FACT SHEETS AND MAPS FOR FEATURES OF THE NATIONAL ECOSYSTEM RESTORATION TENTATIVELY SELECTED PLAN



Table of Contents

Marsh Restoration Measures

Shoreline Protection Measures

Table of Contents (continued)

Chenier Reforestation Measures

Hydrologic & Salinity Control Measures

Measure 3a1
Beneficial Use of Dredged Material from Calcasieu Ship Channel

Measure 3a1 is a marsh restoration feature located adjacent to the southern shoreline of the GIWW west of the Calcasieu Ship Channel near Black Lake.

The measure will consist of converting approximately 599 acres of shallow open water to brackish marsh habitat through dedicated dredging of material to be borrowed from the Calcasieu Ship Channel from MM18 to MM22 with a hydraulic dredge (approximately 139 acres). Approximately 5.3 million cubic yards of borrow will be required for this marsh restoration feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes.[1]

The average depth of open water is 1.2 feet, and the average elevation of existing marsh (for nourishment) is 1.5 feet. The material will be transported directly to the site via pipeline, for a distance of approximately 8.3 miles. Access for the pipeline will require a corridor approximately 30 feet wide, and will be placed along the southern extent of the GIWW. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 43,942 feet long (30 acres), and will require no dredging. Measure 3a1 will result in a net benefit of 191 AAHUs.

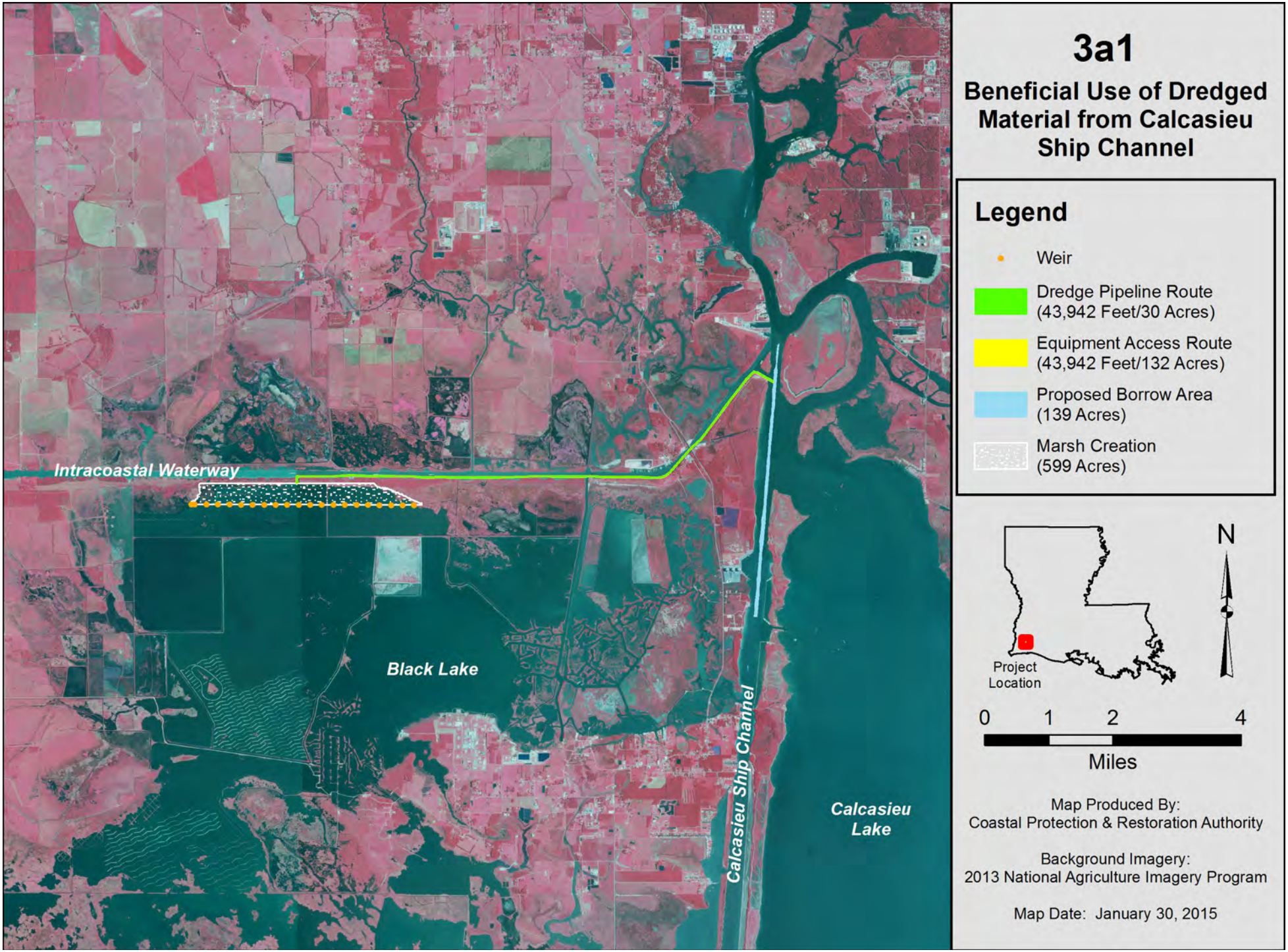
The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4 feet (NAVD88), following dewatering. During construction, effluent from dewatering will be discharged into adjacent wetlands to the south via spill box weirs. Approximately 44,700 feet of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical (clamshell or bucket) dredge. Access for the mechanical dredge will be the GIWW. No dredging for the access channel is anticipated to be required. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One (1) foot of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes will be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations will correspond to weir locations.

One renourishment cycle at TY30 is estimated to include 62 acres of marsh restoration along with 507 acres of marsh nourishment. Approximately 1.0 million cubic yards of borrow from the Calcasieu Ship Channel will be required for this renourishment cycle. The pipeline corridor for the renourishment event is the same as for initial construction.

Best management practices will be implemented to avoid unnecessary impacts. By utilizing material from the Calcasieu Shipping Channel, hypoxic conditions in the borrow area are anticipated to be avoided. The use of airboats to place the pipeline along the corridor will

[1] Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

minimize impacts to existing marsh. Booster pumps will be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. No critical habitat is expected to be impacted by this measure.



3a1

Beneficial Use of Dredged Material from Calcasieu Ship Channel

Legend

- Weir
- Dredge Pipeline Route (43,942 Feet/30 Acres)
- Equipment Access Route (43,942 Feet/132 Acres)
- Proposed Borrow Area (139 Acres)
- Marsh Creation (599 Acres)

0 1 2 4

Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: January 30, 2015

Measure 3c1
Beneficial Use of Dredged Material from Calcasieu Ship Channel

Measure 3c1 is a marsh restoration and nourishment feature located adjacent to the eastern rim of Calcasieu Lake and is situated within the Cameron-Creole Watershed area.

The measure will consist of converting approximately 1,765 acres of open water to brackish marsh habitat, along with the nourishment of approximately 450 acres of adjacent wetlands, through maintenance dredging of material to be borrowed from the Calcasieu Ship Channel from MM5 to MM18 (approximately 314 acres) with a hydraulic dredge. Approximately 10.2 million cubic yards of borrow will be required for this marsh restoration and nourishment feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes.[1]

The average depth of open water is 0.5 feet, and the average elevation of existing marsh (for nourishment) is 0.7 feet. The material will be transported directly to the site via pipeline, for a distance of approximately 11.6 miles. Access for the pipeline will require a corridor approximately 30 feet wide, and will be located along the access corridor previously permitted for the Cameron Creole levee repair following Hurricane Ike. Inside the levee, the pipeline corridor will be placed in the open water borrow canal behind the levee. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 61,497 feet long (42 acres), and will require no dredging. Measure 3c1 will result in a net benefit of 654 AAHUs.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4 feet (NAVD88), following dewatering. During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 92,500 feet of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical (clamshell or bucket) dredge. Access for the mechanical dredge will be via the pipeline corridor. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One (1) foot of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes will be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations will correspond to weir locations.

One renourishment cycle at TY30 is estimated to include 787 acres of marsh restoration along with 1,317 acres of marsh nourishment. Approximately 5.6 million cubic yards of borrow from the Calcasieu Ship Channel will be required for this renourishment cycle. The pipeline corridor for the renourishment event is the same as for initial construction.

[1] Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

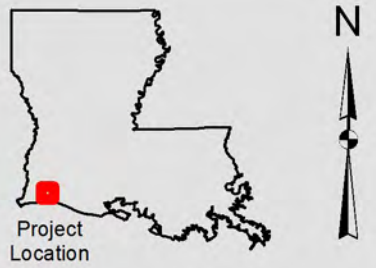
Best management practices will be implemented to avoid unnecessary impacts. By utilizing material from the Calcasieu Shipping Channel, hypoxic conditions in the borrow area are anticipated to be avoided. The use of airboats to place the pipeline along the corridor will minimize impacts to existing marsh. Booster pumps will be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. No critical habitat is expected to be impacted by this measure.

3c1

Beneficial Use of Dredged Material from Calcasieu Ship Channel

Legend

- Weir
- Dredge Pipeline Route (61,497 Feet/42 Acres)
- Equipment Access Route (61,497 Feet/182 Acres)
- Proposed Borrow Area (314 Acres)
- Marsh Creation (2,215 Acres)



N

0 1 2 4

Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: January 30, 2015

Measure 47a1
Marsh Restoration Using Dredged Material South of Highway 82

Measure 47a1 is a marsh restoration and nourishment feature located adjacent to the south side of Highway 82 approximately 4.5 miles west of Grand Chenier.

The measure will consist of converting approximately 933 acres of shallow open water to brackish marsh habitat, along with the nourishment of approximately 88 acres of adjacent brackish marsh, through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms. Approximately 3.0 million cubic yards of borrow will be dredged with a hydraulic dredge for this marsh restoration and nourishment feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes.[1]

The average depth of open water is -1.5 feet (NAVD88), and the average elevation of existing marsh (for nourishment) is 1.27 feet (NAVD88). The borrow area is approximately 1,716 acres, which will be used for all of the dredging needs for 47a1, 47a2, and 47c1, including renourishment. The borrow area is anticipated to be dredged to a depth of 15 feet below the mudline. The size, location and configuration of the borrow area (offshore, with the long axis parallel to the shoreline) is designed to minimize the potential to create hypoxic conditions. The material will be transported directly to the site via pipeline, for a distance of approximately 6.7 miles. Access for the pipeline will require a corridor approximately 30 feet wide, and will be placed along existing open-water canals to the extent practicable. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 35,519 feet long (24 acres), and will require no dredging. Measure 47a1 will result in a net benefit of 272 AAHUs.

This measure will be constructed before measures 47a2 and 47c1. The dredged material will be placed to achieve a post-construction marsh target elevation of +1.5 feet (NAVD88) following dewatering. During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs, with preference on placement that would flow into the footprint of measure 47a2. Approximately 68,300 feet of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical clamshell or bucket dredge. Access for the mechanical dredge will be LA Highway 82. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One (1) foot of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes will be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations will correspond to weir locations.

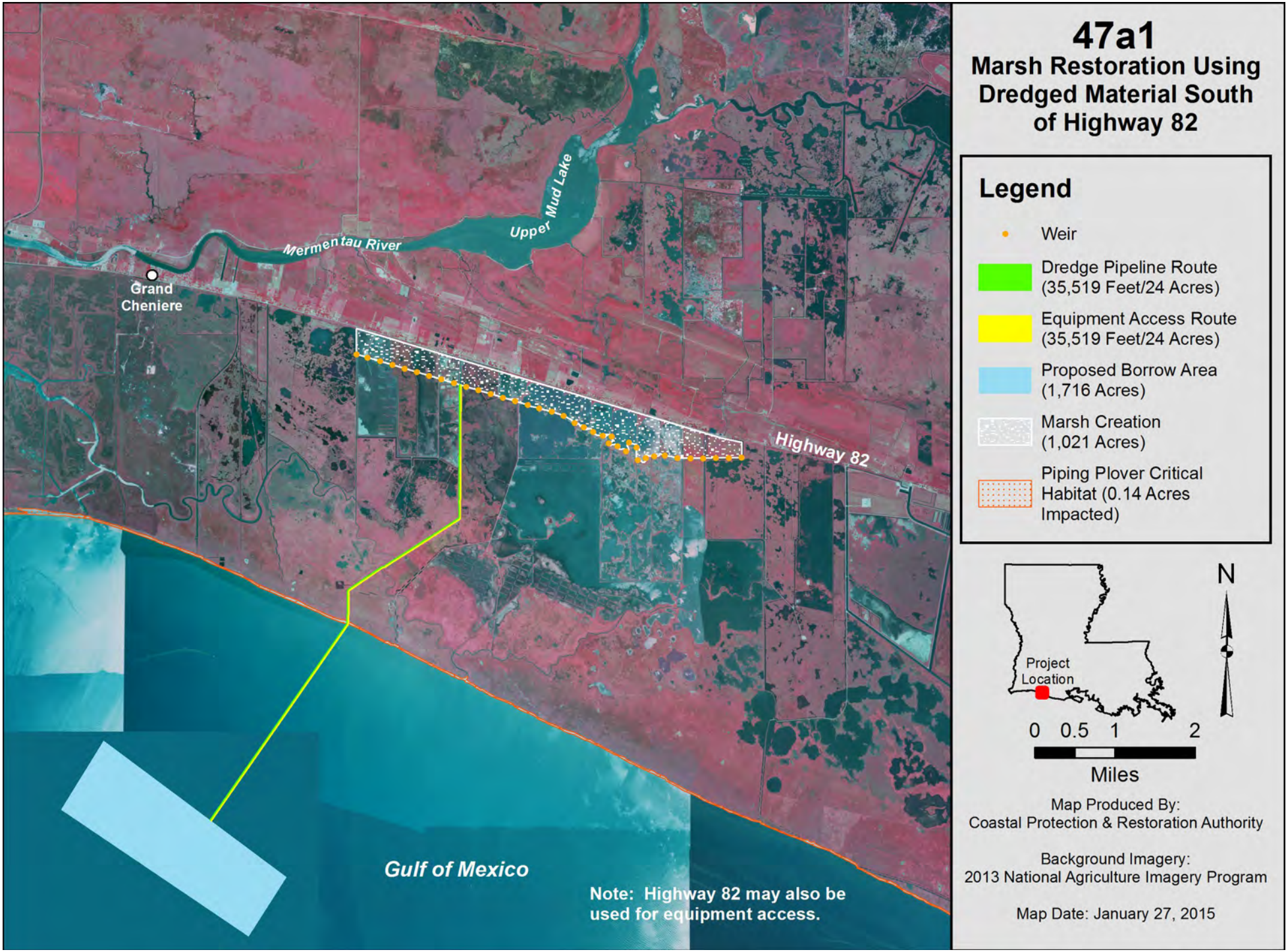
One renourishment cycle at TY30 is estimated to include 70 acres of marsh restoration along with 900 acres of marsh nourishment. Approximately 1.5 million cubic yards of borrow from

[1] Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

approximately 3 miles offshore within state waterbottoms will be required for this renourishment cycle. The borrow area and pipeline corridor for the renourishment event will be the same as for initial construction.

Best management practices will be implemented to avoid unnecessary impacts. By dredging the borrow area with side slopes of no less than a 4H:1V, hypoxic conditions are anticipated to be minimized. Although a marsh buggy will be used to place the pipeline across the beach and may be used to place the pipeline along the corridor, the use of airboats to place the pipeline along the corridor will be explored to minimize impacts to existing marsh. Booster pumps will be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. Any changes in beach topography resulting from placement of the pipeline would be graded and returned to pre-project conditions to the maximum extent practicable following pipeline removal. Piping plover critical habitat includes intertidal sand beaches (including sand flats) or mud flats (between the mean lower low water line and annual high tide) with no or very sparse emergent vegetation for feeding. Per USFWS protocol, the shoreline to vegetation line was digitized as a polygon, then buffered (on the water side) by 56 meters (184 feet) to approximate the mean lower-low water (MLLW) line. If necessary, a 100-foot wide bird abatement corridor across the beach would be maintained during construction to deter foraging, sheltering, and roosting of all potential migratory bird species. Approximately 0.14 acres (200 feet long by 30 feet wide) of critical habitat is expected to be impacted temporarily by this measure. The Conservation Measures are as follows:

1. Pipeline alignment and associated construction activities may be modified to reduce impacts to foraging, sheltering, and roosting;
2. Avoid impacts to the primary constituent elements (PCEs) of piping plover Critical Habitat to the maximum extent practicable;
3. Evaluate the project area prior to design and construction for the presence of piping plover PCEs as a basis for minimizing potential impacts.


