aerial Imagery	2017				
	2018	X	X	X	
	2019				
	2021	X	X	X	X
	2024	X	X	X	X
	2029				X
Monitoring Element: Analysis					
Percent Survival / Percent Cover	2018		X	X	
	2019	X			
	2021		X	X	X
	2022	X			
	2024		X	X	X
	2025	X			
	2029				X
Habitat Analysis	2017/18 (As-built)	X	X	X	
	2019	X	X	X	
	2020				X
	2022	X	X	X	X
	2025	X	X	X	X
	2030				X
Shoreline Position	2017/18 (As-built)	X	X	X	
	2019	X	X	X	
	2022	X	X	X	X
	2025	X	X	X	X
	2030				X
Bathymetric / Topographic Surface Development	2017 (As-Built survey data)		X	X	
	2018 (As-Built survey data)	X			X
	2020	X	X	X	
	2022				X
	2025	X	X	X	X
	2030				X
Breach Determination	2025 (using 3 data sets)	X	X	X	
Volumetric / Sediment Budget	2025 (using BICM data but project contracting analysis)	X	X	X	
Post-Construction Nesting Bird Monitoring (*Estimated projections [not all monitoring articulated here may occur]*)	2016				
	2017		?	?	
	2018	?	?	?	
	2019	?	?	?	X
	2020	?	?	?	X
	2021	?	?	?	X
	2022	?			X
	2023				X
	2024				X
	2025				X
	2026				X
	2027				X
	2028				X
	2029				X
Reports	2019		X	X	
	2020	X			
	2021				X
	2022		X	X	
	2023	X			X
	2026	X	X	X	X
	2031				X

4 Reporting and Data Requirements

This section describes the process the Trustees will follow to document, validate and report field data collected for the purposes of performance monitoring. The reporting and data requirements described herein are intended to:

- Maximize the quality, utility, and integrity of monitoring data
- Organize, track, locate, and access monitoring data over the long-term
- Share finalized monitoring data with the public in a consistent and comprehensible format

4.1 Field Data Documentation

The majority of field data collected during this Project will consist of field observations, measurement of environmental conditions (e.g., spatial extent, elevation, etc.), vegetation species identification and coverage, and avian nesting activity. To the extent possible, all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record Project-specific data, then Project-specific datasheets will be developed prior to conducting any Project monitoring activities.

4.2 Field Data Transcription, Validation, and Analysis

Field datasheets and notebook entries will be scanned to PDF files and archived along with the hardcopy datasheets. Electronic data files should be named with the date on which the file was created. Where possible, a ReadMe file should be included that describes when the file was created and by whom, and any explanatory notes on the file contents. If a data file is revised, a new copy should be made and the original preserved.

Relevant Project data that are handwritten on hardcopy datasheets or notebooks will be transcribed (entered) into Excel spreadsheets (or similar digital format) for required data analysis. After data transcription is completed, a second person not associated with data transcription will perform a 100% check of the data in the electronic data sheets against the original hardcopy datasheets and/or notebooks, and will make any corrections to transcription errors as appropriate before data are used for any analyses or distributed outside of the agency. After any and all identified errors are addressed, data are considered to be QA/QC'd. When the data transcription process is complete, electronic datasets can be used for data analysis. Analyses will be conducted by the Trustees to determine if the Project has met the performance criteria.

4.3 Document and Sample Retention Requirements

Hardcopy and electronic documents generated during data collection will be retained by the Trustees. Preservation includes retaining and not altering any such thing as to its form, content, or manner of filing.

The NRDA monitoring plan for this Project does not include removing any physical samples from the marsh sample sites. However, if any samples are taken, these samples collected from the field and subsequently analyzed for this Project will be retained as long as deemed necessary for the Project. Project sample retention policies will apply to all samples collected and removed from the marsh sampling sites during Project monitoring activities. This primarily includes above or below-ground biomass or sediment samples that are removed from sampling sites to be analyzed after the sampling event concludes. At a minimum, samples will be labeled with the sample collector's name, site name, replicate number, and date collected.

4.4 Data and Document Transfers

Data and document transfers between the Trustees will be conducted throughout the course of this Project. Transfers of electronic files are typically accomplished via email and secure FTP.

4.5 Reporting Schedule

The Trustees will produce a Final Construction Report at the end of construction and interim monitoring progress reports as needed between 2019 and 2031 (see Table 2). A comprehensive monitoring report will be produced after sampling is completed in 2030. If corrective actions are necessary, the Trustees may develop a Corrective Action Plan that would provide a revised performance monitoring and reporting schedule. All reports will contain monitoring data that have been validated and have undergone final quality control checks.

5 References

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