Monitoring Plan for AL Connecting Coastal Waters Projects:

Marsh Restoration in Fish River, Meadows Tract, and Oyster Bay

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1 Introduction

The three projects in Baldwin County Alabama (Fish River Marsh Restoration, Meadows Tract Restoration, and Oyster Bay Marsh Restoration) are part of the larger Connecting Coastal Waters (CCW) initiative led by NOAA to restore several priority Gulf Coast wetland ecosystems. The CCW projects seek to restore and enhance ecosystem resilience, sustainability, and natural defenses by reestablishing natural hydrology and connectivity between freshwater and marine habitats. The Gulf Coast Ecosystem Restoration Council (RESTORE Council) identified the project for funding through the Council-Selected Restoration Component funded priorities list (FPL) under the RESTORE Act.

The NOAA Restoration Center (NOAA-RC) believes monitoring is essential to determine if restoration projects are implemented correctly and performing to achieve their intended benefits. To support an adaptive management project approach, the project team will conduct environmental monitoring before, during, and after restoration of the project site. Pre-restoration monitoring will provide baseline information, during-restoration monitoring will ensure the project is implemented as designed, and post-restoration monitoring will evaluate whether the project meets established success criteria.

1.1 Project Overviews

1.1.1 Fish River and Weeks Bay Marsh Restoration

The Fish River and Weeks Bay Marsh Restoration Project is located at the Weeks Bay National Estuarine Research Reserve (NERR) property north of US Highway 98 (see Figure 1). The project site is comprised of existing public lands that were historically used as a campground. The site contains salt marsh habitat interspersed with approximately 8 acres of canals that were dredged in the late 1960s and early 1970s to facilitate access to the campground and a small docking facility (see Figure 2). These canals do not allow adequate water exchange between the tidally influenced portion of Fish River and cause stagnant water in the uppermost portion of the canals. This condition leads to a low dissolved oxygen level, which reduces the value of this habitat for many fish species. Further, the historical tidal flow of the wetland system is disrupted by the canals. The goal of the Project is to restore the hydrology to approximately 80 acres of wetlands by using the side casted fill material dredged from the canals in the 1960s to fill in portions of the canals (see Figure 3). Approximately 10 acres of spoil areas will be degraded to a natural intertidal marsh elevation. Approximately 23,000 yd3 of on-site fill available from the degrading of spoil areas will be used to fill the deeper portions of the canals and restore natural hydrology.