47a1
Marsh Restoration Using Dredged Material South of Highway 82
Legend
Weir
Dredge Pipeline Route (35,519 Feet/24 Acres)
Equipment Access Route (35,519 Feet/24 Acres)
Proposed Borrow Area (1,716 Acres)
Marsh Creation (1,021 Acres)
Piping Plover Critical Habitat (0.14 Acres Impacted)
Mermentau River
Upper Mud Lake
Grand Cheniere
Highway 82
Gulf of Mexico
Note: Highway 82 may also be used for equipment access.
Project Location
N
0 0.5 1 2
Miles
Map Produced By:
Coastal Protection & Restoration Authority
Background Imagery:
2013 National Agriculture Imagery Program
Map Date: January 27, 2015

Measure 47a2
Marsh Restoration Using Dredged Material South of Highway 82

Measure 47a2 is a marsh restoration and nourishment feature located on the south side of Highway 82 approximately 4.5 miles west of Grand Chenier. Measure 47a2 is located immediately south of Measure 47a1.

The measure will consist of converting approximately 1,297 acres of shallow open water to brackish marsh habitat, along with the nourishment of approximately 126 acres of adjacent brackish marsh, through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms. Approximately 8.8 million cubic yards of borrow will be dredged with a hydraulic dredge for this marsh restoration and nourishment feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes.[1]

The average depth of open water in the placement area is -1.5 feet (NAVD88), and the average elevation of existing marsh (for nourishment) is 1.27 feet (NAVD88). The borrow area is approximately 1,716 acres, which will be used for all of the dredging needs for 47a1, 47a2, and 47c1, including renourishment. The borrow area is anticipated to be dredged to a depth of 15 feet below the mudline. The size, location and configuration of the borrow area (offshore, with the long axis parallel to the shoreline) is designed to minimize the potential to create hypoxic conditions. The material will be transported directly to the site via pipeline, for a distance of approximately 5.9 miles. Access for the pipeline will require a corridor approximately 30 feet wide, and will be placed along existing open-water canals to the extent practicable. The pipeline corridor is approximately 30,898 feet long (21 acres), and will require no dredging. Measure 47a2 will result in a net benefit of 381 AAHUs.

This measure will require approximately 18 months of construction. Construction will begin in TY1, after the construction of measure 47a1, with anticipated completion in TY3. The dredged material will be placed to achieve a post-construction marsh target elevation of +1.5 feet (NAVD88) following dewatering. During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs, with preference on placement that would flow into the footprint of measure 47c1. Approximately 41,000 feet of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical dredge. Access for the mechanical dredge will be from LA Highway 82. The equipment access corridor is 1,829 feet long (1.3 acres). The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One (1) foot of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes will be breached in multiple places

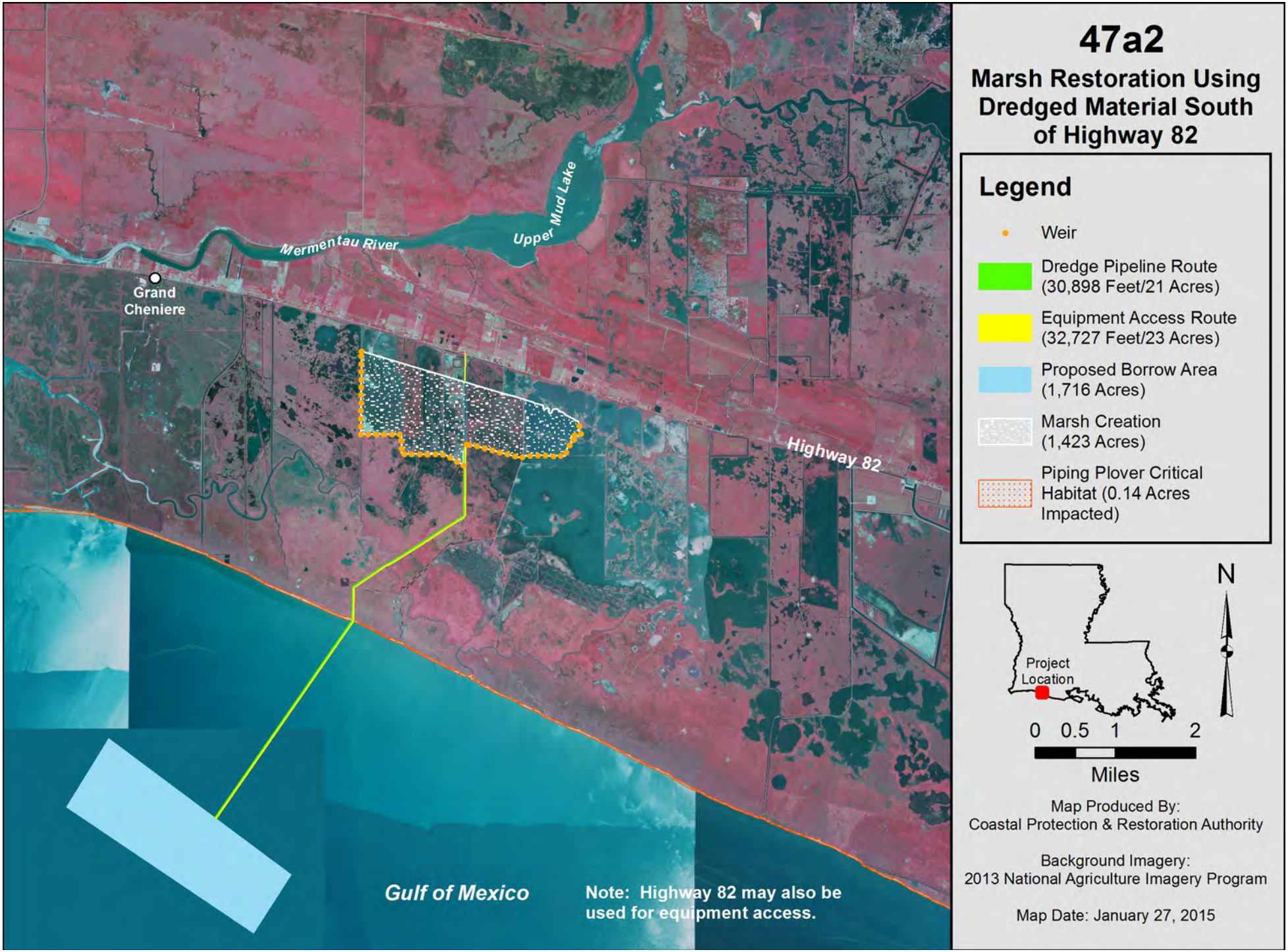
[1] Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations will correspond to weir locations.

One renourishment cycle at TY30 is estimated to include 125 acres of marsh restoration along with 1,227 acres of marsh nourishment. Approximately 1.5 million cubic yards of borrow from approximately 3 miles offshore within state waterbottoms will be required for this renourishment cycle. The borrow area and pipeline corridor for the renourishment event will be the same as for initial construction.

Best management practices will be implemented to avoid unnecessary impacts. By dredging the borrow area with side slopes of no less than a 4H:1V, hypoxic conditions are anticipated to be minimized. Although a marsh buggy will be used to place the pipeline across the beach and may be used to place the pipeline along the corridor, the use of airboats to place the pipeline along the corridor will be explored to minimize impacts to existing marsh. Booster pumps will be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. Any changes in beach topography resulting from placement of the pipeline would be graded and returned to pre-project conditions to the maximum extent practicable following pipeline removal. Piping plover critical habitat includes intertidal sand beaches (including sand flats) or mud flats (between the mean lower low water line and annual high tide) with no or very sparse emergent vegetation for feeding. Per USFWS protocol, the shoreline to vegetation line was digitized as a polygon, then buffered (on the water side) by 56 meters (184 feet) to approximate the mean lower-low water (MLLW) line. If necessary, a 100-foot wide bird abatement corridor across the beach would be maintained during construction to deter foraging, sheltering, and roosting of all potential migratory bird species. Approximately 0.14 acres (200 feet long by 30 feet wide) of critical habitat is expected to be impacted temporarily by this measure. The Conservation Measures are as follows:

1. Pipeline alignment and associated construction activities may be modified to reduce impacts to foraging, sheltering, and roosting;
2. Avoid impacts to the primary constituent elements (PCEs) of piping plover Critical Habitat to the maximum extent practicable;
3. Evaluate the project area prior to design and construction for the presence of piping plover PCEs as a basis for minimizing potential impacts.


47a2
Marsh Restoration Using Dredged Material South of Highway 82
Legend
Weir
Dredge Pipeline Route (30,898 Feet/21 Acres)
Equipment Access Route (32,727 Feet/23 Acres)
Proposed Borrow Area (1,716 Acres)
Marsh Creation (1,423 Acres)
Piping Plover Critical Habitat (0.14 Acres Impacted)
Mermentau River
Upper Mud Lake
Grand Cheniere
Highway 82
Gulf of Mexico
Note: Highway 82 may also be used for equipment access.
Project Location
N
0 0.5 1 2
Miles
Map Produced By:
Coastal Protection & Restoration Authority
Background Imagery:
2013 National Agriculture Imagery Program
Map Date: January 27, 2015

Measure 47c1
Marsh Restoration Using Dredged Material South of Highway 82

Measure 47c1 is a marsh restoration and nourishment feature located on the south side of Highway 82 approximately 4.5 miles west of Grand Chenier.

The measure will consist of converting approximately 1,304 acres of shallow open water to brackish marsh habitat, along with the nourishment of approximately 4 acres of adjacent brackish marsh, through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms. Approximately 8.6 million cubic yards of borrow will be dredged with a hydraulic dredge for this marsh restoration and nourishment feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes.[1]

The average depth of open water in the placement area is -1.5 feet (NAVD88), and the average elevation of existing marsh (for nourishment) is 1.27 feet (NAVD88). The borrow area is approximately 1,716 acres, which will be used for all of the dredging needs for 47a1, 47a2, and 47c1, including renourishment. The borrow area is anticipated to be dredged to a depth of 15 feet below the mudline. The size, location and configuration of the borrow area (offshore, with the long axis parallel to the shoreline) is designed to minimize the potential to create hypoxic conditions. The material will be transported directly to the site via pipeline, for a distance of approximately 5.7 miles. Access for the pipeline will require a corridor approximately 30 feet wide, and will be placed along existing open-water canals to the extent practicable. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 29,858 feet long (21 acres), and will require no dredging.

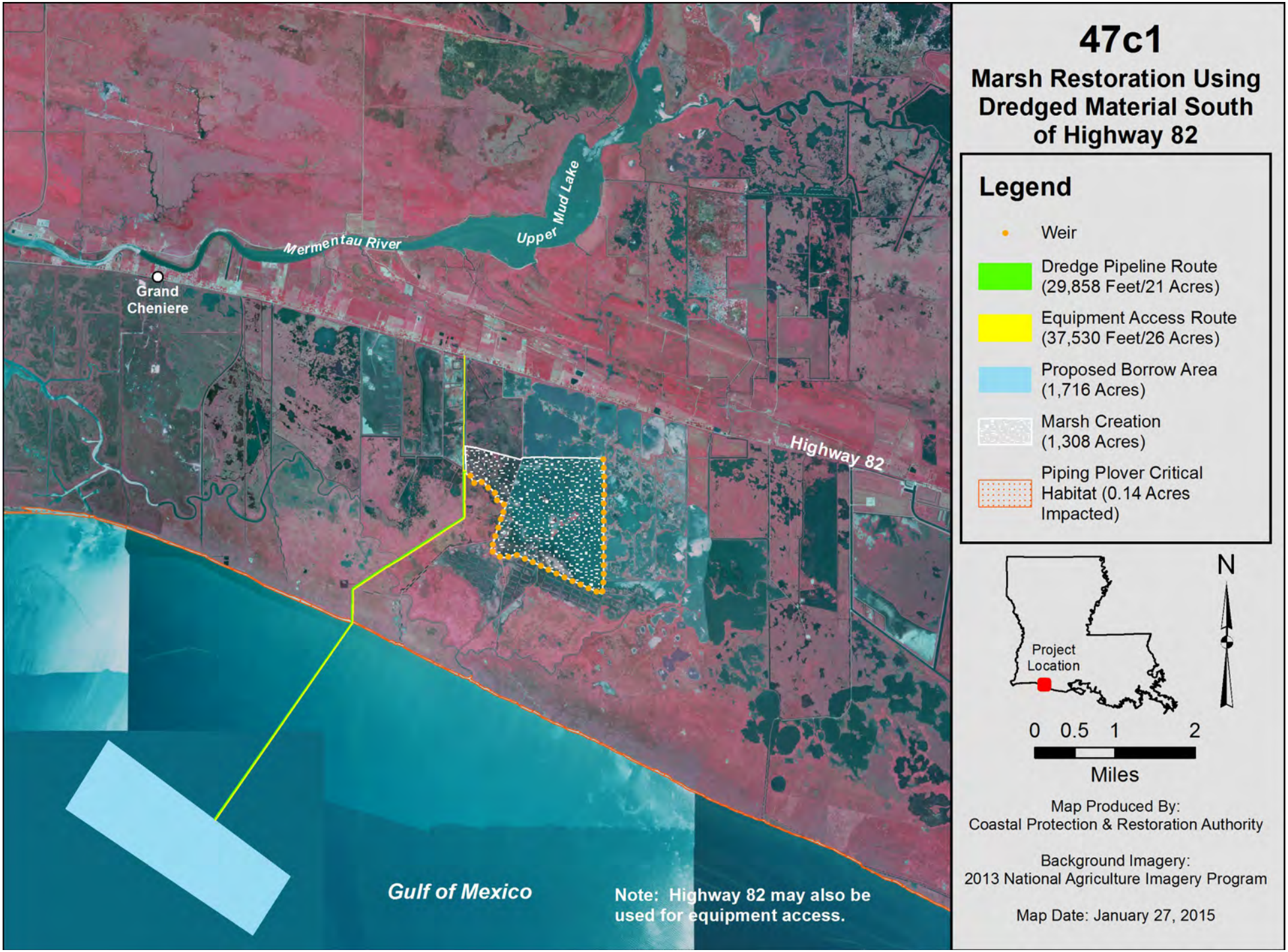
This measure will require approximately 18 months of construction. Construction will begin in TY3, after the construction of measure 47a2, with anticipated completion in TY5. The dredged material will be placed to achieve a post-construction marsh target elevation of +1.5 feet (NAVD88) following dewatering. During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 35,200 feet of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical dredge. Access for the mechanical dredge will be LA Highway 82 and will follow open water channels to the extent possible. The equipment access corridor for the mechanical dredge is 7,672 feet long (5.3 acres). The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One (1) foot of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes will be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations will correspond to weir locations.

[1] Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

One renourishment cycle at TY30 is estimated to include 55 acres of marsh restoration along with 1,188 acres of marsh nourishment. Approximately 1.8 million cubic yards of borrow from approximately 3 miles offshore within state waterbottoms will be required for this renourishment cycle. The borrow area and pipeline corridor for the renourishment event will be the same as for initial construction. Measure 47c1 will result in a net benefit of 353 AAHUs.

Best management practices will be implemented to avoid unnecessary impacts. By dredging the borrow area with side slopes of no less than a 4H:1V, hypoxic conditions are anticipated to be minimized. Although a marsh buggy will be used to place the pipeline across the beach and may be used to place the pipeline along the corridor, the use of airboats to place the pipeline along the corridor will be explored to minimize impacts to existing marsh. Booster pumps will be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. Any changes in beach topography resulting from placement of the pipeline would be graded and returned to pre-project conditions to the maximum extent practicable following pipeline removal. Piping plover critical habitat includes intertidal sand beaches (including sand flats) or mud flats (between the mean lower low water line and annual high tide) with no or very sparse emergent vegetation for feeding. Per USFWS protocol, the shoreline to vegetation line was digitized as a polygon, then buffered (on the water side) by 56 meters (184 feet) to approximate the mean lower-low water (MLLW) line. If necessary, a 100-foot wide bird abatement corridor across the beach would be maintained during construction to deter foraging, sheltering, and roosting of all potential migratory bird species. Approximately 0.14 acres (200 feet long by 30 feet wide) of critical habitat is expected to be impacted temporarily by this measure. The Conservation Measures are as follows:

1. Pipeline alignment and associated construction activities may be modified to reduce impacts to foraging, sheltering, and roosting;
2. Avoid impacts to the primary constituent elements (PCEs) of piping plover Critical Habitat to the maximum extent practicable;
3. Evaluate the project area prior to design and construction for the presence of piping plover PCEs as a basis for minimizing potential impacts.


47c1
Marsh Restoration Using Dredged Material South of Highway 82
Legend
Weir
Dredge Pipeline Route (29,858 Feet/21 Acres)
Equipment Access Route (37,530 Feet/26 Acres)
Proposed Borrow Area (1,716 Acres)
Marsh Creation (1,308 Acres)
Piping Plover Critical Habitat (0.14 Acres Impacted)
Mermentau River
Upper Mud Lake
Grand Cheniere
Highway 82
Gulf of Mexico
Note: Highway 82 may also be used for equipment access.
Project Location
N
0 0.5 1 2
Miles
Map Produced By:
Coastal Protection & Restoration Authority
Background Imagery:
2013 National Agriculture Imagery Program
Map Date: January 27, 2015

Measure 124c
Marsh Creation at Mud Lake

Measure 124c is a marsh restoration and nourishment feature located adjacent and north of Highway 82 and east of Mud Lake.

