4.0 RECOMMENDED PLAN
(PREVIOUSLY TENTATIVELY SELECTED PLAN) (*NEPA REQUIRED)

The NED RP is the Nonstructural 0-25-Year Floodplain Plan (Modified Plan 8).

The NER RP is Alternative Plan CM-4.

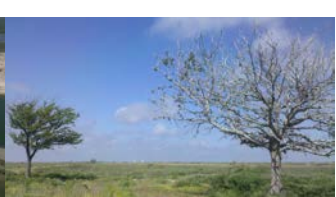
4.1 The National Economic Development (NED) Plan
4.1.1 Description of the NED RP

The NED RP applies nonstructural measures to eligible structures and is a 100% voluntary project. Eligible structures are located in the 0-25-year floodplain and are individually economically justified (i.e. the costs to apply a particular nonstructural measure are less than the hurricane storm surge damages predicted to occur to that structure over the 50-year period of analysis). Eligible structures are those whereby the structure owner would be offered the opportunity to apply nonstructural measures (elevating, dry flood proofing, or localized storm surge risk reduction measures) to the structure if certain eligibility criteria are met. If the structure owner does not want to participate in the Project, USACE and the NFS would defer any further action on that structure until such time as the structure owner elects to participate or until the period of construction ends. However, the Government reserves, at its sole discretion, the right to determine whether or not a structure may participate in the NED RP after a structure owner has declined participation, and if allowed to participate, the timing and scheduling of such participation in the Project. There are 3,961 residential and non-residential structures that meet the initial eligibility criteria (i.e., they are located in the 0-25-year floodplain and are individually economically justified).

The NED RP consists of the following measures (see Appendix L for additional details on the nonstructural plan and methods of implementation):

1. Elevation of eligible residential structures. The term "base flood" is defined by the NFIP as the "flood having a 1% chance of being exceeded in any given year and is also called the 100-year flood." For purposes of this study, the BFE has been forecast into the future based on anticipated hydrologic conditions predicted to occur over the 50-year period of analysis (2025-2075). This measure entails lifting the entire structure or the habitable area to the predicted 2075, 100-year BFE unless the required elevation is greater than a maximum of 13 ft above ground level. Any structure that requires elevating greater than 13 ft above ground level would be ineligible to participate due to engineering and risk related factors. At the time of this Final Report, a structure inventory has been compiled which identifies 3,462 residential structures in the Study Area that have been deemed to be preliminarily eligible to participate in the Project (See Appendix N). The following process to determine final eligibility, which is more fully described in Appendix L, would apply to property owners willing to participate in the elevation Project whose structures meet the initial eligibility criteria (i.e. structure is located in the 0-25-year floodplain and is individually economically justified):
    - Residential property owners would be asked to grant a temporary right-of-entry to USACE and the NFS to enter upon the property to conduct such property and structural investigations deemed necessary to determine final eligibility for participation in the Project.
    - The property owner would submit satisfactory documentation as deemed necessary by USACE to establish proper proof of structure ownership.
    - The NFS would conduct title research to confirm the property has clear title; and any appraisals that may be necessary (i.e., if a structure requires elevation of greater than 13 ft).
    - An ASTM Phase I Environmental Site Assessment (ESA) and asbestos investigation would be conducted to confirm the absence of HTRW and damaged or friable asbestos or asbestos-containing materials. If warranted, additional HTRW investigations may be required.
    - The structure would be evaluated by USACE to ensure that certain eligibility criteria are satisfied including but not limited to: elevation of the structure would not exceed 13 ft above ground level, the structure is in suitable condition for elevation, threatened or endangered species would not be



impacted, no fill would be placed in waters of United States, wetlands would not be impacted, and the property has not previously receive any disaster assistance for structure elevation.

2. Dry flood proofing of eligible non-residential structures (excluding large warehouses). Dry flood proofing consists of sealing all areas below the hurricane storm surge damage risk reduction flood protection level of a non-residential structure to make it resistant to water intrusion from hurricane storm surge and to reduce the risk that hurricane storm surge can get inside by making walls, doors, windows, and other openings resistant to water penetration. Walls are coated with sealants or waterproofing compounds, or plastic sheeting is placed around the walls and covered. Back-flow prevention mechanisms for water and sewer lines such as drain plugs, standpipes, grinder pumps, floor drains, and back-up valves can be installed. This measure is viable for appropriate structures if design hurricane storm surge depths are generally less than 3ft. Hydrodynamic forces would also be a consideration. For structures with crawlspaces, the only effective way to dry flood proof is to make the first floor resistant to the passage of waters from hurricane storm surge.

   While each individual eligible non-residential structures will be evaluated for the most cost effective nonstructural measure, the government reserves the right to determine which measure shall be implemented at each structure location.

   The process of determining eligibility would be substantially similar to the process followed above in connection with the elevation of residential structures. Identification of eligibility criteria and details concerning the process will be developed during PED and provided prior to Project implementation. At the time of this Final Report, a structure inventory has been compiled which identifies 342 preliminarily eligible non-residential structures and public buildings in the Study Area. Eligible property owners who request application of the dry flood proofing measures to their commercial structures or public buildings, must provide temporary right-of-entry, undergo site and structural assessments, present the requisite documentation, and undergo a structure-specific analysis performed during the design phase that is substantially similar to that which is described above in connection with the elevation of residential structures but is designed to ensure that the structure is suitable for this method of flood proofing and that this method of flood proofing is the most cost-effective measure for the structure under consideration.

3. Construction of localized storm surge risk reduction measures less than six feet in height around warehouses. These measures are intended to reduce the frequency of flooding but not eliminate floodplain management and flood insurance requirements. Localized storm surge risk reduction measures can be constructed of earth, concrete, masonry, or steel and placed around a single structure or a contiguous group of structures. It should be noted that some local governments may have adopted floodplain management rules that exceed the minimum requirements of the NFIP, and may limit the ability of certain flood proofing measures to be constructed if effects of the flood proofing measure create the potential for drainage problems by displacing flood storage, elevating buildings on fill, requiring significant tree removal, etc.

   While each individual eligible warehouse will be evaluated for the most cost effective nonstructural measure, the government reserves the right to determine which measure shall be implemented at each warehouse location.

   At the time of this Final Report, a structure inventory has been compiled which identifies 157 preliminarily eligible warehouses in the Study Area. Eligible property owners, who request implementation of the localized storm surge risk reduction measures around their warehouses must provide temporary right-of-entry, undergo site and structural assessments, present the requisite documentation, and undergo a site-specific analysis performed during the design phase that is substantially similar to that which is described above in connection with the elevation of residential structures but is designed to ensure that the structure is suitable for this method of flood proofing and that this method of flood-proofing is the most cost-

effective measure for the structure under consideration. Identification of eligibility criteria and details concerning the process will be developed during PED and provided prior to Project implementation.

4.1.2 Implementing Nonstructural Measures for Eligible Structures

During the Preconstruction Engineering and Design (PED) phase of the Project, the Government, in consultation with the NFS, will develop the Agreement which must be executed by the Owners of each eligible property in advance of the implementation of the non-structural measure determined by the Government to be appropriate for that structure. Appendix L provides an exemplary listing of some of the provisions anticipated to be included within that Agreement and describes the process and requirements for securing that agreement and proceeding with the eligibility determination and non-structural implementation for each structure measure. The agreement will contain restrictive covenants that run with the land in perpetuity. Among other rights, the agreement will include the right for the NFS and the Government to inspect the property during structure elevation. The agreement, as well as any required curative documents, subordination or release agreement(s), shall be recorded by the NFS in the public records of the Parish in which the property is located prior to commencement of the nonstructural improvements on the property. While each individual eligible structure would be evaluated for the most cost effective nonstructural measure, the government reserves the right to determine which measure would be implemented at each structure location. Once the eligibility determination investigations are complete (as described in Appendix L), Appendix L describes the steps that would be completed to initiate the appropriate nonstructural measure at each eligible structure location.

4.1.2.1 Implementation of Nonstructural Improvements

Following eligibility determination, execution of an Agreement between the non-Federal sponsor and the Owner(s), and receipt of proof of recordation of the required documentation, construction of the nonstructural measure would begin. Detailed information regarding the anticipated non-structural measures that would be utilized for each type of structure, eligibility requirements, the process for implementation of the non-structural measures and the eligible and ineligible costs of non-structural measures is contained in Appendix L of this Report.

4.1.2.2 Notice of Construction Completion

Upon completion of the nonstructural improvement of each structure, an inspection would be performed by USACE and upon final approval by the District Engineer, or his designee, a Notice of Construction Completion (NCC) would be issued to the NFS and the individual nonstructural project would be closed out as complete.

4.1.3 NED Implementation Plan

This Final Report recommends a strategy to implement the nonstructural Project for eligible structures. Structures that have been identified as preliminarily eligible as part of the RP are located across the 4,700 mile, three-parish study area. In order to effectively implement the NED RP, clusters of eligible structures that represent the highest risk for hurricane storm surge damages (i.e. those with a FFE below the 10-year stage) would be identified and prioritized for construction. Individual structures would be addressed based on a ranking of risk from highest to lowest within the cluster. The ranking of individual structures would be revisited as elevation work is completed, as additional funding is distributed, and as new clusters are identified. Addressing groups of structures within a small geographic area would be more cost-effective, efficient, and would also allow for a more strategic methodology for applying nonstructural measures to at-risk structures. Additional work on this process would occur during the design phase of the Project. More details on this process can be found in Appendix L.

4.1.4 Hydrologic and Economic Evaluation of the RP

Hydrologic and economic models were run to determine the inundation effects of storms on residential, commercial, and industrial properties. Hydrologic modeling provided the existing and future hydrologic conditions needed to assess storm surge-related damages. The modeling identified 90 hydrologic reaches which

are characterized by unique relationships between storm surge elevations and frequency (Figure 4-1). An inventory of structure values, types, and FFEs was compiled for all structures in the 90 reaches (approximately 52,000 structures). Approximately 16,000 structures are located within the 100-year (1% ACE) floodplain. Based on the results of storm surge modeling, a flood damage analysis model was used to estimate economic damages under the "No-Action" alternative and the potential benefits resulting from the implementation of nonstructural measures.