Figure 1: Fish River Project Area

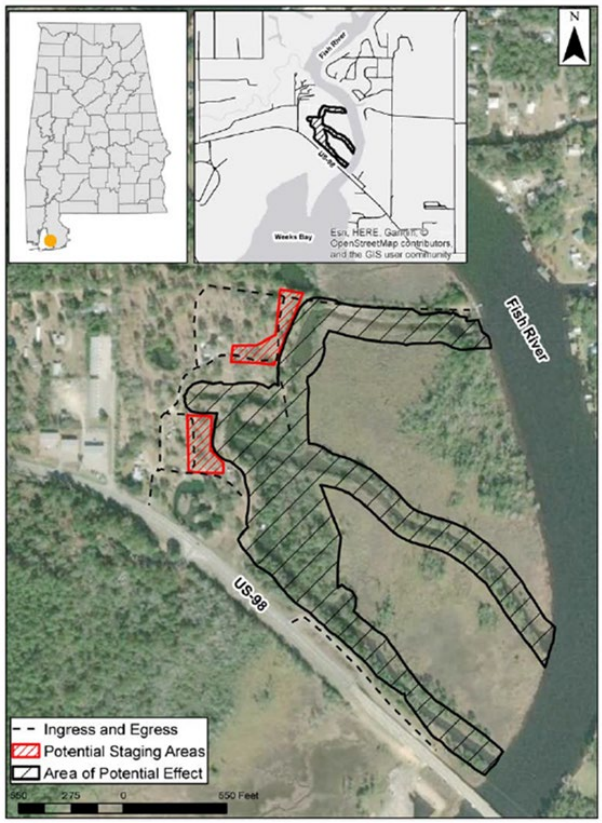

Figure 2: Fish River Site Plan

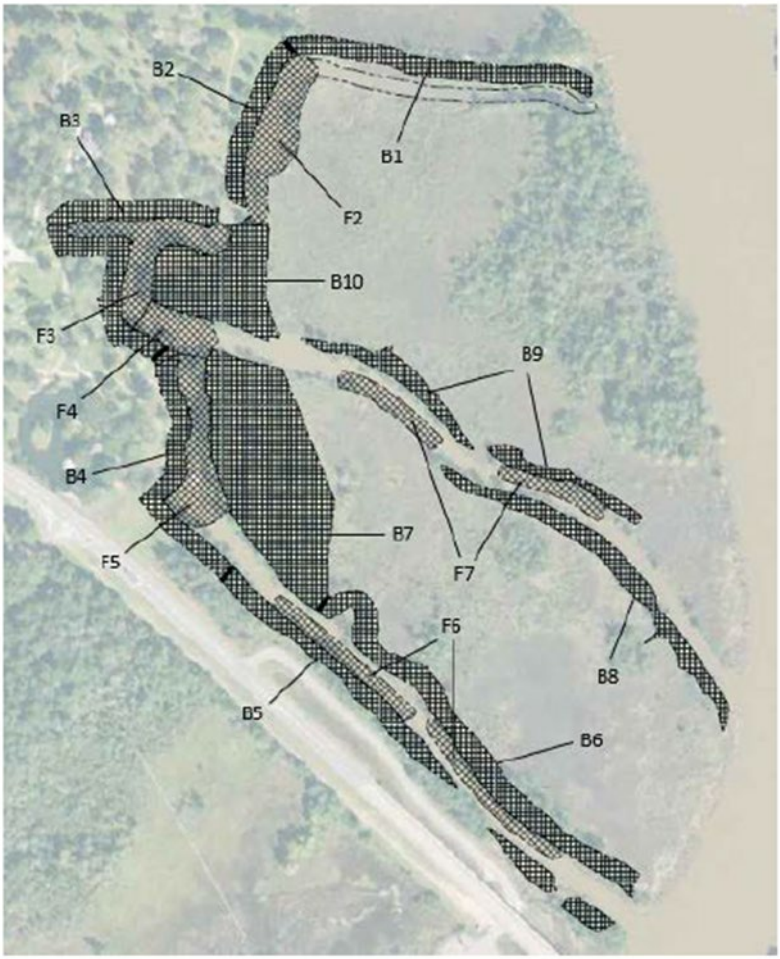

Figure 3: Fish River Borrow (dark)/Fill (light) Sections

1.1.2 Meadows Tract Marsh Restoration

The Meadows Tract Marsh Restoration Project (Project) is located east of County Road 1 on property owned by Baldwin County and the State of Alabama (see Figure 4). The Meadows Tract contains approximately 250 acres of herbaceous and forested wetlands adjacent to Bon Secour Bay (Mobile Bay). Historic logging roads constructed throughout the Project site have created impediments to sheet flow and numerous ditched areas, altering the historic hydrology of the site (See Figure 5). Higher elevation segments of interior site access roads (from logging road construction spoils) will be degraded to the surrounding grade and the spoil materials will be used to fill adjacent roadway ditches to the surrounding grade in order to provide sheet flow improvements (see Figure 6).