The measure will consist of converting approximately 1,908 acres of shallow open water to saline marsh habitat, along with the nourishment of approximately 734 acres of adjacent saline marsh, through dedicated dredging of material to be borrowed from an area approximately 531 acres located approximately 1.5 to 3 miles offshore within state waterbottoms. Approximately 11.1 million cubic yards of borrow will be dredged with a hydraulic dredge for this marsh restoration and nourishment feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes.[1]

The average depth of open water in the placement area is -1.5 feet (NAVD88), and the average elevation of existing marsh (for nourishment) is 1.13 feet (NAVD88). The size, location and configuration of the borrow area (offshore, with the long axis parallel to the shoreline) is designed to minimize the potential to create hypoxic conditions. The material will be transported directly to the site via pipeline, for a distance of approximately 2.1 miles. The pipeline access corridor will be approximately 30 feet wide, and will follow existing waterways to the extent possible. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 10,836 feet long (7.5 acres), and will require no dredging. The pipeline would cross approximately 500 feet (0.34 acres) of beach placed for the CS-33 project. The pipeline would be bored under Louisiana Highway 82. Measure 124c will result in a net benefit of 740 AAHUs.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.5 feet (NAVD88) following dewatering. During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 52,600 feet of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical dredge. Access for the mechanical dredge will be via Louisiana Highway 82 and the pipeline corridor. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One (1) foot of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes will be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations will correspond to weir locations.

One renourishment cycle at TY30 is estimated to include 352 acres of marsh restoration along with 2,158 acres of marsh nourishment. Approximately 4.7 million cubic yards of borrow from

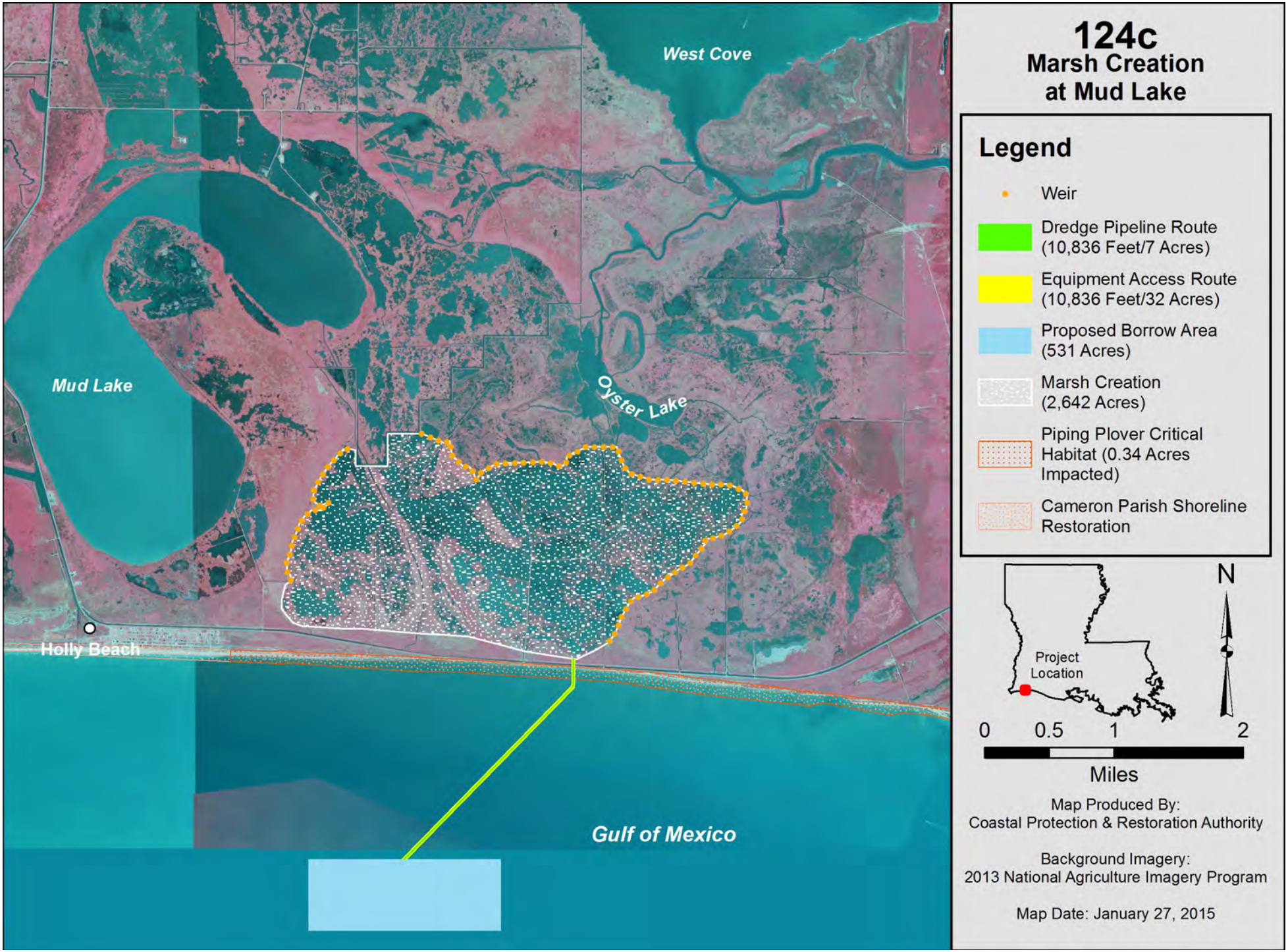
[1] Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

1.5 to 3 miles offshore within state waterbottoms will be required for this renourishment cycle. The borrow area, pipeline corridor, and equipment access for the renourishment cycle will be the same as for construction.

Best management practices will be implemented to avoid unnecessary impacts. By dredging the borrow area with side slopes of no less than a 4H:1V, hypoxic conditions are anticipated to be minimized. Although a marsh buggy will be used to place the pipeline across the beach and may be used to place the pipeline along the corridor, the use of airboats to place the pipeline along the corridor will be explored to minimize impacts to existing marsh. Booster pumps will be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. Any changes in beach topography resulting from placement of the pipeline would be graded and returned to pre-project conditions to the maximum extent practicable following pipeline removal. Piping plover critical habitat includes intertidal sand beaches (including sand flats) or mud flats (between the mean lower low water line and annual high tide) with no or very sparse emergent vegetation for feeding. Per USFWS protocol, the shoreline to vegetation line was digitized as a polygon, then buffered (on the water side) by 56 meters (184 feet) to approximate the mean lower-low water (MLLW) line. If necessary, a 100-foot wide bird abatement corridor across the beach would be maintained during construction to deter foraging, sheltering, and roosting of all potential migratory bird species. Approximately 0.34 acres of critical habitat is expected to be impacted temporarily by this measure.

The Conservation Measures are as follows:

1. Pipeline alignment and associated construction activities may be modified to reduce impacts to foraging, sheltering, and roosting;
2. Avoid impacts to the primary constituent elements (PCEs) of piping plover Critical Habitat to the maximum extent practicable;
3. Evaluate the project area prior to design and construction for the presence of piping plover PCEs as a basis for minimizing potential impacts.


West Cove
Mud Lake
Oyster Lake
Holly Beach
Gulf of Mexico
124c
Marsh Creation
at Mud Lake
Legend
Weir
Dredge Pipeline Route
(10,836 Feet/7 Acres)
Equipment Access Route
(10,836 Feet/32 Acres)
Proposed Borrow Area
(531 Acres)
Marsh Creation
(2,642 Acres)
Piping Plover Critical
Habitat (0.34 Acres
Impacted)
Cameron Parish Shoreline
Restoration
Project
Location
N
0
0.5
1
2
Miles
Map Produced By:
Coastal Protection & Restoration Authority
Background Imagery:
2013 National Agriculture Imagery Program
Map Date: January 27, 2015

Measure
124d Marsh Restoration at Mud Lake

Measure 124d is a marsh restoration and nourishment feature located west of the Calcasieu Ship Channel and adjacent to the southern rim of West Cove.

The measure will consist of converting approximately 159 acres of shallow open water to brackish marsh habitat, along with the nourishment of approximately 448 acres of adjacent saline marsh, through dedicated dredging of material to be borrowed from the Calcasieu Ship Channel from MM00 to MM05 (378 acres) or West Cove with a hydraulic dredge. Approximately 1.4 million cubic yards of borrow will be required for this marsh restoration and nourishment feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes.[1]

The average depth of open water is 1.1 feet, and the average elevation of existing marsh (for nourishment) is 1.45 feet. The material will be transported directly to the site via pipeline, for a distance of approximately 4.1 miles. The pipeline access corridor will be approximately 21,452 feet long and 30 feet wide (15 acres), and will go west from the Calcasieu Shipping Channel to West Cove. The access channel for construction equipment will be dredged to a depth of 7 feet where required with a mechanical dredge to a bottom width of 80 feet, and a top with of approximately 130 feet, with 4H:1V side slopes. Material from the access channel would be sidecast adjacent to the access channel and returned after construction. Approximately 64 acres of state waterbottoms would be dredged for access. Measure 124d will result in a net benefit of 4 AAHUs.

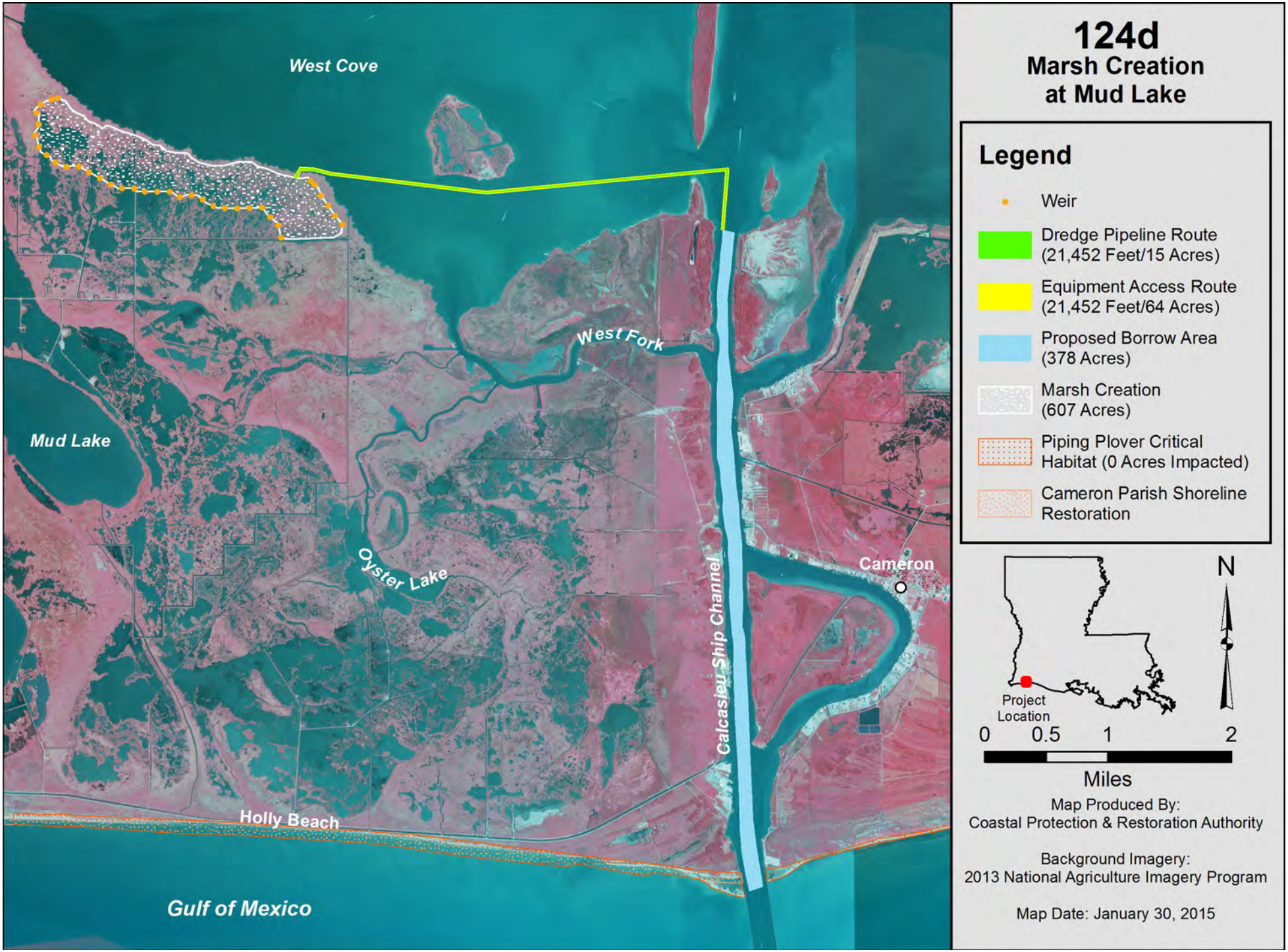
The dredged material will be placed to achieve a post-construction marsh target elevation of +1.5 feet (NAVD88) following dewatering. During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 32,500 feet of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area with a mechanical (clamshell or bucket) dredge. The access for the mechanical dredge will be via the pipeline corridor. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One (1) foot of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes will be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations will correspond to weir locations.

One renourishment cycle at TY30 is estimated to include 103 acres of marsh restoration along with 474 acres of marsh nourishment. Approximately 1.2 million cubic yards of borrow from the

[1] Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

Calcasieu Ship Channel or West Cove will be required for this renourishment cycle. Access for the renourishment cycle will be the same as for construction.

Best management practices will be implemented to avoid unnecessary impacts. By utilizing material from the Calcasieu Shipping Channel, hypoxic conditions in the borrow area are anticipated to be avoided. The use of airboats to place the pipeline along the corridor will minimize impacts to existing marsh. Booster pumps will be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. The pipeline will be sunk where necessary to provide navigation access. No critical habitat is expected to be impacted by this measure.


West Cove
West Fork
Mud Lake
Oyster Lake
Calcasieu Ship Channel
Cameron
Holly Beach
Gulf of Mexico
124d
Marsh Creation
at Mud Lake
Legend
Weir
Dredge Pipeline Route
(21,452 Feet/15 Acres)
Equipment Access Route
(21,452 Feet/64 Acres)
Proposed Borrow Area
(378 Acres)
Marsh Creation
(607 Acres)
Piping Plover Critical
Habitat (0 Acres Impacted)
Cameron Parish Shoreline
Restoration
N
Project
Location
0
0.5
1
2
Miles
Map Produced By:
Coastal Protection & Restoration Authority
Background Imagery:
2013 National Agriculture Imagery Program
Map Date: January 30, 2015

Measure 127c3
Marsh Restoration at Pecan Island

Measure 127c3 is a marsh restoration and nourishment feature located west of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks.