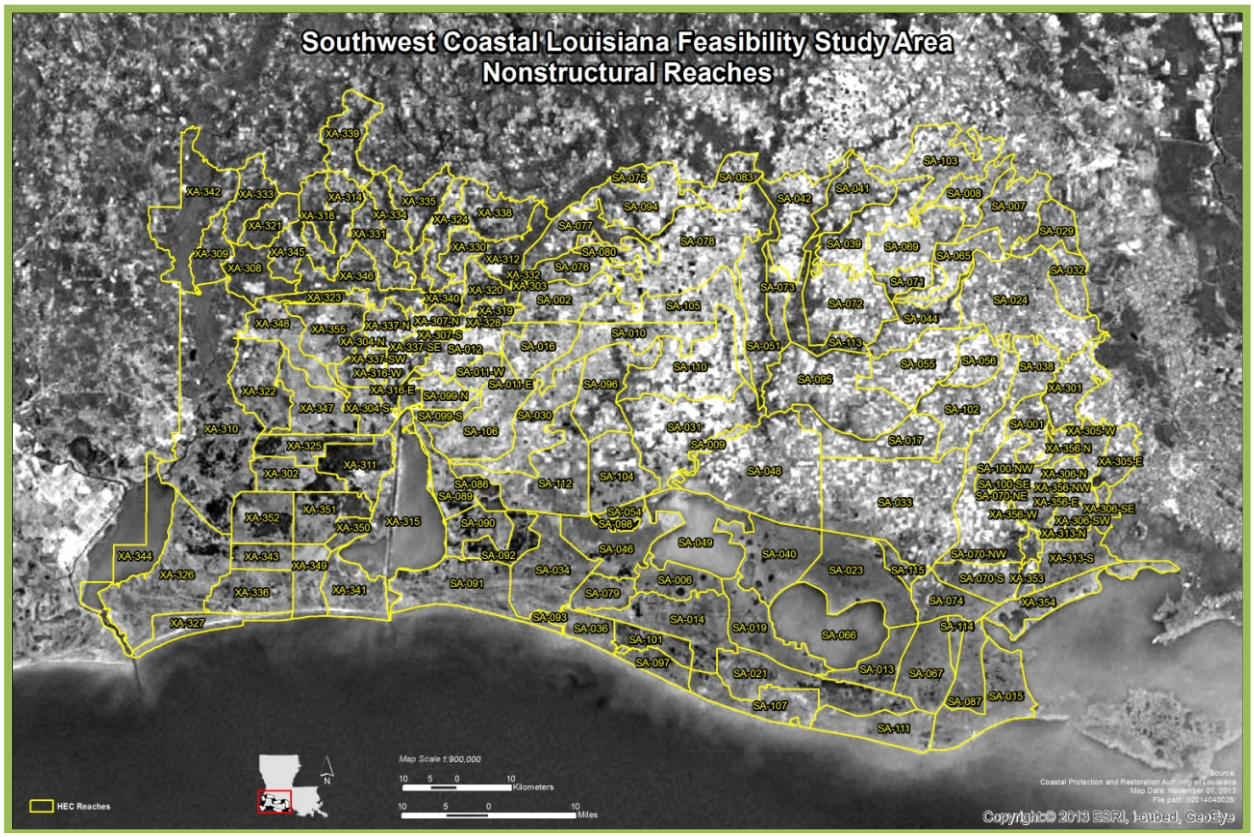


Figure 4-1: Hydrologic reaches in the study area.

The NED RP (Modified Plan 8) assessed benefits using 2025 conditions as the base flood criteria and identified properties in the 0-25-year (0-4% ACE) floodplain as the highest increment of net benefits. The economic evaluation employed several assumptions regarding the nonstructural action to be taken for any given structure. Residential structures with FFEs below the 2025 25-year (4% ACE) WSE were eligible to be raised to the year 2075 100-year (1% ACE) BFE. This evaluation was incrementalized by also evaluating the structures within the 25-50-year (4-2% ACE) floodplain and the 50-100-year (2-1% ACE) floodplain. Project costs and benefits were calculated on the basis of voluntary participation in the nonstructural plan unless certain criteria were met for a given structure. However, should participation be less than 100%, then both benefits and costs are expected to decline in similar proportion such that the BCR would remain unchanged for this plan. In addition, due to the lack of any economically justified structural alternatives there are no viable options to achieve greater positive net benefits. The NED RP addresses study area structures in most immediate need of hurricane storm surge damage risk reduction. Figure 4-2 depicts the eligible structures in the NED RP across the study area. High resolution maps depicting individual eligible structures can be found in Appendix N.

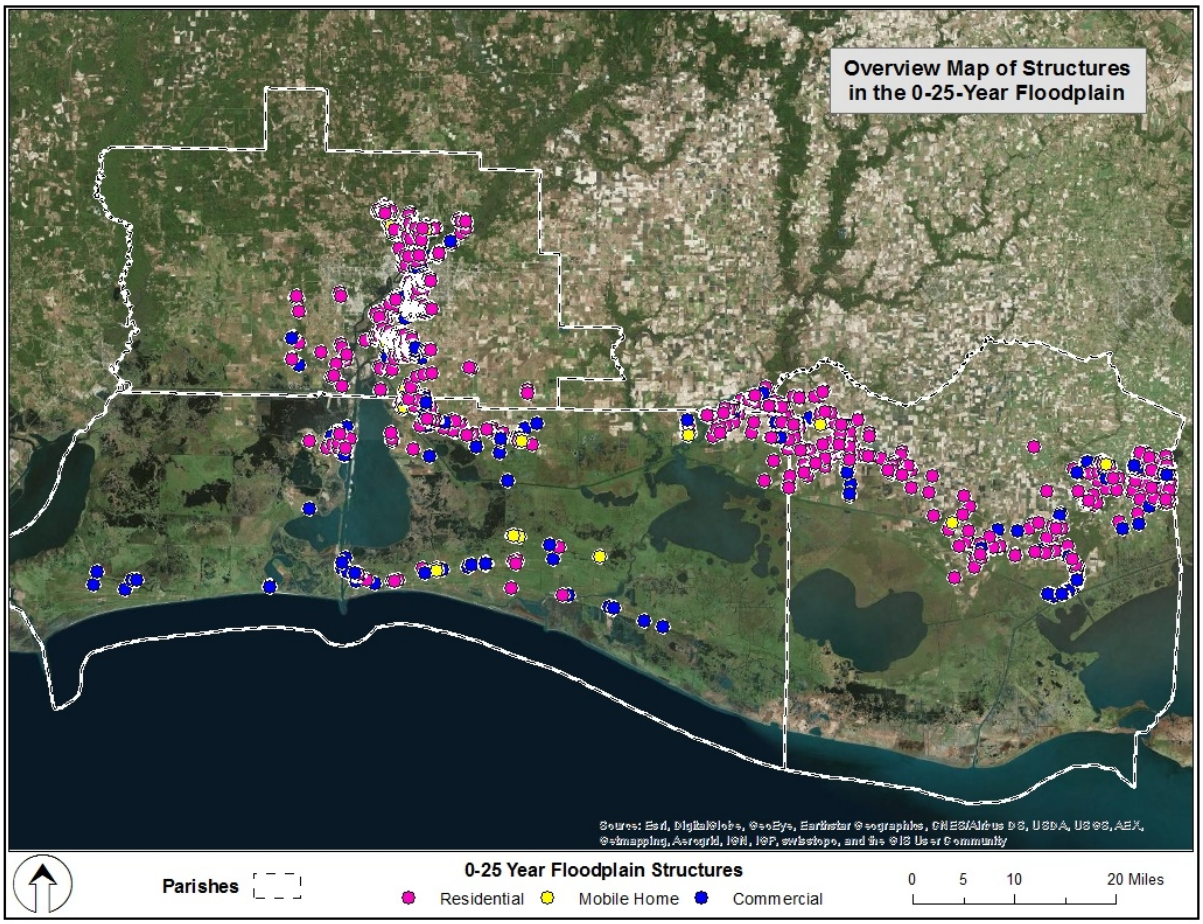


Figure 4-2: Eligible structures in the 0-25-year floodplain.

The expected annual benefits for addressing all the structures within the 0-25 year (0-4% ACE) floodplain are approximately $204 million. The project first cost for implementing the nonstructural Project is $906 million and the corresponding average annual cost is approximately $36 million. The NED RP would have no disproportionate adverse impacts on minority and low-income populations.

4.1.5 Compliance with Executive Order 11988

In implementing Executive Order (EO) 11988, the procedures identified below were followed in the formulation of the NED RP consistent with the 8-step process outlined in ER 1165-2-26, Paragraph 8.

1. While the proposed action is located within the limits of the base floodplain, the recommendation of the NED plan is designed to elevate residential properties that are the most prone to hurricane storm surge damage beyond the limits of the base flood and floodplain values would remain unaffected.

2. Since the study objective is to reduce the risk of damage from hurricane storm surge for the properties at the highest risk of damage specifically within the base floodplain, there are no practicable alternatives to the action that would result in an equivalent level of hurricane storm surge damage risk reduction.

3. The revised draft report was released to the public in February 2015 and a series of public meetings held in April 2015 in the communities of Abbeville, Lake Charles, and Cameron where the public was given the opportunity to express their views on the proposed plan and invited to submit written and electronic comments directly to the Corps during the official public comment period. CEMVN responded to all comments submitted by the public and a number of state and Federal agencies.

4. The proposed action is expected to exclusively have beneficial impacts to natural floodplain values. No losses of natural and beneficial floodplain values are foreseen. The nonstructural nature of the NED RP is designed to avoid adverse impacts to ecosystem or natural resources that are normally associated with structural hurricane storm surge damage risk management alternatives. The nature and extent of flooding within the base floodplain is unaffected by the measures designed to adapt structures to hurricane storm surge damage and/or make them resilient to damages during hurricane storm surge events.

5. The risk of inducement of development within the floodplain is normally associated with structural projects such as levees and floodwalls where vacant parcels are no longer subject to frequent flooding, lowering the cost of potential development and providing economic incentives for the addition of inventory to the floodplain. Even if induced inventory complies with floodplain management regulations such that the primary structure is technically higher than the base flood elevation, the addition of structures to the floodplain still incurs residual risk for hurricane storm surge events that are beyond the design performance of levees and floodwalls. In this case, the NED RP does not induce development since the actions to be taken address structures that are currently within the floodplain. The implementation of the NED RP may make the community more resilient and sustainable in the future, but it does not otherwise lower the cost of developing in the floodplain as a prerequisite to providing economic incentives that may induce development.

The NED RP is not expected to induce development in the base floodplain. Future development is defined as development that is expected, in equal amount, under both without-project and with-project conditions. In contrast, induced development is that which takes place only due to the fact the Federal government has taken action (with-project condition) to reduce hurricane storm surge damage risk in the floodplain. This generally occurs since the cost of development in the floodplain is lowered owing to the lowering or avoidance of future costs associated with hurricane storm surge damage. The NED RP does not reduce hurricane storm surge damage risk for any other structures in the floodplain other than those specifically identified under existing conditions. Therefore, the plan creates no further incentives created to develop in the floodplain. The spatial distribution of target properties in the NED RP is large and diverse. In instances where the application of nonstructural measures are in concentrated areas (neighborhoods or clusters), preservation and an enhanced sustainability of the area may result as a positive project effect. However, given the voluntary nature of plan participation it is too speculative to draw a conclusion of this nature.