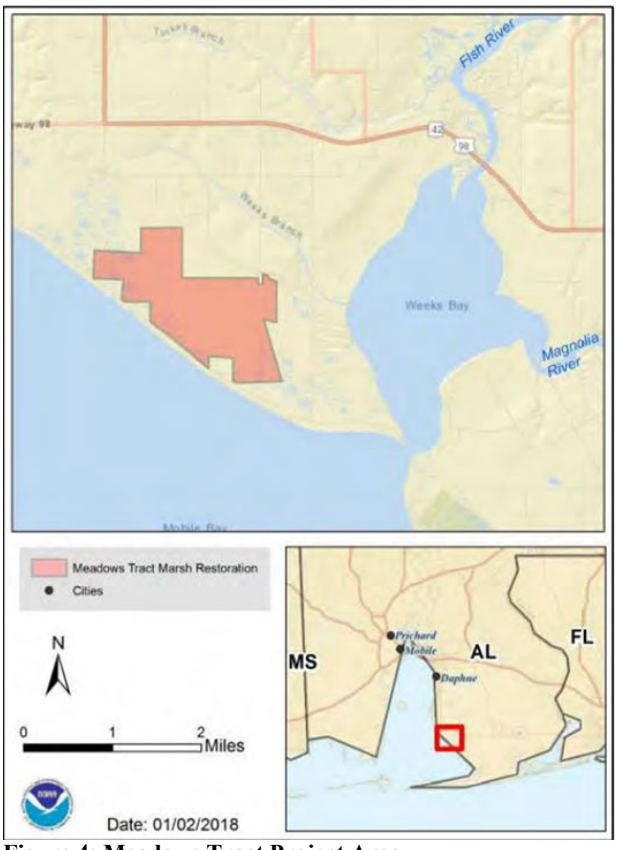

Figure 4: Meadows Tract Project Area

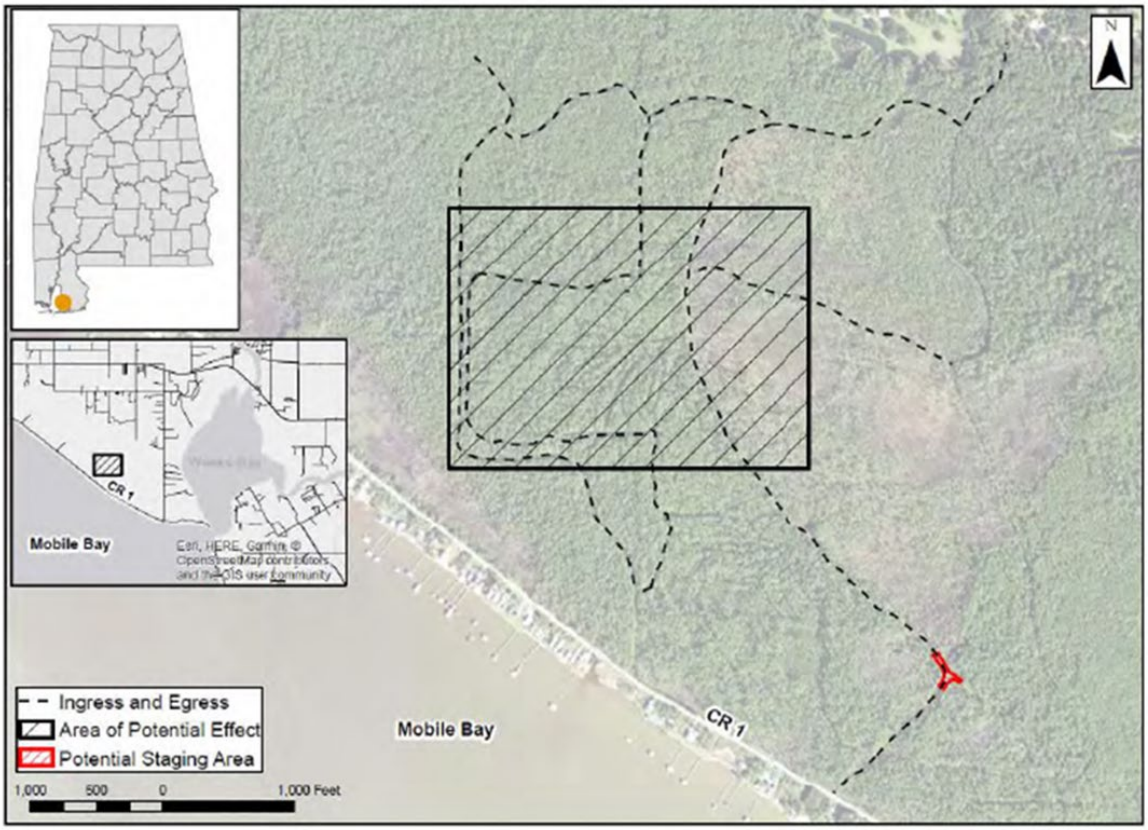

Figure 5: Meadows Tract Site Plan

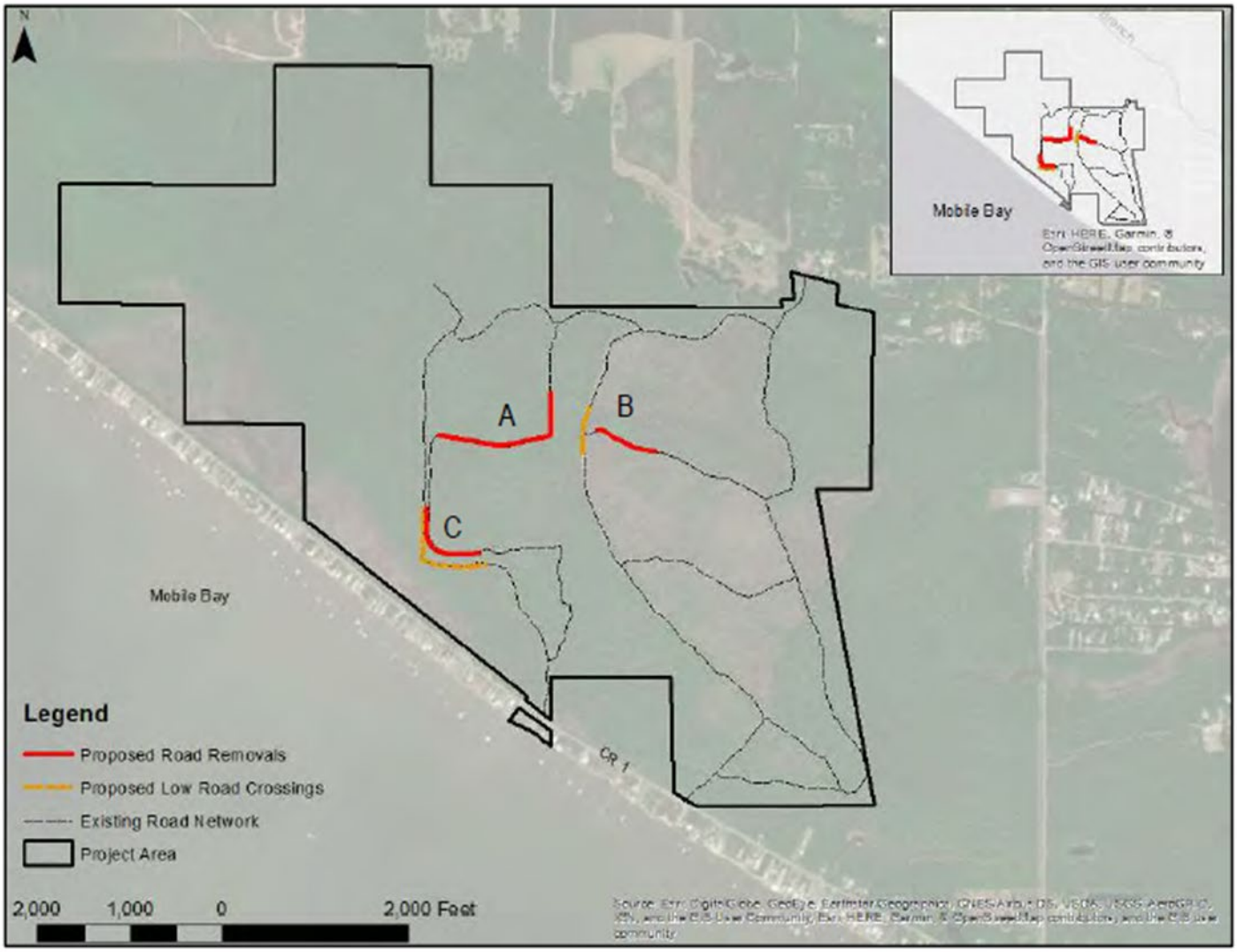

Figure 6: Meadows Tract Road Improvements

1.1.3 Oyster Bay Marsh Restoration

The Oyster Bay Marsh Restoration Project contains approximately 150 acres of estuarine tidal and brackish marsh on the north and south side of County Road 4 in Gulf Shores, Alabama (see Figure 7). The project area is comprised of a causeway constructed across the northern portion of Oyster Bay (see Figure 8). The historical flow pattern was altered by the construction of the Intracoastal Waterway (1940s), the construction of county road 4 (1960s), and by surge inundation issues in this area caused by Hurricane Ivan (2004). The construction of the causeway entailed ditching on the north and south sides of the road, and placement of undersized culverts beneath the roadway. The culverts restrict water exchange resulting in impoundment of freshwater and a subsequent conversion of habitat on the north side of County Road 4 from mesohaline marsh to brackish marsh. Due to the lack of water movement, the drainage areas on both sides of the culvert have trapped sediments resulting in colonization of these areas by giant reed (Phragmites australis). This nuisance plant species further reduces natural flow through the culverts. The project goal is to improve water movement under County Road 4 in order to

provide more suitable habitat for birds, aquatic organisms, and other wildlife. In order to achieve this, an additional triple box culvert system with 8-foot spans and 4-foot rise will be added to the road.