The measure will consist of converting approximately 832 acres of shallow open water to brackish marsh habitat, along with the nourishment of approximately 62 acres of adjacent brackish marsh, through dedicated dredging of material to be borrowed from approximately 1 to 3 miles offshore within state waterbottoms. Approximately 7.3 million cubic yards of borrow will be dredged with a hydraulic dredge for this marsh restoration and nourishment feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes.[1]

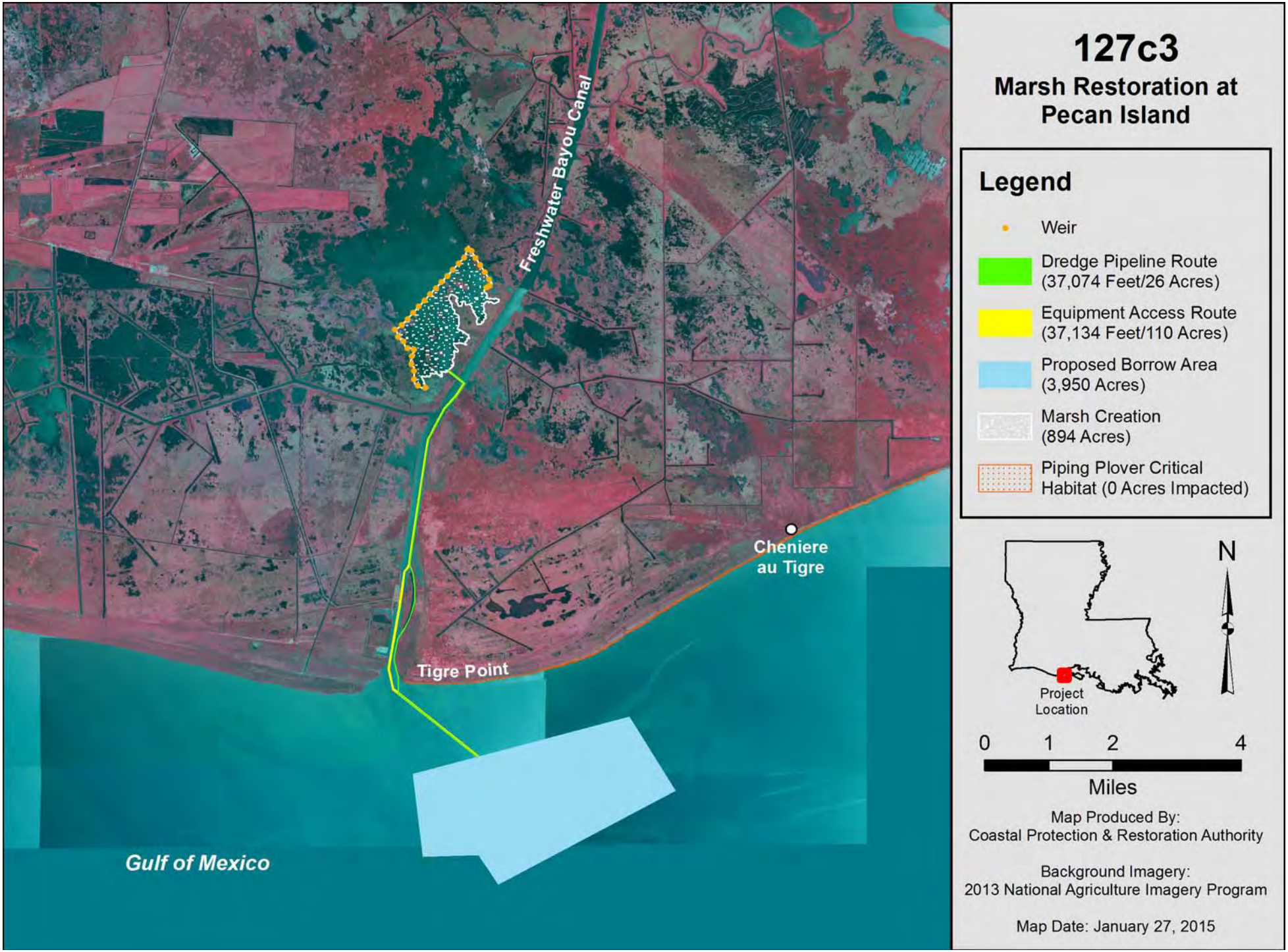
The average depth of open water in the placement area is -0.5 feet (NAVD88), and the average elevation of existing marsh (for nourishment) is 1.43 feet (NAVD88). The borrow area is approximately 3,950 acres, which will be used for all of the dredging needs for measures 127c3 and 306a1, including renourishment. The size, location and configuration of the borrow area (offshore, with the long axis parallel to the shoreline) is designed to minimize the potential to create hypoxic conditions. The material will be transported directly to the site via pipeline, for a distance of approximately 7.0 miles. The pipeline access corridor will be approximately 130 feet wide, and follow the east bank of Freshwater Bayou, and will avoid the Freshwater Bayou Lock by following the bypass channel to the east. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 37,074 feet long (26 acres), the equipment access corridor is approximately 37,134 feet long (110 acres), and neither will require dredging. The pipeline corridor is contained within the equipment access corridor for the entire route except for where it bypasses the Freshwater Bayou Lock. This route is approximately 12,491 feet (8.60 acres). Measure 127c3 will result in a net benefit of 241 AAHUs.

Construction will begin in TY0, prior to construction of measure 306a1, with anticipated completion in TY1. The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4 feet (NAVD88) following dewatering. During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 46,000 feet of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area with a mechanical dredge. Access for the mechanical dredge will be via Freshwater Bayou. No flotation dredging is anticipated to be required. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One (1) foot of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes will be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations will correspond to weir locations.

[1] Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

One renourishment cycle at TY30 is estimated to include 45 acres of marsh restoration along with 425 acres of marsh nourishment. Approximately 781,000 cubic yards of borrow from approximately 1 to 3 miles offshore within state waterbottoms will be required for this renourishment cycle. The borrow area, pipeline corridor, and equipment access for the renourishment cycle will be the same as for construction.

Best management practices will be implemented to avoid unnecessary impacts. By dredging the borrow area with side slopes of no less than a 4H:1V, hypoxic conditions are anticipated to be minimized. The use of airboats to place the pipeline along the corridor will minimize impacts to existing marsh. Booster pumps will be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. The pipeline will be sunk where necessary to provide navigation access. No critical habitat is expected to be impacted by this measure.


127c3
Marsh Restoration at Pecan Island
Legend
Weir
Dredge Pipeline Route (37,074 Feet/26 Acres)
Equipment Access Route (37,134 Feet/110 Acres)
Proposed Borrow Area (3,950 Acres)
Marsh Creation (894 Acres)
Piping Plover Critical Habitat (0 Acres Impacted)
Freshwater Bayou Canal
Cheniere au Tigre
Tigre Point
Gulf of Mexico
N
Project Location
0 1 2 4
Miles
Map Produced By:
Coastal Protection & Restoration Authority
Background Imagery:
2013 National Agriculture Imagery Program
Map Date: January 27, 2015

Measure 306a1
Rainey Marsh Restoration – Southwest Portion (Christian Marsh)

Measure 306a1 is a marsh restoration and nourishment feature located east of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. It will be constructed after the Shoreline Protection 16b measure so that the retention dikes will be protected from wave scour.

The measure will consist of converting approximately 627 acres of shallow open water to brackish marsh habitat, along with the nourishment of approximately 1,269 acres of adjacent brackish marsh, through dedicated dredging of material to be borrowed from approximately 1 to 3 miles offshore within state waterbottoms. Approximately 8.1 million cubic yards of borrow will be dredged with a hydraulic dredge for this marsh restoration and nourishment feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes.[1]

The average depth of open water in the placement area is -0.5 feet (NAVD88), and the average elevation of existing marsh (for nourishment) is 1.43 feet (NAVD88). The borrow area is approximately 3,950 acres, which will be used for all of the dredging needs for measures 127c3 and 306a1, including renourishment. The size, location and configuration of the borrow area (offshore, with the long axis parallel to the shoreline) is designed to minimize the potential to create hypoxic conditions. The material will be transported directly to the site via pipeline, for a distance of approximately 6.7 miles. The pipeline access corridor will be approximately 30 feet wide, and follow the east bank of Freshwater Bayou, and will avoid the Freshwater Bayou Lock by following the bypass channel to the east. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 59,731 feet long (41 acres), the equipment access corridor is approximately 59,695 feet long (179 acres), and neither will require dredging. The pipeline corridor is contained within the equipment access corridor for the entire route except for where it bypasses the Freshwater Bayou Lock. This route is approximately 12,491 feet (8.6 acres). Measure 306a1 will result in a net benefit of 151 AAHUs.

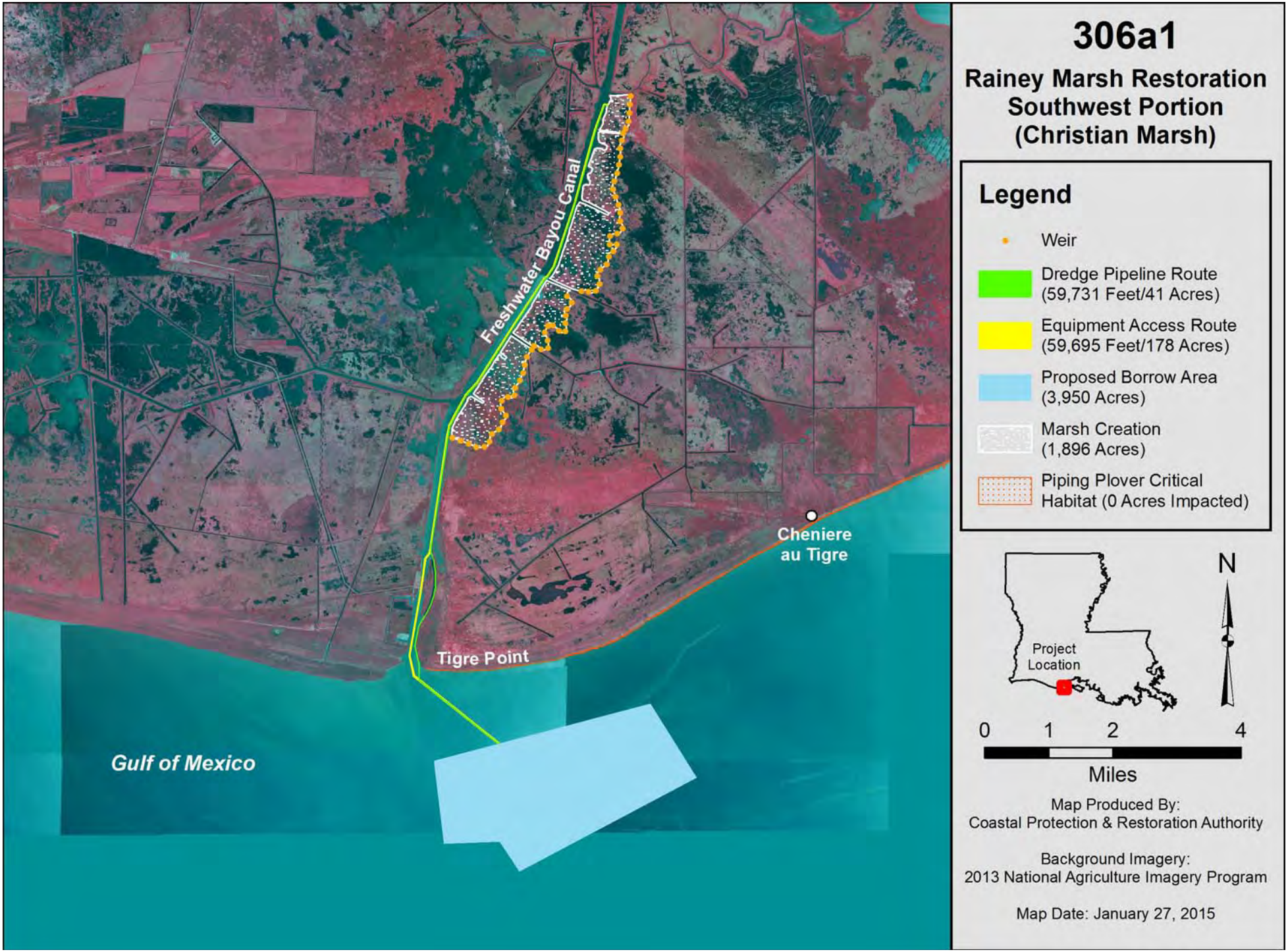
Construction will begin in TY1, after the construction of measure 16bSE which will provide protection to the marsh creation area, and measure 127c3, with anticipated completion in TY2. The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4 feet (NAVD88) following dewatering. During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 108,000 feet of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area with a mechanical dredge. Access for the mechanical dredge will be via Freshwater Bayou. No flotation dredging is anticipated to be required. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One (1) foot of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate

[1] Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

5 foot crown width and slopes no steeper than 4H:1V. Containment dikes will be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations will correspond to weir locations. Dewatering spill boxes will discharge into Freshwater Bayou behind the foreshore rock dikes (Shoreline Protection 16b measure) so that additional sediment discharged in the effluent will preferentially settle between the dike and the shoreline.

One renourishment cycle at TY30 is estimated to include 317 acres of marsh restoration along with 1,484 acres of marsh nourishment. Approximately 3.5 million cubic yards of borrow from approximately 1 to 3 miles offshore within state waterbottoms will be required for this renourishment cycle. The borrow area, pipeline corridor, and equipment access for the renourishment cycle will be the same as for construction.

Best management practices will be implemented to avoid unnecessary impacts. By dredging the borrow area with side slopes of no less than a 4H:1V, hypoxic conditions are anticipated to be minimized. The use of airboats to place the pipeline along the corridor will minimize impacts to existing marsh. Booster pumps will be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. The pipeline will be sunk where necessary to provide navigation access. No critical habitat is expected to be impacted by this measure.


306a1
Rainey Marsh Restoration
Southwest Portion
(Christian Marsh)
Legend
Weir
Dredge Pipeline Route
(59,731 Feet/41 Acres)
Equipment Access Route
(59,695 Feet/178 Acres)
Proposed Borrow Area
(3,950 Acres)
Marsh Creation
(1,896 Acres)
Piping Plover Critical
Habitat (0 Acres Impacted)
Freshwater Bayou Canal
Cheniere
au Tigre
Tigre Point
Gulf of Mexico
Project
Location
N
0
1
2
4
Miles
Map Produced By:
Coastal Protection & Restoration Authority
Background Imagery:
2013 National Agriculture Imagery Program
Map Date: January 27, 2015

Measure 5a
Holly Beach Shoreline Stabilization – Breakwaters

This measure consists of the construction of approximately 8.7 miles of rock breakwaters and is a continuation of existing breakwaters. The breakwaters will be constructed at the approximate -4.0 foot (NAVD88) contour on state waterbottoms to a crown elevation of 3.5 feet (NAVD88) with a crown width of 24.0 feet and 2(H):1(V) side slopes (see Figure 1 for cross section). It will also have a 10-foot (minimum) apron on the Gulf side and a 6 foot (minimum) apron on the shoreward side at -0.5 feet (NAVD88). The rock breakwaters will be constructed using 860,540 tons of rock (minimum of 250-pound gradation) underlain with 386,460 square yards of geotextile fabric to minimize settlement. Breakwater segments will be approximately 280 feet in length with 175 feet of gapping between breakwaters with offset, overlapping ends. The breakwater footprint is approximately 57.4 acres. Flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment will be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes.[1]

Access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 479 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge will be sidecast adjacent to the channel, and returned after construction. Approximately 462 acres are anticipated to be impacted by material removed from the access channels. A maintenance lift at TY15 consisting of approximately 15% of the initial rock quantity is included. A second maintenance at TY25 consisting of approximately 10% of the initial rock quantity is also included. Access for these maintenance events will be along the same access channels as the construction event. There is a possibility that longshore transport may be disrupted by the creation of tombolos. In other words, sediment may eventually fill in the lee of the breakwater and form a tombolo; the breakwater-tombolo formation may then act as a groin which might disrupt the longshore sediment transport in the area. Measure 5a will result in a net benefit of 56 AAHUs.

Best management practices will be implemented to avoid unnecessary impacts. Impacts to sea turtles would be minimized through the use of mechanical dredges and dropping the bucket empty to alter nearby organisms. Shorebirds, including piping plover and red knot, and their habitats will be avoided by remaining offshore. The proposed project would not impact designated wintering piping plover critical habitat.

[1] Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

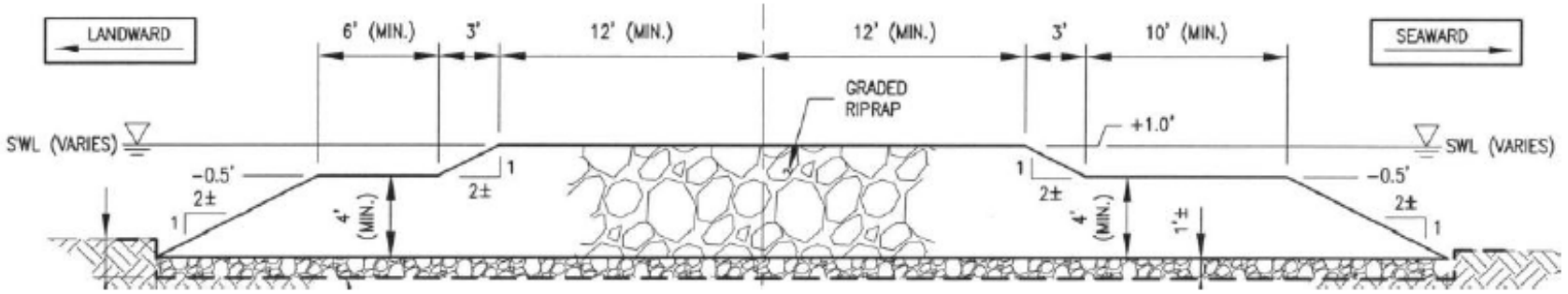
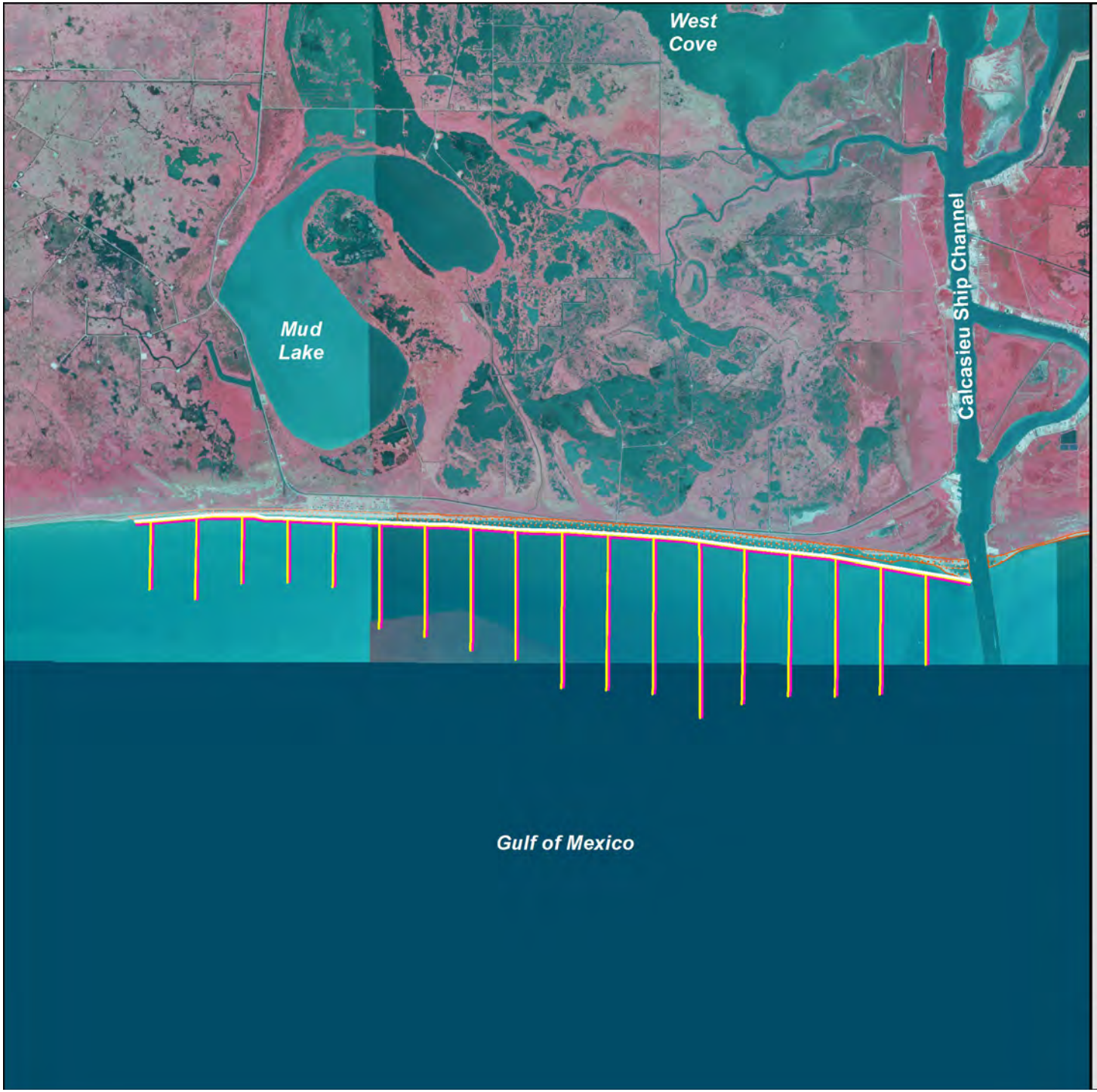


Figure 1. Typical cross-section of the rock breakwater proposed for feature 5a.