Within the study area as a whole, approximately 75% of all hurricane storm surge damage risk, estimated as future without-project expected annual damages, is associated with hurricane storm surge events occurring in the 25-year floodplain. The NED RP effectively reduces risk of damage from the surge event for a majority (80%) of all structures in the 25-year floodplain. Therefore, project performance is exceptionally high and residual risk is correspondingly minimized to a significant degree. The Residual Risk section of the Economic Appendix (Appendix D) details the calculation of residual risk and documents this conclusion.

6. Structure elevation is the primary nonstructural measure comprising the NED RP. Implementation of this measure is not anticipated to extend beyond the footprint of the property boundaries and right-of-way associated with the structure being elevated. There are no identified adverse impacts to ecosystem resources associated with this action, with the possible exception of HTRW-related issues that can only be identified on a structure-by-structure basis through specific site inspection conducted prior to Project implementation. In cases where adverse impacts may occur due to the presence of HTRW, the Government reserves the right to revert to the no-action plan as it relates to that structure, thus avoiding the potential for adverse environmental impacts. This approach applies equally to the other two primary techniques: dry flood proofing and localized storm surge risk reduction measures. Therefore, methods to minimize adverse impacts of the action are not necessary for this NED RP.

7. The public has been notified through the dissemination of the revised draft report and public meetings that there is no practicable alternative to locating the action in the floodplain, particularly since the Project targets properties that are located in the areas within the base floodplain that are most prone to flooding from hurricane storm surge. Moreover, it has been observed that the public is accepting of the action located within the

floodplain since project performance is designed to lower the risk of damage from hurricane storm surge to the community without the adverse impacts normally associated with structural measures.

8. Of all alternatives considered, including those that have been found not to be economically justified and thus not in the Federal interest, the NED RP is the most responsive to the planning objectives established by the study and consistent with EO 11988.

The NED RP consists of applying nonstructural measures to residential and non-residential properties and commercial warehouses. Included among the estimated 342 non-residential structures are public and semi-public buildings, none of which are owned by the Federal government. No critical facilities are included in the plan that would necessitate action to relocate the structure outside of the 0.2% floodplain. Although EO 13690 is under current pubic review, the NED RP does comply with the current tenets of the EO by incorporating sea level rise in project planning. The target level of risk reduction for the elevation of residential structures is the 100-year BFE predicted under 2075 hydrologic conditions, which incorporates the effects of anticipated sea level rise. This approach utilizes data informed by the best available climate science. Moreover, since sea level rise in most reaches in the study area will increase the stage of the 100-year event from 2025 to 2075 by two ft or greater, then elevation to the 100-year stage under 2075 conditions will effectively elevate the structures by two or more ft above the 100-year stage under both 2025 and current (2012) conditions.

There are no practicable alternatives to implementing the Project in the floodplain. This is made evident by the fact that the avoidance of hurricane storm surge damage risk in the floodplain itself is the objective of the study and is positive in its effect on floodplain values.

Floodplain values in population centers primarily relate to conveyance of floodwaters from riverine systems and storage for storm-surge induced and rainfall flooding (tropical and extra-tropical in nature). Flood risk in the study area is dominated by storm-surge and rainfall effects, whereas riverine systems contribute relatively little. In much of the study area, drainage from flood events is characterized by slow gravity drainage past coastal cheniers toward the Gulf of Mexico. Flood durations involving saltwater standing in excess of 1-2 days is typical and accounts for higher than expected economic damage to structures. The NED RP would neither exacerbate nor alleviate this attribute of the floodplain, as nonstructural measures attempt to adapt to floodplain characteristics rather than alter them, as would be expected with structural measures such as levees, floodwalls, and channelization. For the same reason, any other attribute associated with floodplain values, such as water quality, carbon sequestration, fish and wildlife habitat, would be equally unaffected under the RP.

4.1.6 NED Mitigation

Since the application of all nonstructural measures would occur on existing developed properties there are no expected impacts to wetland habitats as a result of implementation of the NED RP and every attempt would be made to avoid impacting wetland habitats. For an eligible structure, if elevating, dry flood proofing, or construction of localized storm surge risk reduction measures results in impacts to wetlands or threatened/endangered species, or if the measure requires the placement of fill in waters of the United States the structure would no longer be eligible as part of the NED RP. Therefore, mitigation for unavoidable impacts from NED plan implementation is not anticipated to be necessary.

4.1.7 NED Adaptive Management and Monitoring

Mitigation is not anticipated to be necessary for the NED RP and as a result adaptive management would not be required.

4.1.8 NED Operations, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R)

For all structure types (residential, non-residential, and warehouses) OMRR&R costs are expected to be 'de minimus' (works) and will be confined to regular, periodic surveys and site visits of structures where NED measures have been applied in order to determine that the requirements of the OMRR&R Manual are being

met (estimated to be $5,000 annually though this estimate will be revised during the PED phase). Once the NED measures have been implemented and NCC'd, the owner of the property will be responsible for all cost and risk of maintaining, repairing, rehabilitating and replacement the flood proofing measures that were utilized for the subject property. A draft OMRR&R Manual shall be provided to the NFS as early as possible in the period of implementation because USACE will issue a NCC for each flood proofed structure once the flood proofing is complete. At the time of the issuance of an NCC, the NFS's obligations for operation and maintenance for the subject structure or lands commences. Flood proofed structures and acquired tracts shall be considered a separable element and functional portion of the Project. The NFS is responsible for the enforcement of the provisions of the agreement executed by the owners of property benefiting from the NED measures and for enforcement of the requirements of the OMRR&R Manual, including by not limited to, compliance with the requirements of Section 402 of the Water Resources Development Act of 1986, as amended. Upon NCC for NED implementation for a given structure or contract, the USACE will furnish to the NFS a final OMRR&R manual addressing, among other things, the NFS responsibility for enforcement of terms of the flood proofing agreement, as well as other OMRR&R requirements.. The NFS shall conduct periodic inspections at the intervals specified in the OMRR&R Manual to ensure that the owners, their heirs, and assigns, are in compliance with the terms and conditions of the executed agreements and shall provide written certifications to USACE that the structures and lands have been inspected and that no violations have been found. Regarding the elevated residential structures, the inspections will determine among other things, that no part of the structure located below the level of the lowest habitable finished floor has been converted to living area for human habitation, or otherwise altered in any manner which would impede the movement of waters beneath the structure; that the area below the predicted 2075 100-year BFE is being used solely for the parking of vehicles, limited storage, or access to the structure and not for human habitation; that mechanical, electrical or plumbing devices have not been installed below the BFE; that the property is in compliance with all applicable floodplain ordinances and regulations. USACE shall have the right, but not the obligation, to perform its own inspections of the flood proofed structures and lands acquired pursuant to the Project.

Further details regarding the obligations of the NFS for the NED RP are set forth in Chapter 7 of this report.

4.1.9 NED Risk and Uncertainty Analysis

Risk and uncertainty are intrinsic in water resources planning and design. This section describes various categories of risk and uncertainty pertinent to the study.

Environmental Factors

Relative Sea Level Rise: There is uncertainty about how much sea level change would occur in the region. An assessment of RSLR was included in plan formulation. The evaluation of RSLR is documented in the Engineering Report. (Appendix B). Calculations based on Engineering Regulation 1100-2-8162 determined that the low, intermediate, and high rates of RSLR at 2075 would be 1.4 ft, 2.3 ft, and 3.2 ft higher than current levels respectively (Table 4-1). The intermediate rate was used for models and screening alternatives, with the low and high rates then used in a sensitivity analysis on the RP to ensure that no superior alternatives had been accidentally eliminated due to the reliance on a single scenario. This analysis is detailed in Appendix O, the Climate Performance and Resilience Register.

RSLR could impact the benefits achieved by the RP. Because the NED RP was developed using the intermediate RSLR rate, the NED RP would provide fewer benefits than anticipated should the low RSLR rate result and more benefits with the high RSLR rate. With the high RSLR rate, the nonstructural component would be less effective because structures would have to be raised to a height that would increase their risk from wind damage during a storm. This could ultimately lead to a shift in project strategy from elevations to relocations if future sea level is higher than anticipated. Such a shift would occur only after careful consideration of not only sea level, but also community cohesion and the viability of supporting infrastructure such as transportation, water supply, and wastewater. For those structures already raised in a previous round of elevation, actual economic benefits could be lower than anticipated if community cohesion and supporting infrastructure are not maintained. These factors would be considered during the implementation phase of the

Project. The Corps will continue to monitor local conditions and determine if the intermediate scenario of RSLR is occurring. If observed conditions deviate from intermediate to high sea level forecasts during design or construction, reevaluation of the NED and NER will be required.

Table 4-1: Predicted RSLR rise rates for the gage on the GIWW west of Calcasieu Lock.

Year and SLR Scenario	Calcasieu West RSLR increment (in feet)	Calcasieu West gage elevations (NAVD88 feet)
2025 Low SLR	0.125	0.222
2025 Intermediate SLR	0.216	0.313
2025 High SLR	0.307	0.405
2075 Low SLR	0.919	1.424
2075 Intermediate SLR	1.827	2.331
2075 High SLR	2.736	3.241

Storms: Uncertainty with regard to the size and frequency of hurricanes that could result from global meteorological events, such as El Nino and La Nina, cannot be predicted over a set period of time. The storm record is constantly being updated and a large storm such as Hurricane Rita or a slow moving storm such as Hurricane Isaac can alter the expected return period for other storms. To reduce the uncertainties of storm events, storms with varying degrees of size, intensity, and path were included in the modeling. By using a long-term record of different storm scenarios, the effects of such storms were incorporated into the modeling to reduce the uncertainty in the determination of Project benefits (see Appendix B, Engineering Report).

If indicated by monitoring of RLSR and/or climate non-stationarity, the nonstructural Project can be adaptive and make adjustments to design criteria and structures preliminarily recommended for inclusion in the Project. This is achievable because the implementation of a broad regional nonstructural project, as well as evidence of a greater-than-predicted rate of RSLR and/or coastal storm damages, would be distributed over time. As sea level changes and is updated over time, the floodplain definitions would change, design criteria can be adapted, and the predicted 2075 100-year BFE could be adjusted upward. This could require raising structures deemed eligible in the NED RP to a higher elevation than identified at this time. Conversely, some structures that were already elevated would return to the risk pool earlier than forecast. However, this would also be a time-distributed effect and identification of greater than expected RSLR would correspond to a potential reduction of forecast benefits.