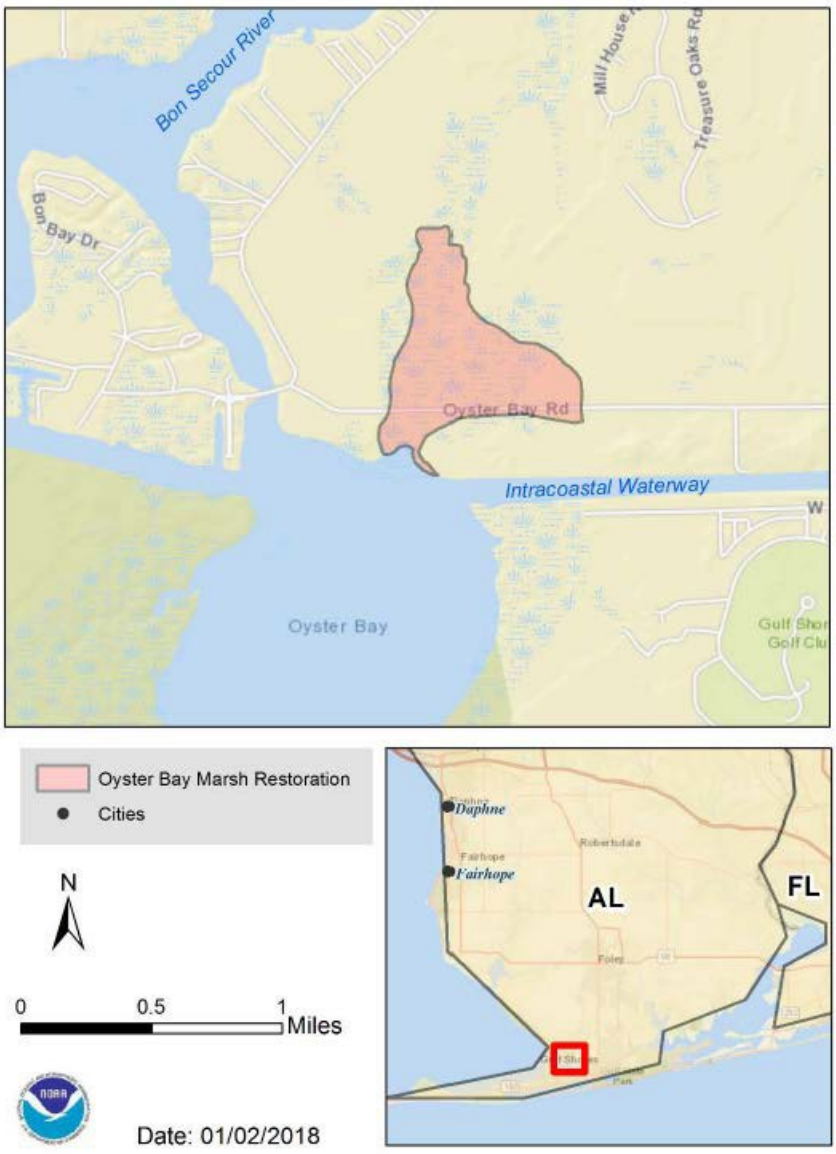

Figure 7: Oyster Bay Project Area

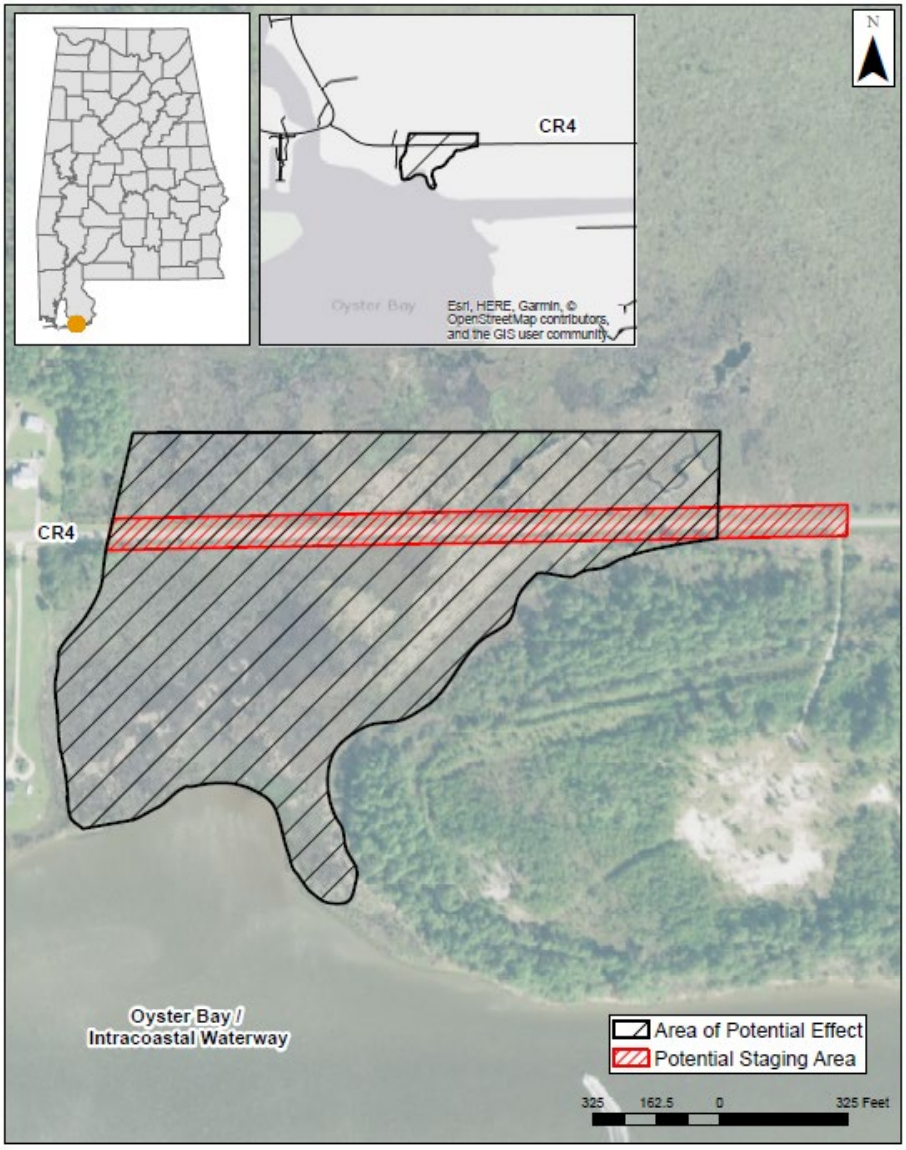

Figure 8: Oyster Bay Site Plan

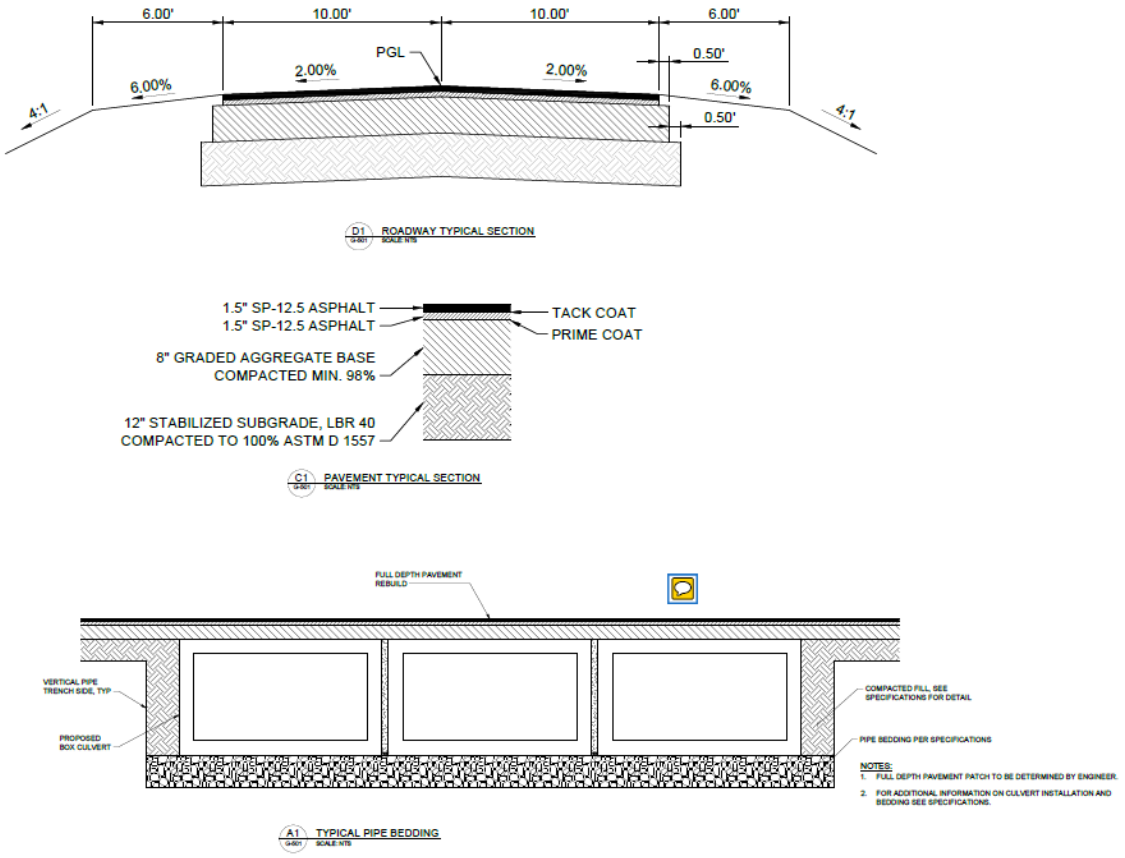

Figure 9: Oyster Bay Preliminary Culvert Design Plan

2 Restoration Goals and Objectives

The Alabama CCW Restoration projects will meet several Gulf of Mexico specific goals and objectives identified by the RESTORE Council in the 2016 update of the Gulf Coast Ecosystem Restoration Council Comprehensive Plan. AL CCW project activities can contribute to meeting RESTORE's primary goal to "restore and conserve habitat" through restoring, enhancing, and protecting habitats. In-the-ground implementation and monitoring of the AL CCW Restoration projects will receive funding from the RESTORE Council, thus creating RESTORE specific restoration objectives relevant to this monitoring plan. To evaluate project effectiveness and measure progress towards the RESTORE Council's stated objective of "restore, enhance, and protect habitats", the project will report on Council defined metrics. The metrics to determine restoration success (and alternatively any needs for adaptive management) are:

<u>Fish River: Restore hydrology to marsh and increase tidal flushing by backfilling and re-grading canals</u>

- HR009 – Restoring Hydrology – Habitat Restoration – 80 Acres of restored hydrology to marsh
- HR011 – Marsh Restoration – Habitat Restoration – 4 Acres of canals backfilled and re-graded

Meadows Tract: Restore hydrologic sheet flow to marsh and forested wetlands by removing and re-grading roads

- HR009 – Restoring Hydrology – Habitat Restoration – 250 Acres of restored hydrology to marsh and forested wetlands

Oyster Bay: Restore Hydrologic flow under CR 4 through the construction of an additional box culvert

- HR009 – Restoring Hydrology – Habitat Restoration – Acres of restored hydrology to marsh

This monitoring plan has been designed around the objectives and desired outcomes for each project addressing questions related to the objectives and metrics described above and for other scientific questions related to the hydrologic reconnection and wetland restoration elements of the projects.