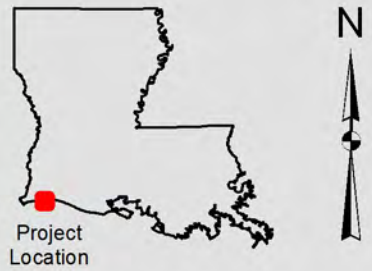


5a

Holly Beach Shoreline Stabilization - Breakwaters

Legend

- Engineered Breakwater (46,014 Feet)
- Access Route Disposal (159,741 Feet/462 Acres)
- Equipment Access Route (161,957 Feet/479 Acres)
- Piping Plover Critical Habitat (0 Acres Impacted)
- Cameron Parish Shoreline Restoration



0 0.5 1 2

Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: January 29, 2015

Measures 6b1
Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou

Measure 6b1 consists of the construction of approximately 11.0 miles of reef breakwater with a lightweight aggregate (LWA) core. The encapsulated LWA core decreases the bearing pressure and allows greater crest elevation and increased wave attenuation (see Figure 1 for cross section). The design of this feature incorporates the design and construction of a portion of a CWPPRA demonstration project (ME-18) along the Rockefeller Refuge shoreline. The breakwater will be located along the approximate -4 foot (NAVD88) contour approximately 150 feet offshore on state waterbottoms. The feature includes geotextile fabric overlying geogrid (447,830 square yards), 1 foot of bedding stone with 3.75 feet of LWA core to be initially covered by approximately 4 feet of armor stone. Approximately 479,150 tons of LWA will be used for the core, and 868,480 tons of rock (minimum 250-pound grade) will be used for the armor stone. The structure will have a crest elevation of +3.25 feet (NAVD88) with a width of 18 feet with 2(H):1(V) side slopes. It will also have a 10-foot (minimum) apron on the Gulf side and a 6 foot (minimum) apron on the shoreward side at -0.5 feet (NAVD88). Breakwater segments will be approximately 280 feet in length with 175 feet of gapping between breakwaters with offset, overlapping ends. The breakwater footprint is approximately 65.9 acres. Flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment will be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes.[1]

Access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 725 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) will be sidecast adjacent to the channel, and returned after construction. Approximately 711 acres are anticipated to be impacted by material removed from the access channels. Approximately 21 acres will be used for the staging area located off of Highway 82 adjacent to the Humble Canal. One maintenance lift at TY25 consisting of approximately 10% of the original armor stone quantity is included. Access for this maintenance event will be along the same access channels as the construction event. There is a possibility that longshore transport may be disrupted by the creation of tombolos. In other words, sediment may eventually fill in the lee of the breakwater and form a tombolo; the breakwater-tombolo formation may then act as a groin which might disrupt the longshore sediment transport in the area. Measure 6b1 will protect 2,140 acres and result in a net benefit of 625 AAHUs.
Best management practices will be implemented to avoid unnecessary impacts. Impacts to sea turtles would be minimized through the use of mechanical dredges and dropping the bucket empty to alert nearby organisms. Shorebirds, including piping plover and red knot, and their habitats will be avoided by keeping construction activities offshore from the Gulf of Mexico

[1] Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

shoreline. The proposed project would not impact designated wintering piping plover critical habitat.

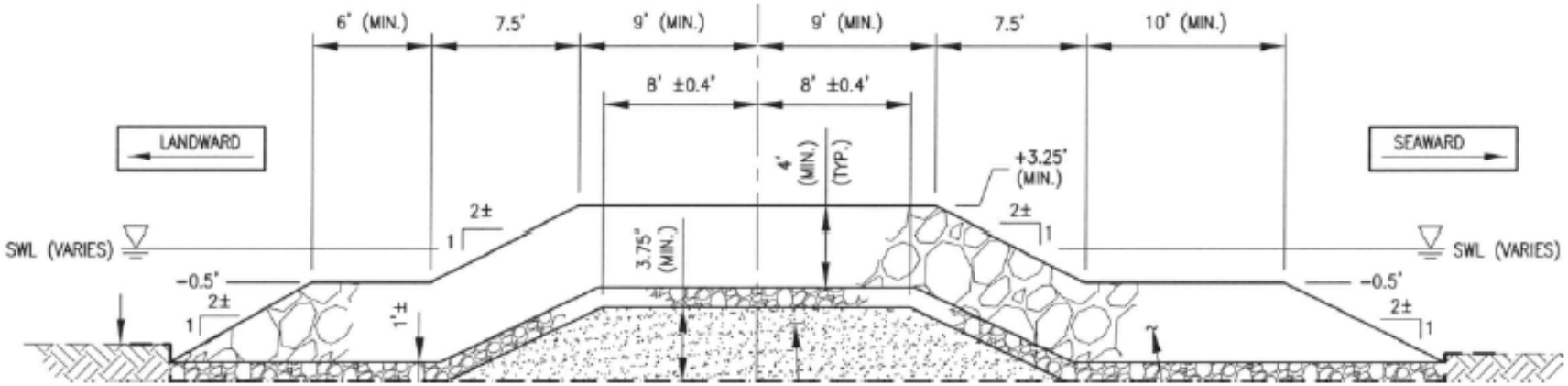
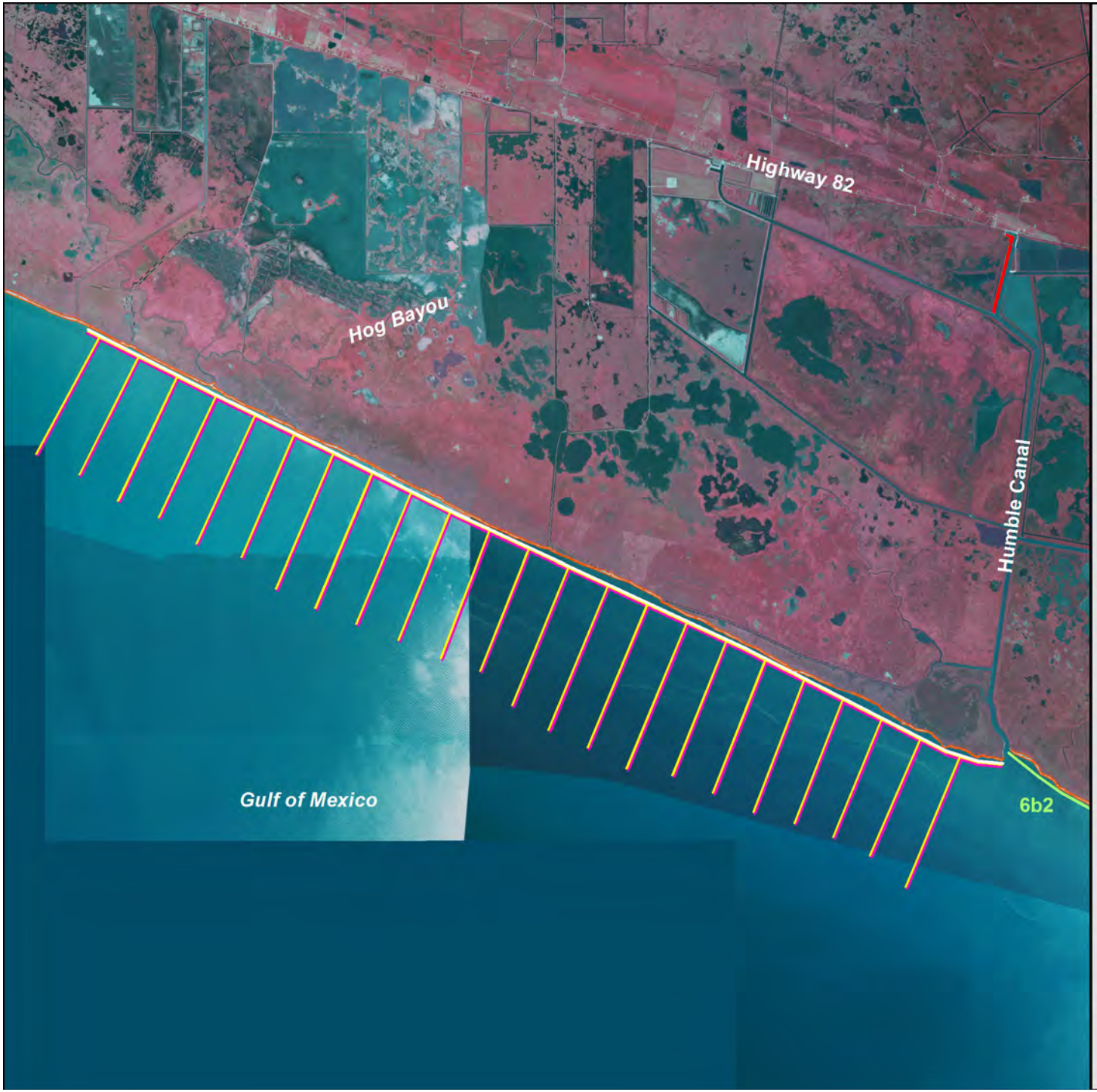


Figure 1. Typical cross-section for the offshore breakwater for measure 6b1.



6b1

Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou

Legend

- Engineered Breakwater (58,293 Feet)
- Potential Staging Area (21 Acres)
- Access Route Disposal (239,001 Feet/711 Acres)
- Equipment Access Route (244,857 Feet/725 Acres)
- Piping Plover Critical Habitat (0 Acres Impacted)

N

0 0.5 1 2

Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: January 27, 2015

Measures 6b2
Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou

Measure 6b2 consists of the construction of approximately 8.1 miles of reef breakwater with a lightweight aggregate (LWA) core. The encapsulated LWA core decreases the bearing pressure and allows greater crest elevation and increased wave attenuation (see Figure 1 for cross section). The design of this feature incorporates the design and construction of a portion of a CWPPRA demonstration project (ME-18) along the Rockefeller Refuge shoreline. The breakwater will be located along the approximate -4 foot (NAVD88) contour approximately 150 feet offshore on state waterbottoms. The feature includes geotextile fabric overlying geogrid (363,270 square yards), 1 foot of bedding stone with 3.75 feet of LWA core to be initially covered by approximately 4 feet of armor stone. Approximately 357,010 tons LWA will be used for the core, and 687,140 tons of rock (minimum 250-pound grade) will be used for the armor stone. The structure will have a crest elevation of +3.25 feet (NAVD88) with a width of 18 feet with 2(H):1(V) side slopes. It will also have a 10-foot (minimum) apron on the Gulf side and a 6 foot (minimum) apron on the shoreward side at -0.5 feet (NAVD88). Breakwater segments will be approximately 280 feet in length with 175 feet of gapping between breakwaters with offset, overlapping ends. The breakwater footprint is approximately 40.2 acres. Flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment will be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes.[1]

Access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 507 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) will be sidecast adjacent to the channel, and returned after construction. Approximately 497 acres are anticipated to be impacted by material removed from the access channels. Approximately 21 acres will be used for the staging area located off of Highway 82 adjacent to the Humble Canal. One maintenance lift at TY25 consisting of approximately 10% of the original armor stone quantity is included. Access for this maintenance event will be along the same access channels as the construction event. There is a possibility that longshore transport may be disrupted by the creation of tombolos. In other words, sediment may eventually fill in the lee of the breakwater and form a tombolo; the breakwater-tombolo formation may then act as a groin which might disrupt the longshore sediment transport in the area. Measure 6b2 will protect 1,583 acres and result in a net benefit of 466 AAHUs.
Best management practices will be implemented to avoid unnecessary impacts. Impacts to sea turtles would be minimized through the use of mechanical dredges and dropping the bucket empty to alter nearby organisms. Shorebirds, including piping plover and red knot, and their

[1] Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

habitats will be avoided by keeping construction activities offshore from the Gulf of Mexico shoreline. The proposed project would not impact designated wintering piping plover critical habitat.

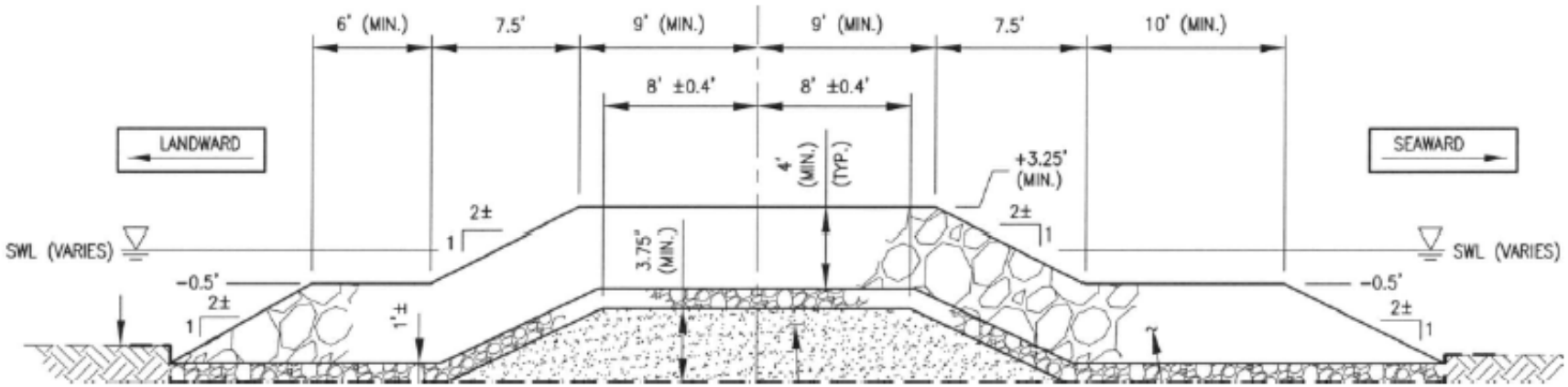
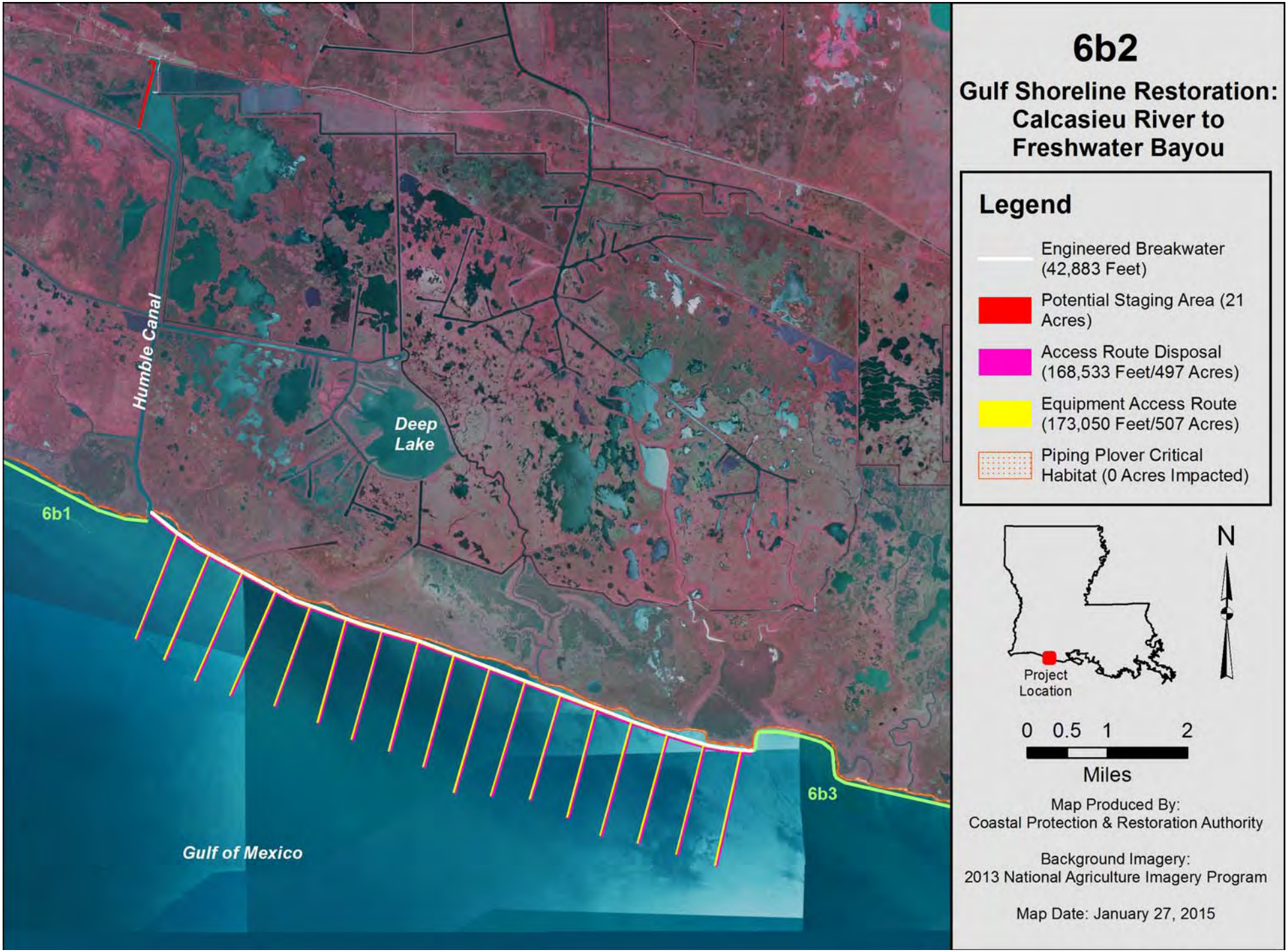