Modeling Factors

ADCIRC and HEC-RAS models appear to provide a specific response on the NED RP in any given scenario; however it is only a representative point of reference in a complex system. While the analysis is enhanced by the models, application of the models can introduce error and uncertainty. Calibration and verification efforts are employed so that the models more closely replicate observed changes or at least provide insight into the limitations of the model. Models are limited by basic, underlying assumptions and uncertainties. Some of the simplifying assumptions include the model parameters such as boundary conditions, which are limited by the data available, especially during storm events and the time period selected for analysis. Another model parameter assumption is model geometry. Survey data/LiDAR has good coverage in some areas; other areas require assumptions, interpolations, extrapolations, or known elevation points to get coverage. Another uncertainty is that a limited number of storm scenarios are modeled. It is assumed that various storm scenarios over a number of years would represent a much higher indicator of the ability for nonstructural measures to appropriately avoid or minimize surge related damages from major storm events. Models use available historic data to extrapolate future storm conditions and frequency. The size and frequency of storms included are based on statistical analysis but do not account for meteorological changes that can increase or decrease storms over a period of several years. The models do not account for the potential of increased frequency and intensity of storms due to climate change.

Economic Factors

There is an economic risk in under or overestimating the future benefits associated with the project alternatives. The with-project damages and overall benefits associated with the alternatives were estimated based on the existing and FWOP damages. For structural features, this could potentially result in the feature not being economically justified or preliminary estimates of the BCRs being overstated. However, no structural features are part of the NED RP so this risk is minimized.

The HEC-FDA model (Version 1.2.5b) was used to calculate the damages for the without project existing and future conditions. Economic and engineering inputs were used to calculate damages for without project existing conditions (2012), the Project base year (2025), and the end of the period of analysis (2075). In an evaluation performed on the nonstructural plan, the most significant factor was the use of the base year risk condition rather than the end year condition to determine the eligibility of structures for the application of nonstructural measures. Increases in relative stage elevation for various base year risk conditions result in greater numbers of structures (incurring damages that exceed remediation costs) introduced into the risk pool, both spatially and for any given event probability. For the study end year risk conditions, increased stage conditions translate into an increase in structures in the risk pool. However, the additional damages incurred by those structures over the period of analysis are nominal in comparison to their remediation costs given that a change in the stage associated with the 1% ACE is, on average, only 2 ft. The evaluation of residual risk associated with structures that are not in the 100-year floodplain under 2025 hydrologic conditions, but are under 2075 conditions, is expanded upon in Appendix D – Economics.

For the NED RP, the PDT assumed a 100% participation rate which is intended to serve as an upper limit to the Federal investment in nonstructural measures. It is recognized that likely participation in any nonstructural risk reduction project would not reach 100%. Reasons of locality preference, community-wide participation trends, economic constraints for willing participants, risk tolerance, ability to affordably mitigate or self-mitigate risks, structural eligibility, issues related to insurability, and the nature of future storm events are some of the factors that may influence participation. Conversely, the NED plan should highlight the benefits of participation such as long-term hurricane storm surge damage risk reduction, and beneficial impacts to insurability. If the NED RP is funded on the basis of 100% participation, but the actual participation is less, the uncommitted funds would not be expended. It is expected that a sensitivity analysis of the BCRs for varying levels of participation would result in no significant change in recommendation. For this analysis, non-participating property owners would be randomly selected to reduce the participation rate, the effect of which would be to reduce benefits and costs, on average, by constant degrees. As a result, net benefits for the NED RP remain positive and the BCR unchanged.

The uncertainty surrounding each of the economic and engineering variables and a probability distribution were entered into the model to quantify the uncertainty associated with the key economic variables. The number of years that stages were recorded at a given gage was entered to quantify the hydrologic uncertainty or error surrounding the stage-probability relationships. The plan costs were estimated based on the number of structures within the 25-year (4% ACE) floodplain in the 2025 base year. RSLR prior to the base year significantly affects the determination of the number of structures that would be eligible for application of nonstructural measures. This means that uncertainty in the projected rate of future RSLR translates directly to uncertainty as to how many structures would be included in the NED RP.

The NED RP offers hurricane storm surge damage risk reduction only for those eligible, economically justified structures in the 0-25-year floodplain, which equals 3,961 of a total of 4,952 structures. An additional 10,715 structures are present in the 25-100 year (4% - 1% ACE) floodplain. However, complete implementation of the NED RP has the potential to reduce damages from the design hurricane storm surge within the study area as a whole floodplain by 58%, suggesting a highly effective plan and a significant reduction in residual risk. Most damages occurring within the 100-year floodplain occur in the 0-25-year floodplain increment, thereby accounting for most project benefits. From the standpoint of public safety, the NED RP is not expected to have a large and widespread impact. For those residents that may participate in elevating their residences, the probability is that their degree of risk aversion is not expected to change as a result of this nonstructural measure, and evacuation behavior would be the same under both without- and with-project conditions.

The localized risk reduction measures as applied to single warehouse structures were formulated as a small-scale approach, similar in scale to individual structure elevations and dry floodproofing of commercial structures, but intended to reduce flooding associated with the highest frequency events for a unique type of structure for which this measure is both technically feasible and economically effective. The level of risk reduction for localized risk reduction measures is contingent upon the fixed maximum height of the barrier, which is constrained by the footprint of parcel ownership, and does not necessarily correlate with the 100-year level of risk reduction that is represented by the performance of the structure elevation measure applied to the overwhelming majority of structures comprising the recommended plan. Although, economically justified on an individual basis, localized risk reduction measures still carry potential large residual flood risk. The level of residual risk will vary by location, and not all warehouse operators are guaranteed to voluntarily participate in the recommended plan. Yet, because of the commercial/industrial nature of the occupational use of the structure, life-safety considerations are not as significant as they would be as for plans that address residential structures which may have equivalent high residual risk.

4.1.10 NED Real Estate Requirements

Costs for the nonstructural elevations were included as construction costs and not as separable real estate acquisition costs. In addition, a Chart of Accounts which captures the real estate costs associated with the plan implementation (administrative costs for elevations) is included in the Real Estate Plan (Appendix E). A maximum of 3,961 structures are eligible for inclusion in the NED Project. Additional discussion of the real estate requirements for NED RP features can be found in the Real Estate Plan (Appendix E). The NFS would be responsible for acquiring all necessary real estate interests under established criteria.

4.1.11 Summary of Environmental Consequences of NED Plan

Each non-residential structure will be evaluated to determine the most cost effective method of flood proofing. At the time of this Report, it is anticipated that implementation of localized storm surge risk reduction measures will be through the Federal procurement of Indefinite Deliverable, Indefinite Quantity (IDIQ) contracts that will be implemented by the issuance of individual task orders for the implementation of flood proofing measures at each warehouse. The basis for this assumption is that the PDT has completed an inspection of the warehouse inventory. That inspection indicates that the geographic distribution of these warehouses and the inability to determine the schedule for voluntary participation do not comport with the clustering strategy whereby the rest of the NED RP will be implemented. For these reasons it is anticipated that an individual task order will be limited to a single warehouse to be flood proofed. The PDT anticipates that only a small amount of borrow would be needed for construction of the localized storm surge risk reduction measures for each warehouse being accomplished by separate task order. Based on this conclusion, it is foreseeable that commercial borrow sites would be used. As of the date of this Report, there are several commercial borrow sites within the project area that are readily available.

Real Estate regulations (ER. 405-1-12, paragraph 12-9d(3)) allow for small quantities of borrow material to be supplied by the construction contractor through the use of readily available commercial sites, if supported by an analysis conducted by the Government and the NFS, and if no other constraints exist. Since it has been determined that each IDIQ task order will address a single warehouse, for purposes of this Final Report, it has been assumed that the analysis performed pursuant to the above cited ER 405-1-12 will determine that the required borrow quantities constitute a small quantity that can be obtained through a commercial site that meets the Project requirements. Prior to issuing a construction task order, the Government will conduct the necessary analysis in accordance with ER 405-1-12. Contractors would be required to demonstrate that any proposed commercial borrow site is environmentally cleared and contains geotechnically suitable borrow material. In evaluating the suitability of the proposed commercial borrow site, impacts to wetlands or bottomland hardwoods would be prohibited. Costs of utilizing a commercial borrow site would be considered an item of construction cost, and not an item of LERRD cost.

The NED RP avoids and minimizes negative environmental impacts to the maximum extent. The eligibility criteria for implementation of a plan measure stipulates that implementation cannot impact threatened or

endangered species, that implementation will not require fill in the waters of the United States and would not result in any impact to wetlands. The current impact analysis indicates that no mitigation for the NED RP would be required. This determination would be refined as each eligible structure is evaluated for a particular measure. The more significant changes between the initial TSPs and the NED RP are highlighted in Table 4-2 below.

Table 4-2: NED Plan Changes.

Plan	Recommendation	2013 Draft Report (TSP)	2015 Revised Draft Report (TSP)	Final Report (NED RP)
NED	Eligibility	11 Justified Reaches	Justified Floodplains	Justified Floodplains
	Eligible Floodplain	2075 100-Year	2025 0-25-Year	2025 0-25-Year
	Eligible Structures	3,915	4,952	3,961[1]
	Benefit/Cost Ratio	1.25:1	7.74:1	5.65:1[2]
	Eligibility	Voluntary	Voluntary & Involuntary	Voluntary
	Project First Cost	$388,000,000	$824,000,000	$906,091,000

1- Only economically justified structures are included in the NED RP
2- BCR was updated with certified cost numbers

4.2 National Ecosystem Restoration Recommended Plan (NER RP)

4.2.1 Description of the NER RP (Plan CM-4)

The NER RP (Alternative CM-4) consists of a broad range of ecosystem restoration measures including marsh restoration features (which involves hydraulic dredging and placing of sediments), shoreline protection/stabilization features, and chenier reforestation. The CSC Salinity Control Structure and the Cameron-Creole Spillway Structure are recommended as additional long-range studies to adequately account for potential environmental benefits, economic costs, and engineering. The NER RP features comprise an integrated comprehensive restoration plan that would have synergy with other ecosystem restoration projects and would facilitate hydrologic and geomorphic stability and resilience. Each restoration feature is detailed in a fact sheet which can be found in Appendix K.

The NER RP restoration features (together with their benefits and impacts) are constructible and would move into the preconstruction engineering and design (PED) phase next. The construction acres and habitat benefits for all NER RP features are depicted in Tables 4-3 and 4-4.

Table 4-3: NER RP Feature Construction Benefits.