Fish River:

1. Were the anticipated number of acres of restored hydrology (80 acres) achieved?
2. Were the anticipated number of acres of backfilled and re-graded canals (4 acres) achieved?
3. Has tidal flushing increased in the canals?

Meadows Tract:

1. Were the anticipated number of acres of restored hydrology (250 acres) achieved?
2. Has sheet flow improved on access roads throughout tract?

Oyster Bay:

1. Were the anticipated number of acres of restored hydrology (acres) achieved?
2. Has water flow under CR 4 increased?

3 Project Monitoring

Project monitoring will be conducted from Pre-restoration, and Year 0 (as-built) for a period of up to two (2) years following construction commencement. Table 1, below, summarizes when each parameter will be measured; however, this schedule may be revised as needed depending on changing site conditions over time. An as-built (year 0) report will be prepared to define the baseline conditions for measuring progress toward the restoration goals and final performance standards. The as-built monitoring will record conditions immediately after project completion and establish permanent sampling locations for future monitoring activities, which will consist primarily of topographic mapping and surveys of the aerial extent of each of the project features. Any deviations from the final site plan will be noted, and the significance of these deviations will be evaluated in the as-built report. The following sections of this monitoring plan have been organized by the Objectives outlined above, describe each parameter, and provide methodologies to measure each parameter.

Table 1. Anticipated monitoring schedule.

Project Site	Monitoring Parameter	Monitoring Timeframe					
		Pre-Restoration Monitoring	Post-Restoration Monitoring				
			Year 0 (As-Built)	6 Months	Year 1	18 Months	Year 2
Fish River	Areal Extent	X	X				
Fish River	Vegetation, Percent Cover		X		X		X
Fish River	Canal Improvements	X	X				
Fish River	Water Velocity		X	X	X	X	X
Meadows Tract	Areal Extent	X	X				
Meadows Tract	Road Improvements	X	X				
Meadows Tract	Water Velocity		X	X	X	X	X
Oyster Bay	Areal Extent	X	X				
Oyster Bay	Vegetation, Percent Cover		X		X		X
Oyster Bay	Water Velocity		X	X	X	X	X

3.1 Fish River

3.1.1 Objective 1: Restore approximately 80 acres of marsh hydrography

Parameter 1 – Areal Extent

Purpose: Areal extent is the calculation of the area influenced by project implementation. The purpose is to measure the habitat spatial extent and composition of the project's total marsh restoration footprint.

Method: Conduct visual observations and take pictures of the project site from a boat or shoreline, or during an aerial survey. Permanent photograph stations will be established at each sampling point; photographs will be taken in the same direction at these stations every pre and post-restoration.

Timing and Frequency: Monitoring of project boundaries will occur pre-restoration and post-restoration.

Sites: Various extents within the restoration project footprint.

Performance criteria:

Parameter 2 – Vegetation, Percent Cover

Purpose: Percent cover (the proportion of ground area with vegetation cover in a sampling unit) and composition are estimated within defined plots or transects in the project area to determine if vegetation is establishing, increasing, or being maintained.

Method: Establish permanent transects within the project's created wetlands and at reference site(s). Transects will be oriented perpendicular to the shore and locations recorded with GPS. Quadrats (quarter meter to meter in area) will be placed along transects at regular intervals and used to measure species composition and make visual estimates of percent cover. Permanent photo stations will document changes in vegetation over time. Repeated measures at these permanent monitoring stations will be recorded and analyzed for trends.

Timing and Frequency: Pre-construction, and annually, post-construction.

Sites: Transects will be located at a site within the restoration footprint.

3.1.2 Objective 2: Backfill and re-grade approximately 4 acres of canals

Parameter 3 – Canal Improvements (acres)

Purpose: Backfill and re-grade canals to prevent interior portions of canals from becoming hypoxic and causing fish kills. The purpose is to measure the length of canals that have been restored to allow increased tidal flushing.

Method: Conduct visual observations and take pictures of the project site from a boat or shoreline, or during an aerial survey.

Timing and Frequency: Monitoring of canals will occur pre-restoration and post-restoration.

Sites: Various extents within the restoration project footprint.