Figure 1. Typical cross-section for the offshore breakwater for measure 6b2.


6b2
Gulf Shoreline Restoration:
Calcasieu River to
Freshwater Bayou
Legend
Engineered Breakwater
(42,883 Feet)
Potential Staging Area (21
Acres)
Access Route Disposal
(168,533 Feet/497 Acres)
Equipment Access Route
(173,050 Feet/507 Acres)
Piping Plover Critical
Habitat (0 Acres Impacted)
Humble Canal
Deep
Lake
6b1
6b3
Gulf of Mexico
Project
Location
N
0 0.5 1 2
Miles
Map Produced By:
Coastal Protection & Restoration Authority
Background Imagery:
2013 National Agriculture Imagery Program
Map Date: January 27, 2015

Measures 6b3
Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou

Measure 6b3 consists of the construction of approximately 6.3 miles of reef breakwater with a lightweight aggregate (LWA) core. The encapsulated LWA core decreases the bearing pressure and allows greater crest elevation and increased wave attenuation (see Figure 1 for cross section). The design of this feature incorporates the design and construction of a portion of a CWPPRA demonstration project (ME-18) along the Rockefeller Refuge shoreline. The breakwater will be located along the approximate -4 foot (NAVD88) contour approximately 150 feet offshore on state waterbottoms. The feature includes geotextile fabric overlying geogrid (244,205 square yards), 1 foot of bedding stone with 3.75 feet of LWA core to be initially covered by approximately 4 feet of armor stone. Approximately 279,030 tons of LWA will be used for the core, and 561,530 tons of rock (minimum 250 pound grade) will be used for the armor stone. The structure will have a crest elevation of +3.25 feet (NAVD88) with a width of 18 feet with 2(H):1(V) side slopes. It will also have a 10-foot (minimum) apron on the Gulf side and a 6 foot (minimum) apron on the shoreward side at -0.5 feet (NAVD88). Breakwater segments will be approximately 280 feet in length with 175 feet of gapping between breakwaters with offset, overlapping ends. The breakwater footprint is approximately 37.8 acres. Flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment will be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes.[1]

Access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 372 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) will be sidecast adjacent to the channel, and returned after construction. Approximately 289 acres are anticipated to be impacted by material removed from the access channels. Approximately 21 acres will be used for the staging area located off of Highway 82 adjacent to the Humble Canal. One maintenance lift at TY25 consisting of approximately 10% of the original armor stone quantity is included. Access for this maintenance event will be along the same access channels as the construction event. There is a possibility that longshore transport may be disrupted by the creation of tombolos. In other words, sediment may eventually fill in the lee of the breakwater and form a tombolo; the breakwater-tombolo formation may then act as a groin which might disrupt the longshore sediment transport in the area. Measure 6b3 will protect 1,098 acres and result in a net benefit of 312 AAHUs.

Best management practices will be implemented to avoid unnecessary impacts. Impacts to sea turtles would be minimized through the use of mechanical dredges and dropping the bucket empty to alert nearby organisms. Shorebirds, including piping plover and red knot, and their

[1] Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

habitats will be avoided by keeping construction activities offshore from the Gulf of Mexico shoreline. The proposed project would not impact designated wintering piping plover critical habitat.

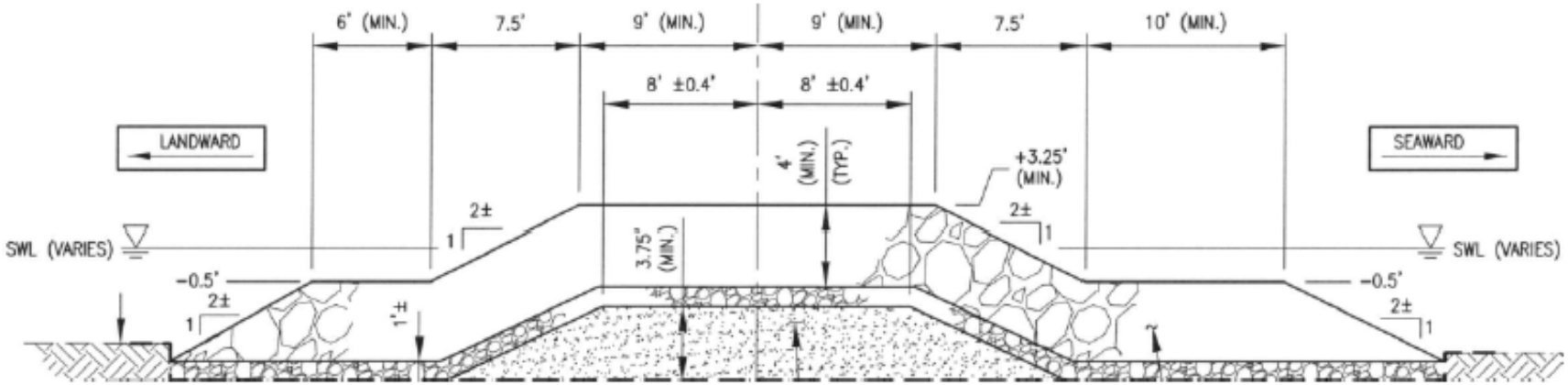
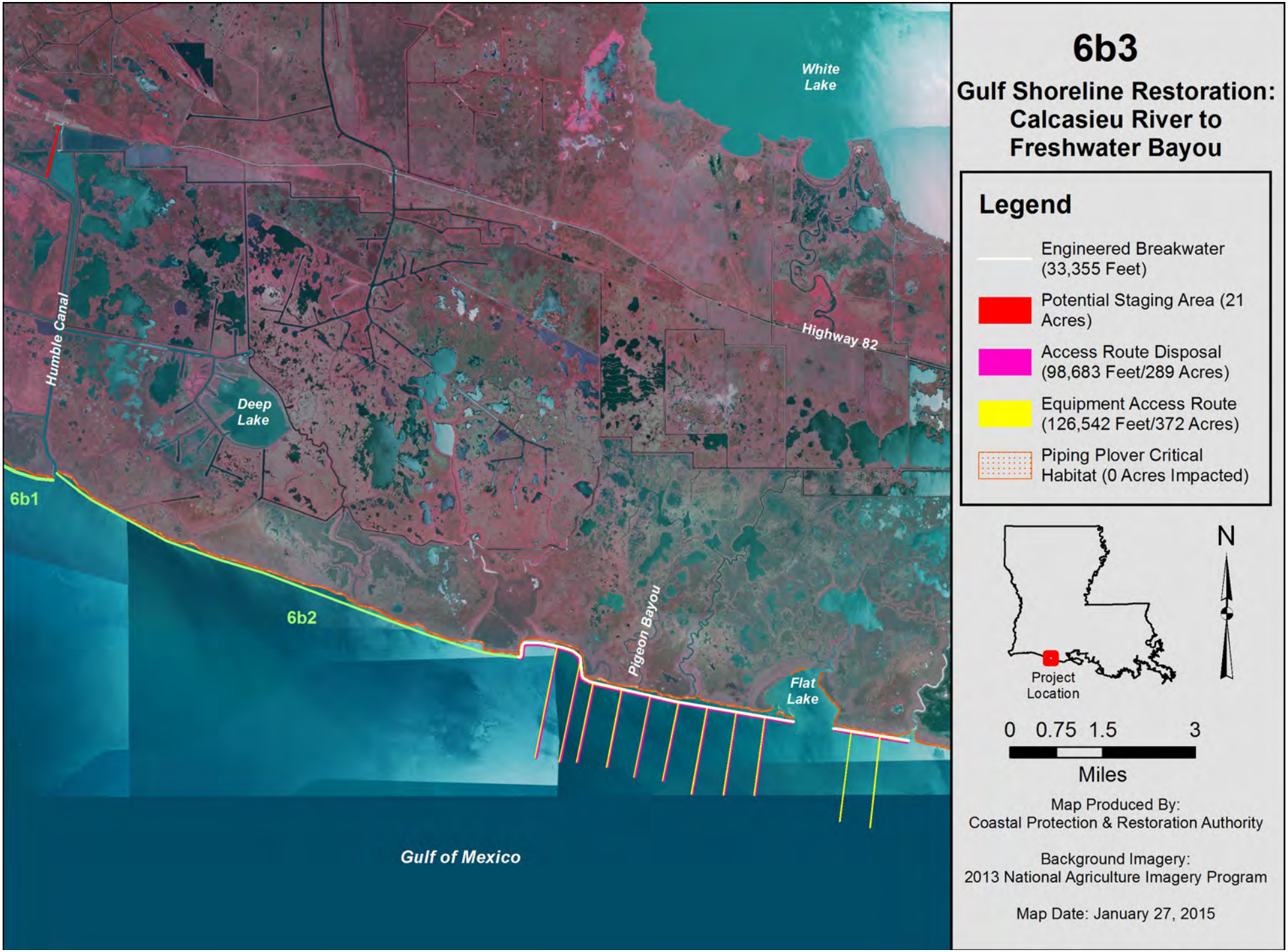


Figure 1. Typical cross-section for the offshore breakwater for measure 6b3.



6b3

Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou

Legend

- Engineered Breakwater (33,355 Feet)
- Potential Staging Area (21 Acres)
- Access Route Disposal (98,683 Feet/289 Acres)
- Equipment Access Route (126,542 Feet/372 Acres)
- Piping Plover Critical Habitat (0 Acres Impacted)

0 0.75 1.5 3

Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: January 27, 2015

Measure 16b
Fortify Spoil Banks of GIWW & Freshwater Bayou

These three measure reaches, 16bNE (approx. 2.9 miles), 16bSE (approx. 7.7 miles), and 16bW (approx. 2.8 miles), consist of the construction of foreshore rock dike shoreline protection along critical areas of the Freshwater Bayou navigation canal. Armoring of the shoreline is intended to prevent the shoreline from breaching so that salt water does not negatively impact the surrounding freshwater marshes and lakes in the Mermentau Basin. Implementation of similar shoreline protection projects along Freshwater Bayou has halted the shoreline erosion along those reaches. The proposed rock dike feature will be located at the approximate -0.3 foot (NAVD88) contour (at Mean Low Water) on state waterbottoms, and contain 617,640 tons of rock (minimum 250 pounds gradation). Crown elevation will be +3.0 feet (NAVD88) with a 4 foot crown width and 4(H):1(V) side slopes (Figure 1). The rock dike will be underlain with approximately 516,860 square yards of geotextile fabric to minimize settlement. Gaps will be included at naturally occurring waterways or navigable channels, with additional gaps for ingress and egress of aquatic organisms at 1,500 foot intervals, as needed. These features will be constructed prior to the Marsh Restoration 306a1 feature to provide protection to the retention dike from wave scour. Limited flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment will be accomplished with a mechanical dredge, and will be limited to a 120-foot bottom width channel not to exceed an elevation of -5.0 feet (NAVD88), with a top width of 130 feet and 2:1 side slopes. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes.[1]

The access channel will be at least 50 feet from the centerline of the rock dike. A maximum of approximately 358 acres could be dredged for the access channels. Any material dredged for access would be placed between the rock dike and the shoreline (to a maximum elevation of +5.0 feet NAVD88). A maintenance lift at TY15 consisting of approximately 15% of the initial rock quantity is included. A second maintenance lift at TY25 consisting of approximately 10% of the initial rock quantity is also included. Measure 16b will protect 662 acres and result in a net benefit of 156 AAHUs.

Best management practices will be implemented to minimize impacts to the water quality of Freshwater Bayou, including the use of mechanical dredging for access channels, if required. Shorebirds, including piping plover and red knot, and their habitats will be avoided by keeping construction activities offshore from the Gulf of Mexico shoreline. The proposed project would not impact designated wintering piping plover critical habitat.

[1] Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

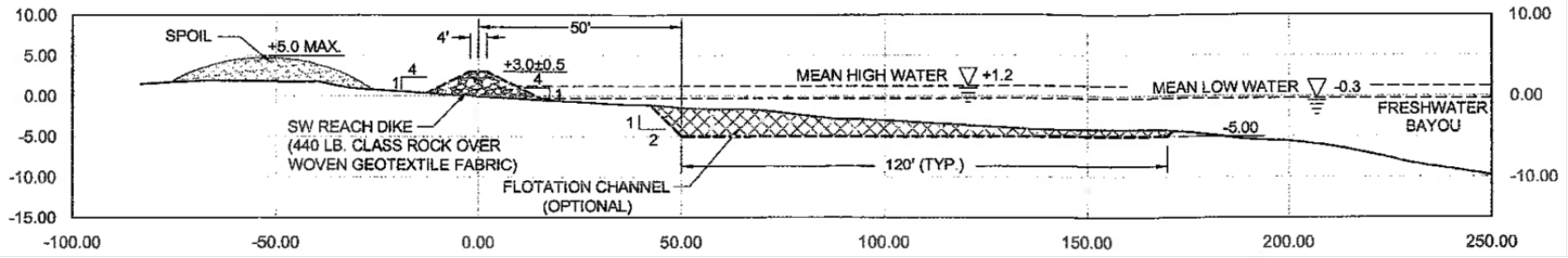
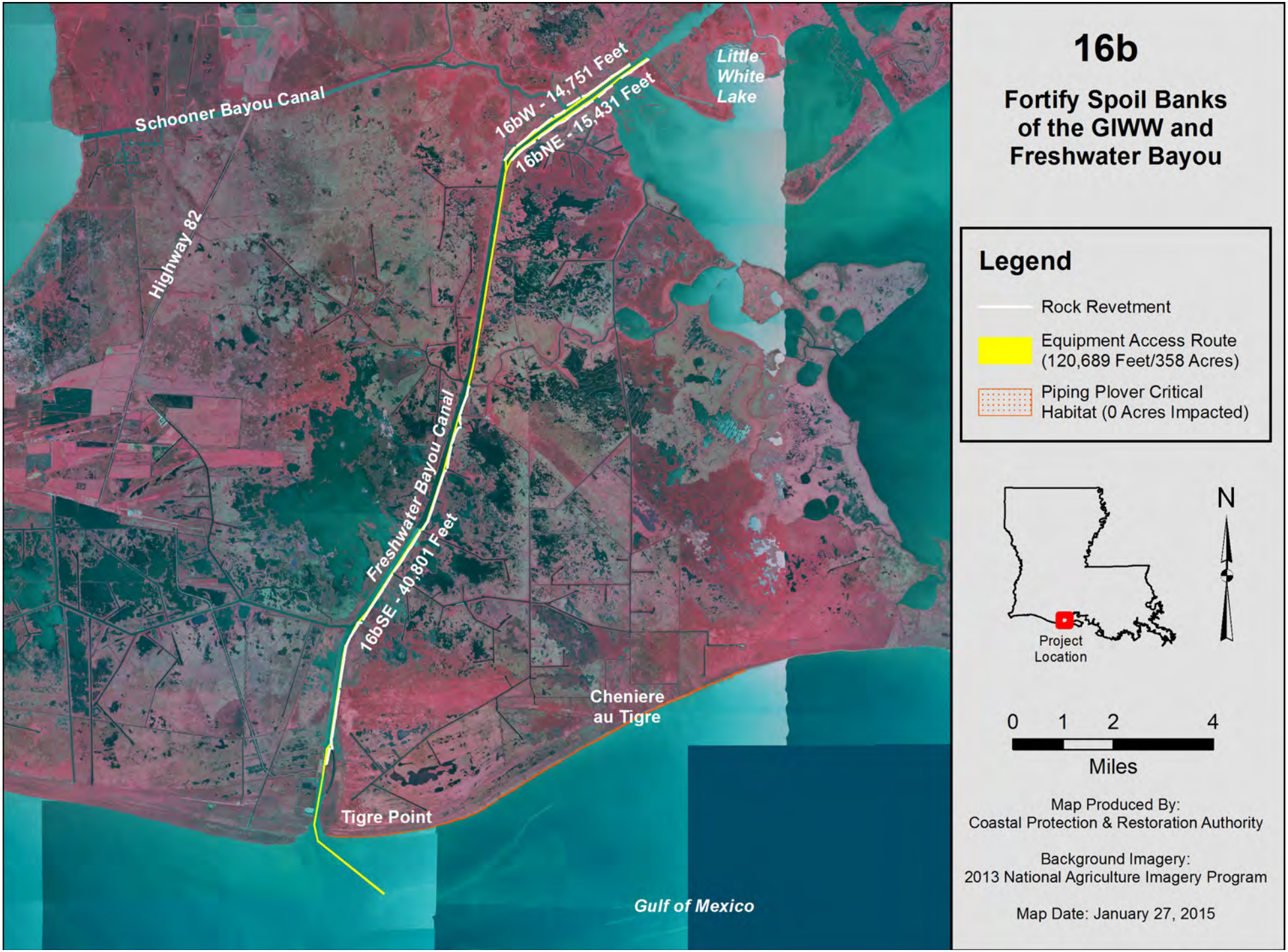


Figure 1. Typical cross-section of the foreshore rock dike proposed for feature 16b.