	Category	ID	Description	Net Acres	Net AAHUs
Mermantau/Teche-Vermilion (Plan M-4)	Marsh Restoration[1]	47a1	Marsh restoration using dredged material south of LA-82, about 4.5 miles west of Grand Chenier. 933 marsh acres would be restored and 88 acres would be nourished from 3M cubic yards of dredged material with one renourishment cycle.	895	272
		47a2	Marsh restoration using dredged material south of LA-82, approximately 4.5 miles west of Grand Chenier. 1,297 marsh acres would be restored and 126 acres would be nourished from 8.8M cubic yards of dredged material with one renourishment cycle.	1,218	381
		47c1	Marsh restoration using dredged material south of LA-82, approximately 4.5 miles west of Grand Chenier. 1,304 marsh acres would be restored and 4 acres would be nourished from 8.6M cubic yards of dredged material with one renourishment cycle.	1,135	353
		127c3	Marsh restoration at Pecan Island, west of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. 832 marsh acres would be restored and 62 acres would be nourished from 7.3M cubic yards of dredged material with one renourishment cycle.	735	241
		306a1	Rainey marsh restoration at Christian Marsh, east of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. 627 marsh acres would be restored and 1,269 acres would be nourished from 8.1M cubic yards of dredged material with one renourishment cycle.	743	151
	Shoreline Protection/ Stabilization[1]	6b1	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 11.0 miles of Gulf shore protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore consisting of geotextile fabric and stone built to an 18 ft crest width.	2,140	625
		6b2	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 8.1 miles of Gulf shoreline protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore using geotextile fabric and stone built to an 18 ft crest width.	1,583	466
		6b3	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 6.3 miles of Gulf shoreline protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore using geotextile fabric and stone built to an 18 ft crest width.	1,098	312
		16b	Fortify spoil banks of Freshwater Bayou. Approximately 13.4 miles of rock revetment at three critical locations to prevent shoreline breaching. Rock revetment would be built to +3 ft with a 4 ft crown. Two maintenance lifts would be required.	1,288	279
	Chenier Re-forestation	CR	13 separate chenier locations would be replanted. Approximately 435 seedlings per acre, at 10 ft x 10 ft spacing, with invasive species control incorporated[3].	281	96
Calcasieu/ Sabine (CM-1)	Marsh Restoration[1]	3a1	Beneficial use of dredged material from the Calcasieu Ship Channel. Located adjacent to the south shore of the GIWW west of the Calcasieu Ship Channel near Black Lake. Restore 599 marsh acres with 5.3M cubic yards of dredged material with one renourishment cycle.	454	191

		3c1[2]	Beneficial use of dredged material from the Calcasieu Ship Channel. Located adjacent to the eastern rim of Calcasieu Lake and situated within the Cameron-Creole Watershed area. 1,347 marsh acres would be restored and 734 acres would be nourished from 9.4M cubic yards of dredged material with one renourishment cycle.	1,324	607
		124c	Marsh restoration at Mud Lake. Located adjacent and north of Highway 82 and east of Mud Lake. 1,077 marsh acres would be restored and 708 acres would be nourished from 10.4M cubic yards of dredged material with one renourishment cycle.	1,228	500
		124d[2]	Marsh restoration at Mud Lake. Located west of the Calcasieu Ship Channel and adjacent to the south rim of West Cove. 159 marsh acres would be restored and 448 acres would be nourished from 1.4M cubic yards of dredged material with one renourishment cycle.	168	4
	Shoreline Protection/ Stabilization[1]	5a	Holly Beach Shoreline Stabilization Breakwaters. Construction of 8.7 miles of rock and low action breakwaters and is a continuation of existing breakwaters. Crown elevation of +3.5 ft with a crown width of 24 ft. Two maintenance lifts would be required.	26	56
	Chenier Re-forestation	CR	22 separate chenier locations would be replanted. Approximately 435 seedlings per acre, at 10 ft x 10 ft spacing, with invasive species control incorporated[3].	1,132	442
	TOTALS			15,448	4,976

1-Renourishment and maintenance lifts are considered an OMRR&R cost and are a 100% NFS responsibility. Renourishment material would come from the site of the initial dredging effort.
2- Features 3c1 and 124d are partially located on USFWS property. While USACE believes that these features are worthy of recommendation, USACE has determined that these features would more properly be implemented by USFWS. Therefore, USACE will not seek authorization and funding of these features. Rather USACE will recommend to USFWS that it consider seeking independent Congressional authorization and funding for implementation of these features by USFWS.
3- Costs to ensure the minimum survival percent are considered 'construction' and will be cost-shared accordingly. Following NCC of these features, control of invasive species are considered an OMRR&R cost and are a 100% NFS responsibility.

The full benefits for all feature types in the NER RP are presented below.

Table 4-4: NER Plan Benefits by Measure Type.

Restoration Measure	# of Features	Net Acres	AAHUs	Parishes
Marsh Restoration	9	7,900	2,700	Calcasieu, Cameron, Vermilion
Shoreline Protection/Stabilization	5	6,135	1,738	Cameron, Vermilion
Chenier Reforestation	35	1,413	538	Cameron, Vermilion
Total	**49***	**15,448**	**4,976**	**---**

**- The Calcasieu Ship Channel Salinity Control Structure and the Cameron-Creole Spillway Structure are recommended for additional feasibility study.*

Each of the marsh restoration features involves delivering sediments to open water or eroding marsh areas (minimum of 100 acres) that have water levels of less than two ft and that have been optimized to preserve or restore critical geomorphologic features to create new vegetated wetlands. The marsh restoration locations include: (a) three areas on the south side of LA-82 approximately 4.5 miles west of Grand Chenier; (b) Pecan Island west of the Freshwater Bayou Canal approximately 5 miles north of the Freshwater Bayou locks; (c)

Christian Marsh located east of Freshwater Bayou Canal and approximately 5 miles north of Freshwater Bayou locks; (d) southern shoreline of GIWW west of Calcasieu Ship Channel near Black Lake; (e) eastern rim of Calcasieu Lake within the Cameron-Creole Watershed; (f) east of Mud Lake and north of Highway 82; (g) Mud Lake west of the CSC adjacent to the southern rim of West Cove. Dredged material sources would be the CSC (through beneficial use of dredged material) and the Gulf of Mexico (through dedicated dredging). All marsh restoration locations would have one future re-nourishment cycle. A 30-year renourishment interval was chosen as the best balance between cost, net acres, and AAHUs. The costs are included in the OMRR&R estimates and would be the responsibility of the NFS (currently estimated at $311,573,000 for all restoration features). Adaptive management techniques would be used to adjust the projected interval, either sooner or later than the 30-years, based on actual loss rates after construction. (See Appendix A for Adaptive Management and Monitoring).

The five shoreline protection/stabilization features, which span approximately 252,000 linear ft, would be used to reduce erosion of canal banks and shorelines in critical areas in order to protect adjacent wetlands and critical geomorphic features.

Chenier restoration consists of planting of 435 seedlings per acre at 10 foot x 10 foot spacing, in 35 chenier locations on over 1,400 acres in Cameron and Vermilion parishes. Cheniers selected for restoration would be greater than five ft in elevation and with low shoreline erosion rates, provided the existing canopy coverage is less than 50% unless nearby development would prevent achieving study objectives.

Figures 4-3a and 4-3b depict the NER RP features. Figure 4-4 depicts active restoration activities in the study area under various programs.

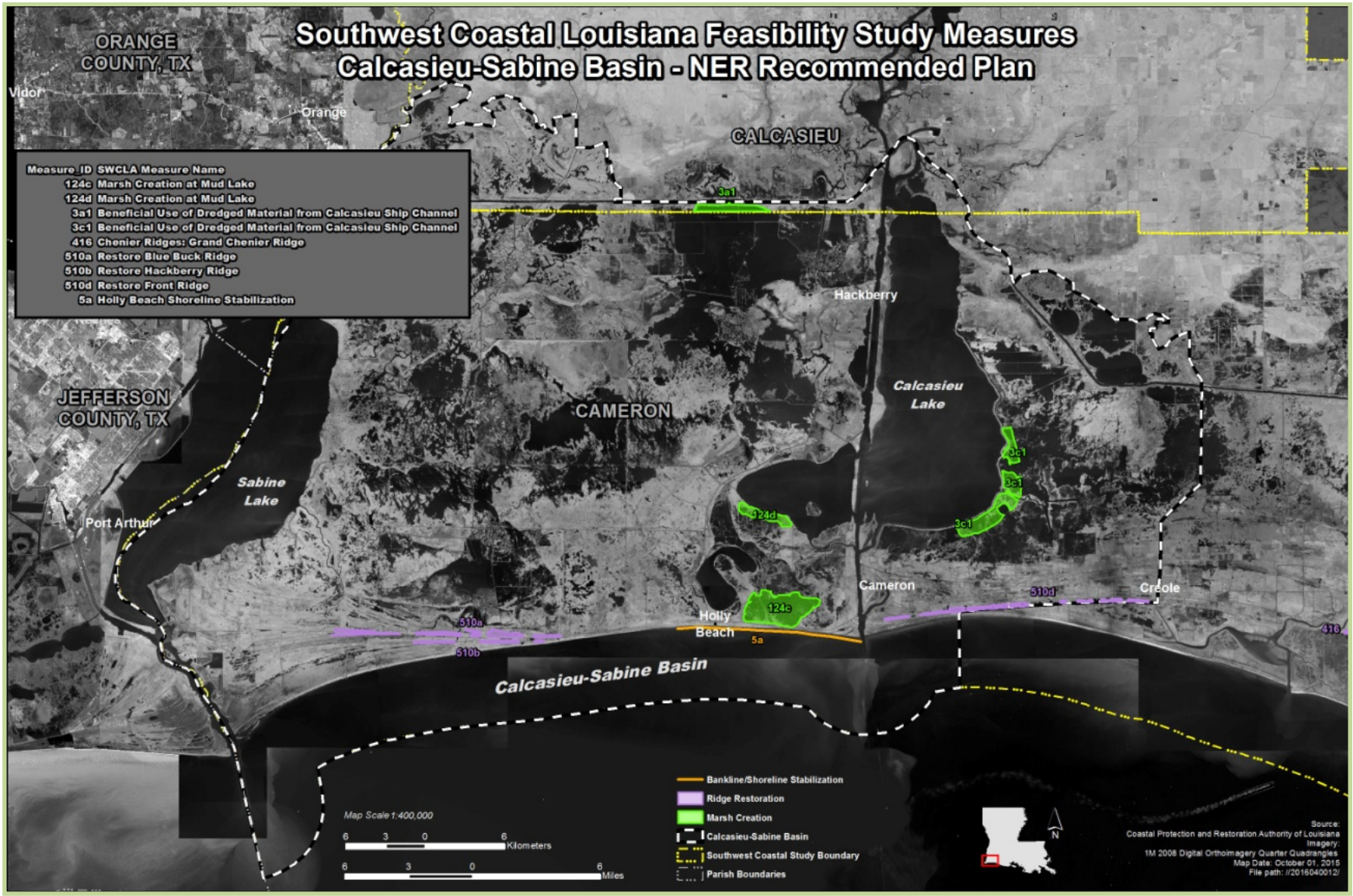


Figure 4-3a: NER RP features (Calcasieu-Sabine Basin).