3.1.3 Objective 3: Increase tidal flushing in canals

Parameter 4 – Water Velocity (ft/sec)

Purpose: Measuring water velocity within the canals will show whether tidal flushing has increased. Measure the speed of water within the restored canals in units of distance per time (feet per second). Velocity may vary based on position within the canals (higher midstream near the surface and lower along banks)

Method: In-situ sampling to measure water velocity using a current meter. Establish sampling locations along each canal using GPS, and take flow measurements from these locations every six months.

Timing and Frequency: In-situ monitoring of water velocity will occur every 6 months post-restoration.

Sites: Various locations within canals.

Performance crtieria?

3.2 Meadows Tract

3.2.1 Objective 1: Restore approximately 250 acres of marsh and forested wetlands hydrography

Parameter 1 – Areal Extent

Purpose: Areal extent is the calculation of the area influenced by project implementation. The purpose is to measure the habitat spatial extent and composition of the project's total marsh and forested wetland restoration footprint.

Method: Conduct visual observations and take pictures of the project site from or during an aerial survey. Permanent photograph stations will be established at each sampling point; photographs will be taken in the same direction at these stations every pre and post-restoration.

Timing and Frequency: Monitoring of project boundaries will occur pre-restoration and post-restoration.

Sites: Various extents within the restoration project footprint.

3.2.2 Objective 2: Increase sheet flow across access roads

Parameter 2 – Road Improvements (linear ft)

Purpose: Road improvements will allow water unobstructed flow across the tract. The purpose is to measure the length of roads that have been improved to allow increased sheet flow.

Method: Conduct visual observations and take pictures of the project site, or during an aerial survey.

Timing and Frequency: Monitoring of roads will occur pre-restoration and post-restoration.

Sites: Various extents within the restoration project footprint.

Parameter 3 – Water Velocity (ft/sec if possible)

Purpose: Measuring water velocity across the access roads will show whether sheet flow has increased. If possible, measure the speed of water over the access roads in units of distance per time (feet per second). If water level is not high enough, measure using visual survey and photographs.

Method: In-situ sampling to measure water velocity using a current meter and/or visual survey with photographs, determine sheet flow across access roads. Establish sampling locations where roads have been removed/regraded, and take flow measurements/survey from these locations every year.

Timing and Frequency: Monitoring of sheet flow will occur annually post-restoration.

Sites: Various locations along access roads.

3.3 Oyster Bay

3.3.1 Objective 1: Restore acres of marsh hydrography

Parameter 1 – Areal Extent

Purpose: Areal extent is the calculation of the area influenced by project implementation. The purpose is to measure the habitat spatial extent and composition of the project's total marsh restoration footprint.

Method: Satellite imagery will be used to digitally calculate the aerial extent of the wetlands complex and compared to the baseline conditions.

Timing and Frequency: Monitoring of project boundaries will occur once pre-restoration and once post-restoration.

Sites: Marsh complex north of CR4.

Parameter 2 – Vegetation, Percent Cover

Purpose: Percent cover (the proportion of ground area with vegetation cover in a sampling unit) and composition are estimated within defined plots or transects in the project area to determine if vegetation is establishing, increasing, or being maintained.

Method: Establish permanent transects within the project's created wetlands and at reference site(s). Transects will be oriented perpendicular to the shore and locations recorded with GPS. Quadrats (quarter meter to meter in area) will be placed along transects at regular intervals and used to measure species composition and make visual estimates of percent cover. Permanent photo stations will document changes in vegetation over time. Repeated measures at these permanent monitoring stations will be recorded and analyzed for trends.

Timing and Frequency: Pre-construction, and annually, post-construction.

Sites: Transects will be located at a site within the restoration footprint.

3.3.2 Objective 2: Increase water exchange under CR4

Parameter 3 – Water Velocity (ft/sec)

Purpose: Measuring water velocity under CR4 will show whether water exchange has increased. Measure the speed of water through the culvert in units of distance per time (feet per second). Velocity may vary based on position within the stream flow (higher midstream near the surface and lower along banks).

Method: In-situ sampling to measure water velocity using a current meter. Establish sampling locations North and South of culverts using GPS, and take flow measurements from these locations every six months.

Timing and Frequency: In situ measurements will occur every 6 months post-restoration.

Sites: Various locations within the project area.

4. Project Management and Reporting

Monitoring tasks will be coordinated among the project partners, with all partners conducting sampling work. The Weeks Bay NERR and NOAA-RC will be responsible for monitoring activities at the Fish River and Meadows Tract Sites, and the City of Gulf Shores and NOAA-RC will be responsible for monitoring activities at the Oyster Bay site. The NOAA-RC and any sub-recipients of RESTORE monitoring funds will be responsible for RESTORE specific reporting requirements.

5. Data Management

A data management plan will be prepared for the RESTORE funded monitoring as part of the associated Interagency Agreement with the RESTORE Council. Data storage and accessibility will be the responsibility of the NOAA-RC and details will be developed as project implementation progresses.