16b

Fortify Spoil Banks of the GIWW and Freshwater Bayou

Legend

- Rock Revetment
- Equipment Access Route (120,689 Feet/358 Acres)
- Piping Plover Critical Habitat (0 Acres Impacted)

0 1 2 4

Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: January 27, 2015

Measure CR
Chenier Reforestation

Measure CR is a series of chenier ridge reforestation features located along existing chenier ridges situated within Cameron and Vermilion Parishes (see attached maps).

The measure will consist of invasive species control and planting native species seedlings to achieve a 50 percent canopy cover. From the possible locations, east/west-oriented chenier ridges with elevations identified through LiDAR surveys as generally being greater than +5 feet (NAVD 88) were selected. The +5 feet (NAVD 88) target elevation is considered a conservative minimum elevation that could sustain tree plantings for the duration of the study period given relative sea level rise, and is taken from Didier (2007) and other professional opinions.

The selected chenier ridges included: Measure 416 - Grand Chenier Ridge (nine locations with 251.9 total acres); Measure 509c - Bill Ridge (three locations with 21.4 total acres); Measure 509d - Cheniere Au Tigre (one location with 8.2 acres); Measure 510a - Blue Buck Ridge (eight locations with 524.4 total acres); Measure 510b - Hackberry Ridge (three locations with 148.5 total acres); and Measure 510d - Front Ridge (eleven locations with 458.7 total acres). The total acreage included in the Chenier Reforestation measure is 1,413.1 acres. A total of 538.2 AAHUs are anticipated to be restored with this measure.

Prior to planting, an application of 64 ounces of Clearcast® would be sprayed over the top of hardwoods to control invasive species, primarily Chinese tallow (*Triadica sebifera*), if needed. Up to 50 percent of the measure acreage would be planted with live oak (*Quercus virginiana*) and hackberry (*Celtis occidentalis*). Bare-root seedlings would be planted on 10x10-foot spacing (435 trees per acre), which assumes 57% survival. Fencing would be installed to exclude cattle and reduce deer herbivory. Fencing would be 7.5 feet tall, and fence posts would be installed in concrete with a small tractor using an auger bit and portable cement mixer. Approximately 150,000 linear feet of fencing would be required at $1.00 per linear foot, not including labor. Fencing would not be required for the CR-509c and CR-509d measures, since they are located near the coast where there is no current cattle grazing remote and not subject to cattle grazing.

For a given planting, a minimum of 250 seedlings/saplings per acre must be present (with a 60 to 40 hard mast to soft mast ratio) at the end of the fourth year (i.e., Year 5) following successful attainment of the one-year survivorship criteria. Trees established through natural recruitment may be included in this tally; however, no less that 125 hard mast-producing seedlings per acre must be present. Surviving hard mast seedlings must be representative of the species composition and percentage identified in this Plan. Exotic/invasive species may not be included in this tally. By Year 5 (four years following successful attainment of the one-year survivorship criteria) the perimeter will be virtually free (approximately 5% or less on an acre-by-acre basis) of exotic/invasive vegetative species. The developing plant community must exhibit characteristics and diversity indicative of a viable native forested chenier community commensurate with stand age and site conditions by Year 5.

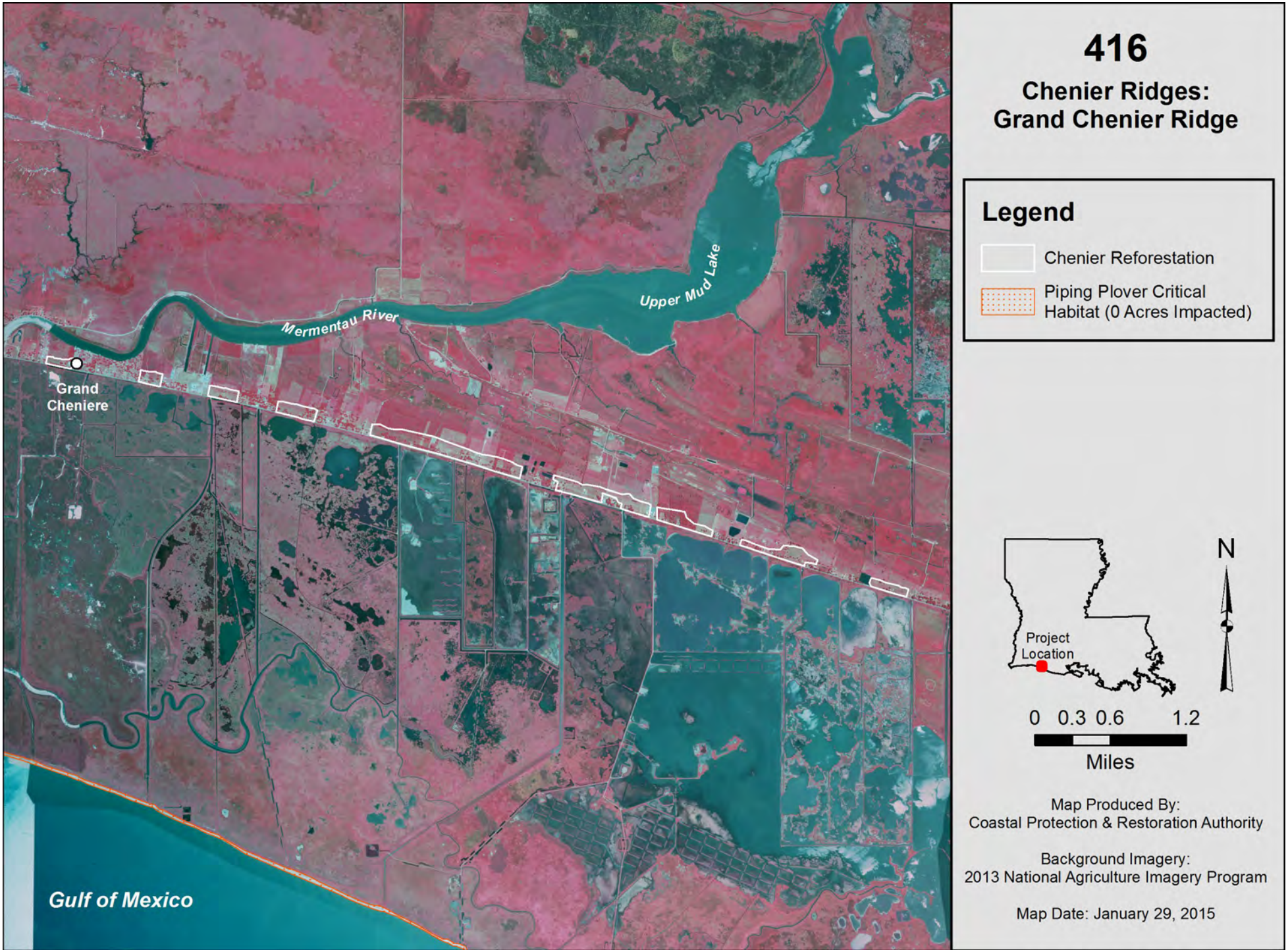
Costs are based on:

- Cost of bare root seedlings is $0.30 per seedling which includes delivery to the sites.
- Planting scheme: 10x10 spacing (435 trees per acre)
- Planting costs (labor): 20 acres and up = $65 per acre; 19 acres and less = $75 per acre

- Chinese tallow control spraying: $150 per acre for helicopter spraying. Sites would be sprayed using 64 ounces of Clearcast® sprayed over the top of hardwoods to control the tallow trees.
- Fencing cost is $1.00 per linear foot, not including labor (150,000 linear feet required).
- Air boat rental may be required for measures that are inaccessible by automobile (extra $10 per acre).

Mobilization for the chenier ridge restoration sites would be via Louisiana Highway 82 or other existing roadways, except for remote locations, such as measures 509c and 509d, which are not accessible by roadway. Measure 509c would be accessed by airboat using existing waterways and canals to the extent practicable to minimize impacts to existing wetlands. This access corridor is 13,867 feet long (10 acres). Measure 509d would be accessed by airboat or small barge from existing waterways connected to Freshwater Bayou. No wetland impacts are anticipated. For sites that are not immediately accessible via roadways, staging areas would be on developed land near the roadway, and will not damage existing chenier or other habitats. Planting would be accomplished by delivering seedlings to the planting site with a four-wheeler, marsh buggy or airboat, depending on topography and land use.

***Recommendation*.** Because of the low relative cost, it was decided that the chenier reforestation program would be included in any restoration alternative recommended by the study.



416

Chenier Ridges: Grand Chenier Ridge

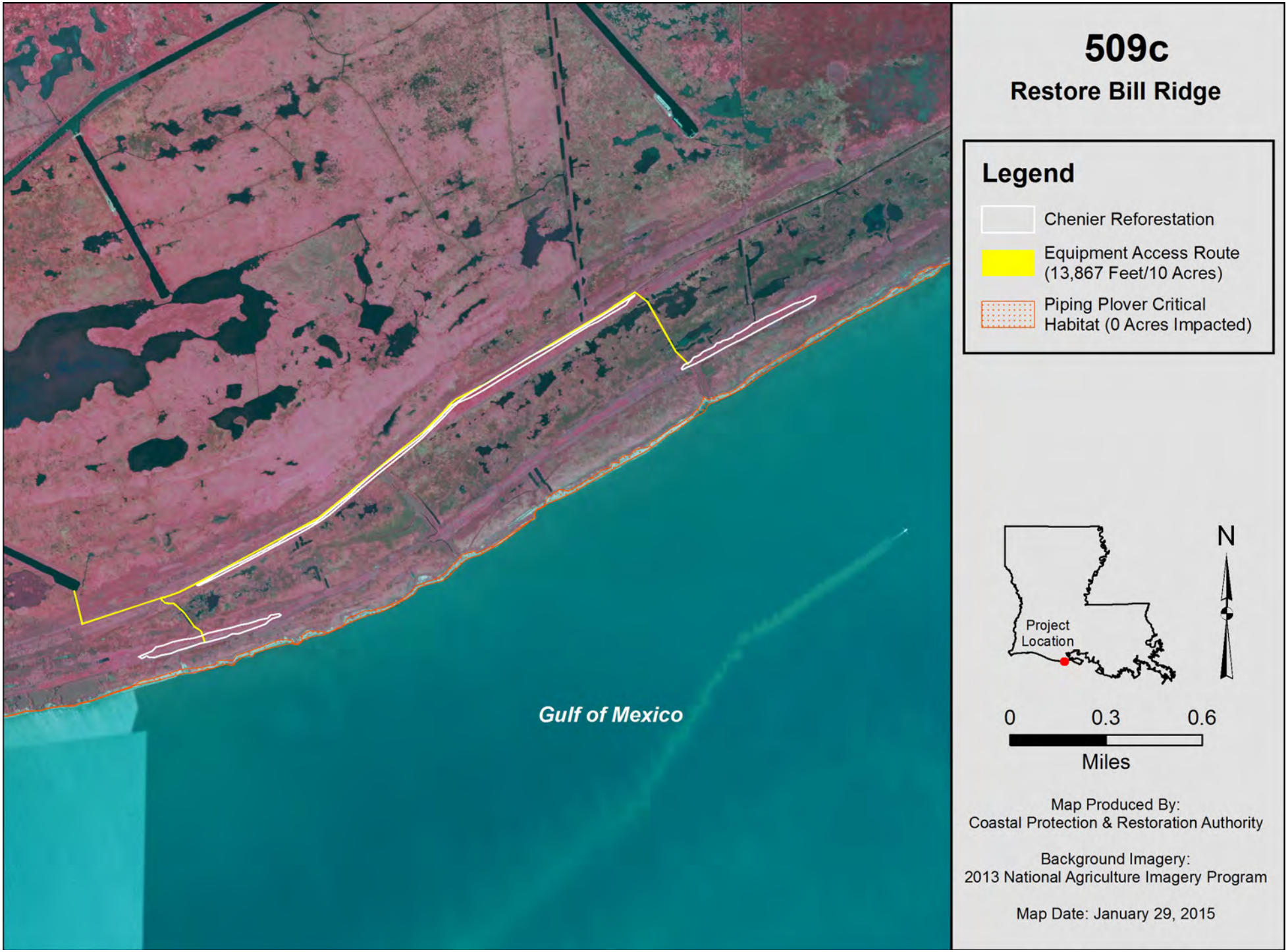
Legend

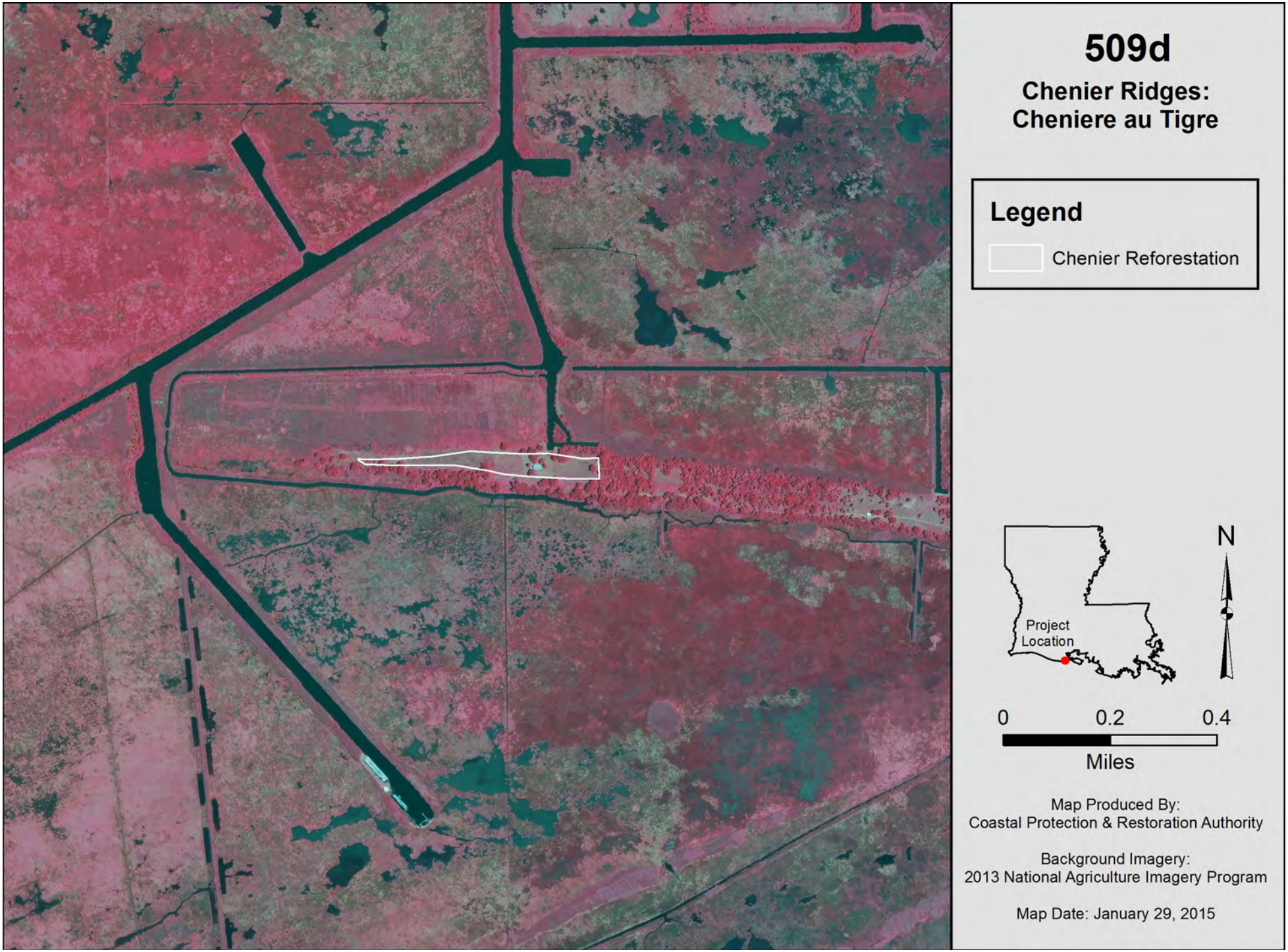
- Chenier Reforestation
- Piping Plover Critical Habitat (0 Acres Impacted)