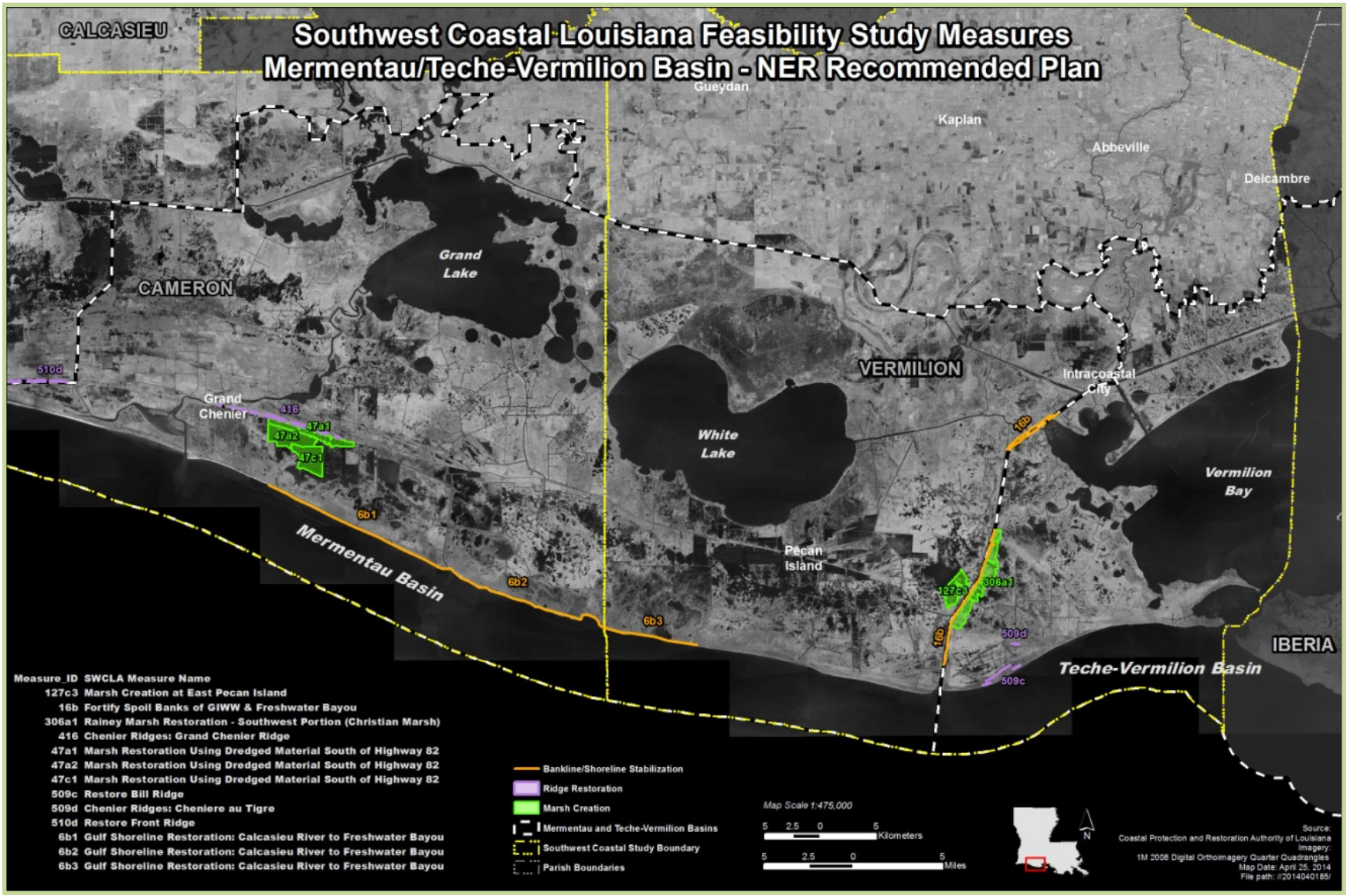


Figure 4-3b: NER RP features (Mermentau/Teche-Vermilion Basin).

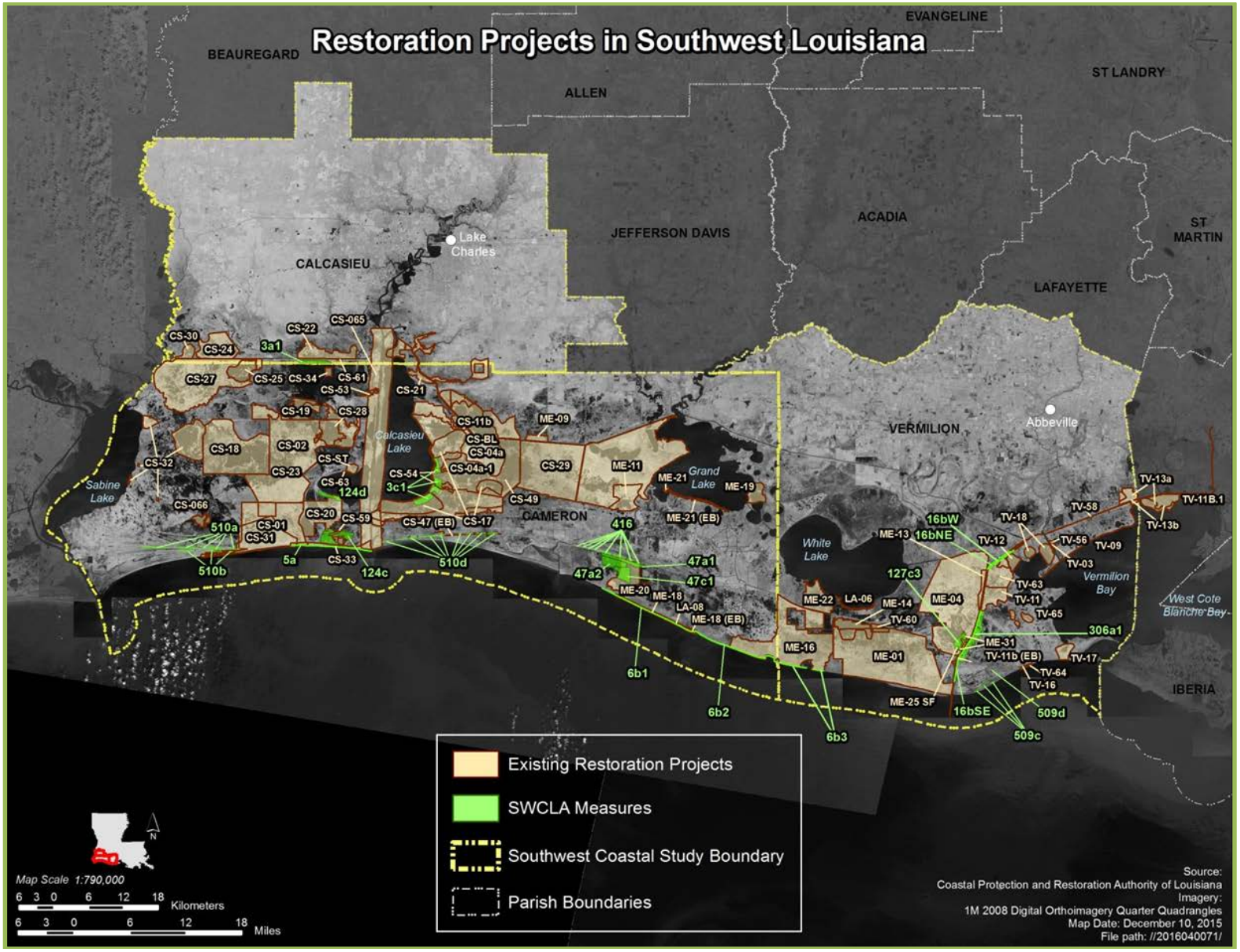


Figure 4-4: Ecosystem restoration activities in the study area

4.2.2 NER RP Implementation

This section describes the sequence in which NER RP features would be constructed. NER RP features were categorized into three tiers whereby Tier I features would be constructed before Tier II, and Tier II features constructed before Tier III. Tier I features may be constructed simultaneously because they would not affect the construction of any nearby Tier I NER RP feature. Shoreline protection features would be constructed prior to marsh restoration features in an effort to better protect the more storm-vulnerable marsh restoration features. This approach contributes to the sustainability of the marsh restoration features. Tier II NER RP features were so categorized because they utilize the same borrow or staging area, and/or construction of these features would potentially interfere with construction of a Tier I NER RP feature. Tier II NER RP features would be constructed contemporaneously as the construction of any one of these features would not affect any other feature within this grouping. Tier III NER RP features were so categorized because they would utilize the same borrow or staging area, and/or interfered with construction of a Tier II feature, and/or interfered with an existing mitigation project. Tier III features would be constructed contemporaneously if they would not affect construction of the other features within this grouping.

In categorizing features, it was assumed that all construction funds would be available, multiple construction contracts could be let at one time, and there is an adequate supply of all materials to facilitate construction. More detailed design and analysis would be undertaken during the PED phase. The initiation of construction for features within each tier was scheduled over ten year intervals. For planning purposes the first construction interval beginning at the base year of 2025 through 2034, the second 2035-2044, and the third 2045 to completion. Actual initiation of construction would be contingent on the date of authorization, and subsequent provision of appropriations, for this recommendation. The individual features are organized, and would be staged, within the tiers based on their systemic criticality and for sequential staging. The tiering and staging of the individual features has been developed to assure several implementation requirements. First, that the features are implemented in the most effective order for long-term ecosystem performance. Second, that no conflicts will occur with common resources required for construction, and finally, that the completion of any existing obligations for mitigation projects that interface with some plan features will be met prior to implementation. General prioritization for staging within the tiers would apply the criteria of addressing shorelines and channel banks, and working from the coastline landward. Features that interface with projects having outstanding mitigation obligations would also be staged later in each tier.