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: January 29, 2015


509c
Restore Bill Ridge
Legend
Chenier Reforestation
Equipment Access Route (13,867 Feet/10 Acres)
Piping Plover Critical Habitat (0 Acres Impacted)
Gulf of Mexico
Project Location
N
0
0.3
0.6
Miles
Map Produced By:
Coastal Protection & Restoration Authority
Background Imagery:
2013 National Agriculture Imagery Program
Map Date: January 29, 2015

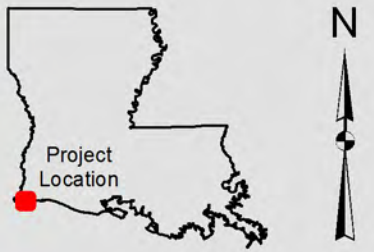

509d
Chenier Ridges:
Cheniere au Tigre
Legend
Chenier Reforestation
Project
Location
N
0
0.2
0.4
Miles
Map Produced By:
Coastal Protection & Restoration Authority
Background Imagery:
2013 National Agriculture Imagery Program
Map Date: January 29, 2015

510a

Restore Blue Buck Ridge

Legend

- Chenier Reforestation
- Piping Plover Critical Habitat (0 Acres Impacted)



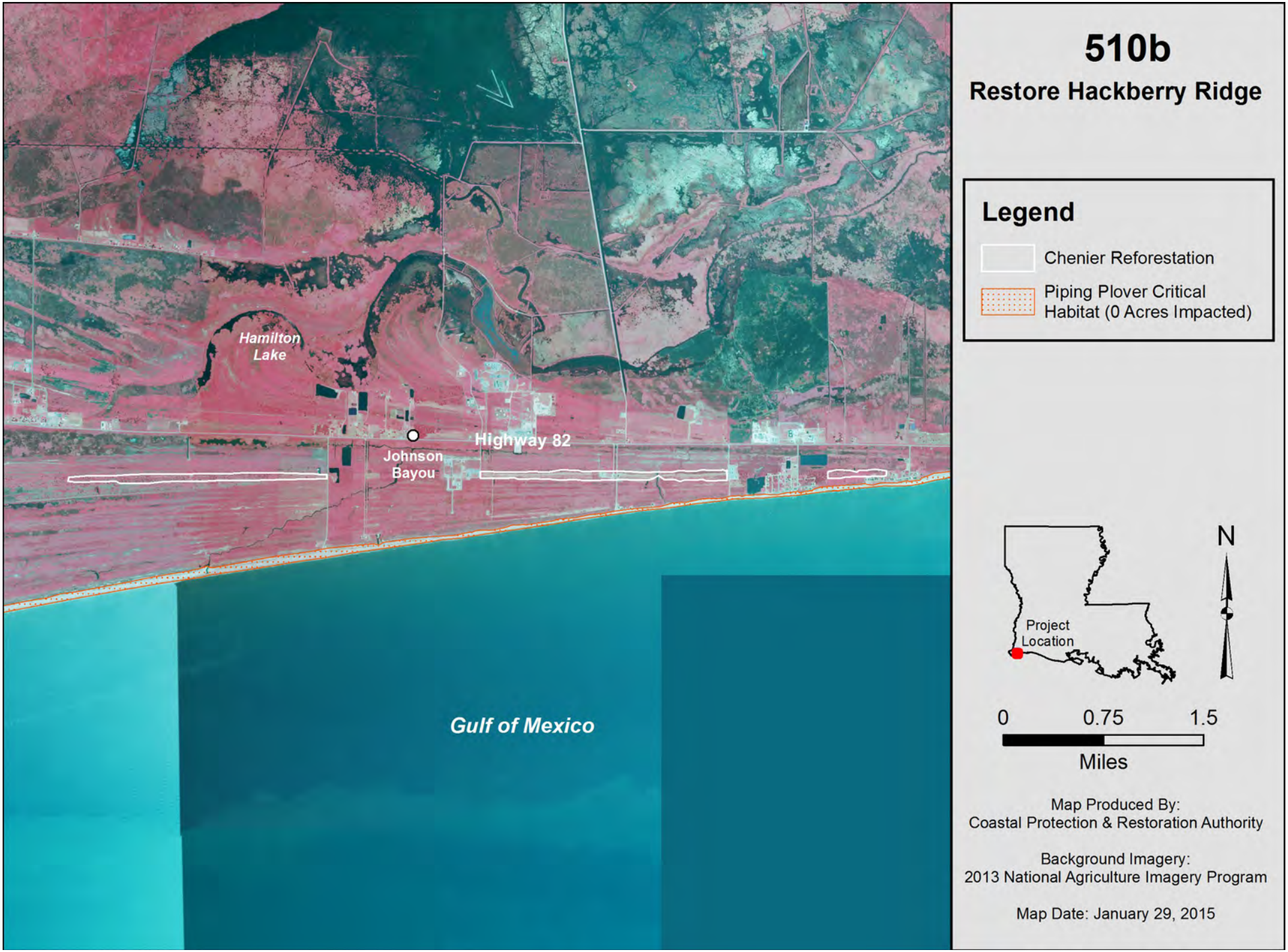
0 1.5 3

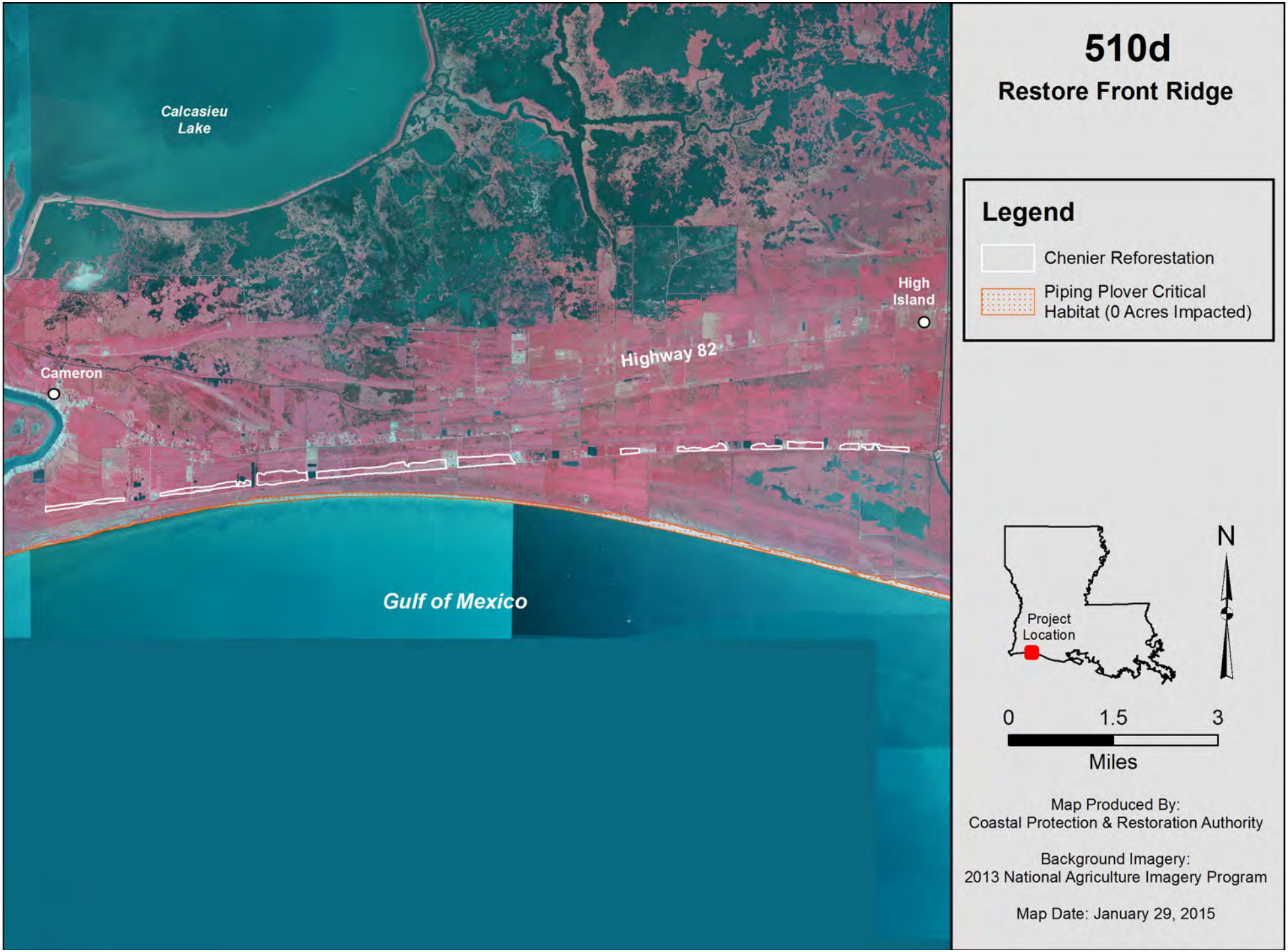
Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: January 29, 2015


510b
Restore Hackberry Ridge
Legend
Chenier Reforestation
Piping Plover Critical Habitat (0 Acres Impacted)
Hamilton Lake
Johnson Bayou
Highway 82
Gulf of Mexico
Project Location
N
0
0.75
1.5
Miles
Map Produced By:
Coastal Protection & Restoration Authority
Background Imagery:
2013 National Agriculture Imagery Program
Map Date: January 29, 2015



510d

Restore Front Ridge

Legend

- Chenier Reforestation
- Piping Plover Critical Habitat (0 Acres Impacted)

0 1.5 3

Miles

Map Produced By:
Coastal Protection & Restoration Authority

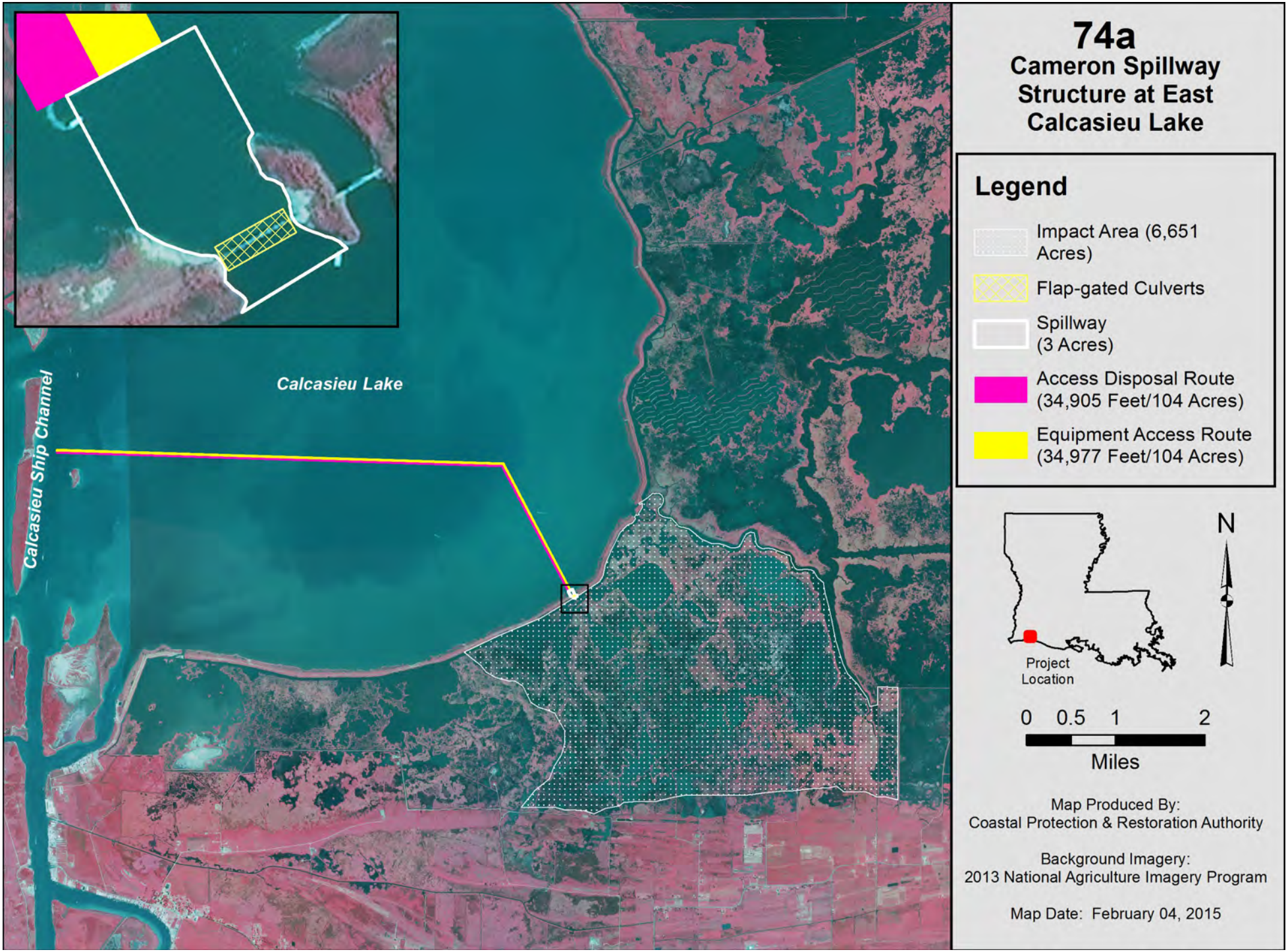
Background Imagery:
2013 National Agriculture Imagery Program

Map Date: January 29, 2015

Measure 74a
Cameron Spillway Structure at East Calcasieu Lake

Hydrologic and salinity control measure 74a is proposed as a spillway structure located on East Calcasieu Lake, located at the breach in the levee south of Lambert Bayou, and would aid in the drainage of storm surge waters from wetlands located behind the Cameron-Creole levee. The measure would not be used to manage daily tidal exchange from Calcasieu Lake. Existing water levels are approximately +1.0 feet (NAVD88). The structure dimensions are approximately 204 feet wide by 600 feet in length, and would directly impact approximately 3 acres of water bottoms in Calcasieu Lake (state waterbottoms). The structure would be a passive system of up to eight 6-foot flap-gated culverts with a bottom invert of +2.5 feet (NAVD88), with a spillway channel lined with 47,800 tons of rock (250-pound gradation). Water levels of greater than +2.5 feet (NAVD88) would drain through the structure. This is anticipated to occur every 15-20 years due to tropical storms overtopping the Cameron-Creole levee. The area of impact would be approximately 6,651 acres of brackish marsh, which would experience a reduced impact from salt-water inundation following storm surge events through the expedited drainage of surge waters.

Construction access would be via the access corridor previously permitted for the Cameron Creole levee repair following Hurricane Ike. The access channel for construction equipment will be dredged to a depth of -7 feet (NAVD88) where required with a mechanical dredge to a bottom width of 80 feet, and a top with of approximately 130 feet, with 4H:1V side slopes. Material from the access channel would be stockpiled adjacent to the access channel and returned after construction. With an access channel length of approximately 34,977 feet, approximately 104 acres of state waterbottoms would be dredged for access. Approximately 104 acres of state waterbottoms would be used for temporary placement of dredged material. The staging area would be adjacent to the Calcasieu Shipping Channel and would not impact any wetlands or other habitats.



74a
Cameron Spillway Structure at East Calcasieu Lake

Legend

- Impact Area (6,651 Acres)
- Flap-gated Culverts
- Spillway (3 Acres)
- Access Disposal Route (34,905 Feet/104 Acres)
- Equipment Access Route (34,977 Feet/104 Acres)

N

0 0.5 1 2

Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: February 04, 2015