Tier I Projects (projected implementation 2025-2034):

- Holly Beach Shoreline Stabilization – Breakwaters (5a)
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b1)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bSE)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bNE)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bW)
- Beneficial Use of Dredged Material from the Calcasieu Ship Channel (3a1)
- Marsh Restoration at Mud Lake (124d)[1]
- Marsh Restoration at Pecan Island (127c3)
- Chenier Ridges: Grand Chenier Ridge (416)[2]
- Restore Bill Ridge (509c)[2]
- Chenier Ridges: Cheniere au Tigre (509d)[2]
- Restore Blue Buck Ridge (510a)[2]
- Restore Hackberry Ridge (510b)[2]
- Restore Front Ridge (510d)[2]

Tier II Projects (projected implementation 2035-2044):

- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b2)
- Marsh Restoration at Mud Lake (124c)
- Rainey Marsh Restoration Southwest Portion (Christian Marsh) (306a1)

Tier III Projects (projected implementation 2045-completion):

- Beneficial Use of Dredged Material from the Calcasieu Ship Channel (3c1)[1]
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b3)
- Marsh Restoration Using Dredged Material South of Highway 82 (47a1)
- Marsh Restoration Using Dredged Material South of Highway 82 (47a2)
- Marsh Restoration Using Dredged Material South of Highway 82 (47c1)

Recommended for Further Study:

- Calcasieu Ship Channel Salinity Control Structure
- Cameron-Creole Spillway Structure

[1]- *Recommended for independent Congressional authorization and appropriation for construction by USFWS*

[2]- *Individual features that comprise the chenier reforestation measure*

Two marsh restoration measures, (Features 124d and 3c1) are partially located on USFWS property (Sabine National Wildlife Refuge and Cameron Prairie National Wildlife Refuge, respectively) and are included in the NER RP. These features are vitally important to help preserve the Calcasieu Lake rim and prevent vast new expanses of open water from forming should the lake rim be breached by erosional forces. All NED and NER RP features (including those recommended for appropriation and construction by USFWS) represent the "Federal Plan". Because USFWS is ultimately responsible for managing its refuge lands, USACE is not seeking authorization and funding for the USFWS Features 124d and 3c1. The NED RP and the subset of NER features that are recommended for authorization and appropriation by USACE [all features minus 124d and 3c1) represent the "Corps Plan"]. Rather, USACE supports USFWS in seeking its own authorization and appropriation to construct the two features and offers USFWS the information that USACE developed under this study effort as a starting point for USFWS efforts to obtain independent authorization and funding for the USFWS features of the Federal Plan. The NER project first cost estimate for the Federal Plan (which includes costs associated with these two features) is $2.485 billion. The total benefits for the Federal NER RP are 15,448 acres and 4,976 AAHUs. Of the total cost, the USACE estimates approximately $297 million for the design, construction, and construction management costs of these two USFWS features. However, it is anticipated that USFWS would develop its own costs in connection with these features. The total NER benefits for the two USFWS suggested features are 1,492 acres and 611 AAHUs. The NER RP was evaluated and justified through the incremental analysis. Therefore, each individual restoration feature is justified as a stand-alone project. These features are particularly desirable because they provide additional benefit not quantified in the evaluation and selection process (i.e. preserving critical geomorphic structure of the lake rim). These features are in the Federal interest and USFWS is encouraged to seek independent authorization and appropriation for construction.

The NER recommended Corps Plan includes a three tiered implementation sequence. (1) Tier I features may be constructed simultaneously because they would not affect the construction of any nearby Tier I NER Recommended Plan feature. Shoreline protection features would be constructed prior to marsh restoration features in an effort to better protect the more storm-vulnerable marsh restoration features. This approach contributes to the sustainability of the marsh restoration features. The project first cost for Tier 1 is $850,998,000 producing 1,930 AAHUs. (2) Tier II NER Recommended Plan features were so categorized because they utilize the same borrow or staging area, and/or construction of these features would potentially interfere with construction of a Tier I NER Recommended Plan feature. The project first cost for Tier II is $561,186,000 producing 1,117 AAHUs. (3) Tier III NER Recommended Plan features were so categorized because they would utilize the same borrow or staging area, and/or interfered with construction of a Tier II feature, and/or interfered with an existing mitigation project. The project first cost for Tier III is $776,002,000 producing 1,318 AAHUs.

Construction of NER RP features would overlap ten permitted mitigation projects. Completion of the permit obligation requirements range between 2016 and 2040. Project-induced impacts to the mitigation projects would be avoided by tiering construction of NER RP features until after mitigation permit obligations have been satisfied. As contemplated in the current recommended tiered construction schedule, the expiration date for each mitigation project identifies the earliest construction start date for the corresponding NER RP feature. Prior to initiating construction of the NER RP measures, the Government and the NFS shall first obtain written confirmation from the permitting authority that the mitigation obligations and all other permit obligations have been satisfied by the permittee. Commencement of implementing the NER RP measure that overlaps a permitted mitigation project would be delayed until such time as written confirmation is obtained. Given that some mitigation features will not be completed for 20+ years, there is a risk that NER feature construction costs, schedules, and implementability could change from current estimates. Table 4-5 identifies mitigation projects and the tiers into which they are assigned based upon the estimated date of satisfying permit obligations. Following confirmation that all permit requirements have been met for a mitigation project, the Government would re-assess the site to assure that the proposed NER RP feature for the site remains justified.

Table 4-5: Mitigation Projects that Interface with NER RP Features.

Permit #	Description	NER RP Feature	Permittee or Owner	Expiration Date (permit completion date + 20 years)	Mitigation Project Description
Tier I Features					
P20061888	Terraces at GIWW N of Black Lake	3a1	Gulfport Energy Corporation	11/30/2032	Proposed construction of 5,358 linear ft of terraces south of the GIWW and north of Black Lake.
P19900448	Marsh Management Plan area	124d	Apache Louisiana Minerals	11/13/2016	Install and maintain water control structures for CTU 1 and 2. In CTU 1, 64,000 linear ft of smooth cordgrass plantings. In CTU 2, 32,470 linear ft of boundary levee are to be repaired. Various water control structures are to be repaired or replaced.
P19971118	West Cove Planting Project	124d	Union Pacific Resources	7/28/2022	West Cove Planting Project; 5,000 ft of plantings of *Spartina alterniflora*.
P19950086	Marsh Management Plan area	127c3	Vermilion Corporation	4/1/2021	Eight water control structures will be installed; a riprap levee will be constructed; five double flapgated culverts and one earthen plug will be installed; two earthen plugs will be constructed.
Tier II Features					
P20141590	Spoil Placement	306a1	Hilcorp Energy Company	4/8/2040	Dredging of 15,430 cubic yards of native material to construct slip for the purpose of installing a drill rig, well protector and pilings. The dredged material will be pumped into a shallow pond adjacent to the proposed drill site using a temporary discharge pipe. An additional 301 cubic yards of material will be displaced to construct containment berms.

Tier III Features					
P20141138	Rip-rap Grand Bayou	3c1	CPRA	1/29/2040	Installation of 21,000 tons of riprap along the Calcasieu Lake Shoreline near the Peconi, Mangrove and Grand Bayou water control structures.
P19870422	Marsh Management Plan area	47a2	T.Bonsall	2/3/2023	Construction of a levee and multiple water control structures (South of Upper Mud Lake).
P20031576	Mitigation for P20031304	47a2	Kash Oil & Gas, Inc.	3/31/2029	Constructed 4,803 linear feet of terraces and planted with *Spartina alterniflora.*
P20081326	Mitigation for P20080132	47a2	PetroQuest Energy, L.L.C.	11/25/2033	Construct and plant 2,897 linear ft of wave dampening terraces that will capture re-suspended sediments and protect fragile shorelines by planting plugs of smooth cordgrass on both sides of constructed terraces.
P20071745	Mitigation for 20070883	47c1	Manti Operating Company	3/5/2025*	Construction of ten 500-foot terraces, eight 300-foot terraces, two 200-foot terraces and eight 400-foot terraces (6.1 acres). Plantings of *Spartina alterniflora* rows on each side of the terraces.

*11 years, not 20 years

4.2.3 Adaptive Management and Monitoring (AM&M)

The AM&M plan describes the adaptive management and monitoring to be used to evaluate the progress made towards meeting project goals and objectives, and is contained in Appendix A. The primary reason for implementing AM&M is to increase the likelihood of achieving desired project outcomes given the uncertainties with ecosystem restoration. Adaptive management works best when it is tailored to the specific problem(s), designed to ensure accountability and enforceability, used to promote useful learning, and supported by sufficient funding. AM&M is warranted when there are consequential decisions to be made, when there is an opportunity to apply learning, when the objectives of management are clear, when the value of reducing uncertainty is high, and when a monitoring system can be put in place to reduce uncertainty. The plan describes the organizational structure for the AM&M process, the Conceptual Ecological Model, key uncertainties, and provides potential Adaptive Management/contingency actions that may be needed to ensure success. The level of detail in the AM&M plan is based on currently available data and would be refined further in subsequent design phases. AM&M costs are based on the monitoring needed to measure ecological success and the identified risks and uncertainties. Section 2039 of the WRDA 2007 allows ecological success monitoring to be cost-shared for up to ten years post-construction. Once ecological success has been achieved, which may occur in less than ten years post-construction, no further monitoring would be performed. If ecological success cannot be determined within the ten-year post construction period of monitoring, any additional required monitoring will be a non-Federal responsibility.

4.2.4 NER RP Operation, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R)

The NFS is responsible for all of the OMRR&R of the NER RP. At the time of this Report, it is anticipated that the OMRR&R of the marsh restoration elements primarily consists of marsh renourishment through the periodic addition of dredged sediment to maintain wetland elevations. OMRR&R of the shoreline protection/stabilization features is currently anticipated to consist of periodic maintenance lifts and the addition of material for rock and/or rip-rap features. Construction and OMRR&R of the chenier reforestation features will not be required following the achievement of the minimum survival threshold criteria, which is anticipated to occur for each chenier feature by Target Year 5 (following initial planting). For purposes of this report, it has been assumed that the minimum survival threshold will be obtained on or before 10 years post construction; therefore, this report does not capture any OMRR&R beyond the 10 years post-construction date. At such time as the minimum survival threshold is obtained for a given element of the chenier feature, or 10 years from the

date of the construction of the element of the chenier feature, whichever comes first, the Government shall NCC the individual chenier element to the NFS. OMRR&R costs are the responsibility of the NFS (currently estimated at $311,573,000 for all NER RP features).The estimated average annual OMRR&R cost for the NER features is $5,958,000, which would be refined during the PED phase. The NFS shall commence OMRR&R once each project undergoes a final inspection by both USACE and the NFS and the USACE issues a NCC together with the OMRR&R Manual to the NFS.

4.2.5 Risk and Uncertainty Analysis

Risk and uncertainty are intrinsic factors in water resource plans. This section describes risk and uncertainty categories pertinent to the NER RP.

Environmental Factors

Relative Sea Level Rise: An assessment of RSLR (see Appendix O) was included in plan formulation and alternatives analysis; however there is uncertainty about how much sea level change may occur. Higher than estimated RSLR could cause salt water intrusion further into the Calcasieu and Sabine estuaries, causing significant changes to lower salinity wetlands. However, improved cohesiveness across the system should also result in a broader near-term increase in ecosystem resilience, not just for those restored wetlands, even in the face of a higher RSLR. Values for the RSLR rates were previously presented in Table 4-1. A graphic of the projected rates is also presented in Chapter 1.RSLR could impact the benefits of the NER RP. Because the features were developed using the intermediate RSLR rate, the NER RP would provide more benefits than anticipated if the lower RSLR rate occurs and less benefits if the higher RSLR rate occurs. With the high rate the marsh restoration and shoreline protection/stabilization features would be less effective because they could be overwhelmed by water levels and this could increase their vulnerability. This is a risk to the effectiveness of the NER RP but this situation would also imply that landscape-level inundation would be so great that engineered or designed features could no longer control how, when, or where water moves throughout the study area.

Storms: Risks associated with the NER RP relate to possible extreme weather events. Uncertainty about the size or frequency of storms and climate events, such as El Nino cannot be predicted over a set period of time. Storm events can cause significant damage to wetlands. Intact habitats are more resilient against the effects of hurricane storm surge and associated flooding, salinity spikes, and tidal scour, though some hurricane storm surge damages may be unavoidable.

4.2.6 Real Estate Requirements

The Real Estate Plan (Appendix E) provides a description of the lands, easements, rights-of-way, including those needed for relocations and the borrowing of material, ensuring the performance of relocations and the disposal of dredged or excavated materials (LERRDs) as deemed by the Government to be required for the construction and OMRR&R of the NER RP features. Appendix E, Table 1 describes the estates to be acquired for each NER RP feature, and indicates whether the lands are owned by private landowners or by the state of Louisiana. An estimated 158 private landowners will be affected by the NER RP. A cost estimate was prepared in April, 2014, and is included within Appendix E. Fact sheet maps for NER RP features have been prepared to show required project rights-of-way, including access, borrow, staging, and other project features (see Appendix K for more information).

The majority of the NER RP features are located on privately owned land and would require the acquisition of a standard Fee, Excluding Minerals (With Restriction of Use of Surface) estate. A standard Temporary Work Area Easement would be acquired for staging areas. A standard perpetual Utility and/or Pipeline Easement would be acquired for transport of dredged materials. A Perpetual Access Easement (Non-Material Deviation from Standard Estate) would be acquired over privately owned access areas. A Real Estate Plan providing detailed information regarding real estate acquisition for the NER RP is found in Appendix E.

4.2.7 Summary of Environmental Consequences of NER Plan

Restoration, protection/stabilization, and chenier features for the NER RP are designed to be self-mitigating and would not require compensation. Table 4-6 depicts the changes between the NER TSP contained in the December 2013 Draft Report, the 2015 Revised Draft Report, and the final NER RP contained herein.

Table 4-6: NER Plan Changes.

Plan	Recommendation	2013 Draft Report	2015 Revised Draft Report	Final Report
NER	Marsh Features (Acres/AAHUs)	9 (8,714/N/A)	9 (8,714/3,481)	9 (7,900/2,700)
	Hydrology/Salinity Control Features (Acres/AAHUs)*	2 (6,092/N/A)	1 (-56/267)	Recommended for Study[1]
	Shoreline Protection/Stabilization Features (Acres/AAHUs)	5 (5,509/N/A)	5 (5,509/1,615)	5 (6,135/1,738)
	Oyster Reef Preservation Features (Acres/AAHUs)	1 (N/A/N/A)	Removed	Removed
	Chenier Features (Acres/AAHUs)	22 (1,413/N/A)	35 (1,414/538)	35 (1,413/538)
	Project First Cost (Oct 2015 Price Level)/Total Project Cost	$992,000,000[2]	$987,738,000[2]	$2,485,025,000/ $2,491,025,000[1]

[1] *The Calcasieu Ship Channel Salinity Control Structure and the Cameron-Creole Spillway Structure are recommended for additional study ($3M for each study has been added to the Total Project Cost).*

[2] *Based on uncertified costs, no adaptive management, and without a tiered construction schedule.*

4.2.8 Significance of Benefits for the Recommended Plans

The Southwest Coastal study area is significant for multiple reasons as described below. Aside from the institutional, public, and technical considerations, the area is extremely important locally, regionally, and nationally, and the NED and NER RPs would help to preserve and sustain this importance in a number of ways.

NED Significance

Implementing the NED RP measures to reduce damages from hurricane storm surge to structures in the study area serves multiple purposes. First, it would help to lessen the financial and social impacts that tropical storms and hurricanes can cause by reducing the risk of property damage that displaces residents, shuts down commercial and industrial services, and disrupts livelihoods. If structures avoid or have reduced damages because of nonstructural measures, families and businesses can rebound much more quickly after a tropical event. This is exemplified by increasing the opportunity to return children to school where their residences and schools were not damaged from the design hurricane storm surge event; by reducing lost work days of workers who support the local or regional economy by decreasing the number of hurricane storm events that require repairs to hurricane storm surge damaged houses, businesses and other non-residential structures, by minimizing the debris from hurricane storm damaged structures that can affect other properties; and by generally improving the opportunity and time necessary for residents, businesses and government to return to normal function after the design hurricane storm event. Eligible structures that are at-risk from storm surge from the NED RP design hurricane would be subject to nonstructural measures that would reduce the risk of the anticipated storm surge Second, time, money, and energy would not be lost to repairing structures damaged by storm surge from the NED RP design hurricane, relocating to other areas due to displacement from a home or business, or disruptions in community cohesiveness. This would help to ensure that the economy would continue to operate after the NED RP design hurricane and that the stress and hardship associated with hurricane storm surge would be lessened. Implementing the NED RP would also help to preserve a sense of place and community identity by reducing the potential for this unique culture in the United States to be displaced, perhaps permanently, to other areas in the region. Finally, the study area supports national needs, logistics, and persona. For example, the nation enjoys Louisiana seafood, relies on the uninterrupted supply of energy and material goods, and benefits from having a culture that exemplifies the passionate and hard-working

spirit that defines the study area. Pronounced impacts from repetitive hurricane storm surge events, such as the NED RP design hurricane, threatens the productivity and sustainability of these important national interests by reducing the continuity, functionality, and export of supplies, commerce, and culture.

NER Significance

Restoring fresh, intermediate, brackish, and saline marshes within a framework of marsh restoration, shoreline protection/stabilization, and chenier features would interact to provide benefits greater than the sum of their parts. Together these features would help regulate fresh and saltwater flows, protect against substrate erosion, and provide important transitional estuarine habitat between upland and marine environments. Restoring lost wetlands, protecting existing wetlands, and reducing the profound environmental and habitat loss across the study area could help support the NED RP recommendations. Part of the area's vulnerability to hurricane storm surge damages is directly related to the significant loss of wetlands the area has experienced. Restoring these important habitats helps to reduce the ability of coastal floodwaters to work their way into the communities that need risk reduction measures to help reduce damages from hurricane storm surge. Wetlands provide a buffer between ever-growing open water areas that allow water (and surge) to permeate further inland and thus more directly affect the surrounding infrastructure such as roads, residences, businesses, and critical infrastructure (i.e. electrical, water, sewer, and drainage facilities). Implementing the NER RP could help increase the effectiveness of the NED RP. Wetlands provide important habitat that directly supports the viability of threatened and endangered species; commercially important species such as alligator, shrimp, and crabs; and the economy through the creation of and support for industries that depend on wetlands such as fishing and hunting guides, bait/tackle shops, birding enthusiasts, or eco-tourism. Wetlands are a unique yet imperiled ecosystem in the Nation and coastal Louisiana has experienced a tremendous loss of this important habitat.

Resource Significance—Institutional, Public, and Technical

Significance of Benefits

The NER RP would benefit a total of 15,448 net acres (Table 4-3). The significance of benefits for the NER RP is substantially greater than just the net acres restored and/or protected. Compared to the "No Action Alternative", implementing the marsh restoration, chenier reforestation, and shoreline protection/stabilization features of the NER RP would result in positive effects on resources which are institutionally, technically, and publicly recognized. Restoration supports the global, national, state, and locally significant resources within the area would contribute to the unique services, functions, and values provided by these resources.

Implementing the NER RP would reduce some forms of habitat degradation and land loss reestablishing processes that contribute plant production replenishing vertical maintenance necessary for a stable ecosystem. Restoring estuarine marsh habitats for wildlife, finfish, shellfish, and other aquatic organisms would provide habitats used for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements. T&E species, such as piping plover, sea turtles, and species of interest such as the brown pelican and bald eagle would benefit from the restoration of scarce important estuarine habitats. The shoreline protection features would restore and protect approximately 335 acres of designated critical habitat for the threatened piping plover and important habitat for the threatened rufa red knot.

There would also be benefits to various resources such as estuarine EFH including: estuarine mud bottoms; marsh ponds, inner marsh and marsh edge; SAV; beach; tidal creeks; and marsh/water interface associated with the restoration of transitional estuarine habitat between upland and marine environments. This would result in restored EFH for Federally-managed species such as brown and white shrimp, red drum, Spanish mackerel, King mackerel, and cobia. Increases in available EFH would result in more opportunities for recreational and commercial fisheries. Restoring the rare and imperiled chenier forest would provide stopover habitat for migrating neotropical birds. Benefits of the NER plan would include a decrease in inter- and intra-specific competition between resident and migratory fish and wildlife species for decreasing estuarine resources.

The loss of marsh and wetlands would threaten nationally significant economic, historical, and cultural resources and have significant negative impacts on the navigation, oil and gas, and seafood industries, and the residents that service these industries. Southwest Louisiana's "Working Coast" is unique in its scope and scale, with extensive infrastructure needs to serve the navigation, oil and gas, and commercial and recreational fishing industries, which must be balanced and must exist in harmony with each other. While human populations in and near the wetland areas are moderate, Southwest Coastal Louisiana is a hub of activity supporting the numerous ports, waterways, oil and gas fields, rich fishing grounds, and other elements of a working coast. The impact of the loss of wetlands will be felt far beyond the industries directly impacted, with residents that serve important national industries, especially the offshore oil and gas fields, being forced to abandon their communities and move further inland.

A resource is considered significant if it is acknowledged in three categories:

1. *Institutional*—the resource is acknowledged in the laws, adopted plans, or other policy statements of public agencies or private groups;
2. *Public*—the resources are recognized as important by some segment of the general public as evidenced by people engaged in activities that reflect an interest or concern for that particular resource; and/or
3. *Technical*—the resources are determined to be important based on technical or scientific criteria.

Institutional Recognition

Human Environment resources (socioeconomics and human resources) within the project area are institutionally significant. Of particular relevance is the degree to which the proposed action could positively affect the public health, safety, and economic well-being; and the quality of the human environment by providing hurricane storm surge risk reduction by implementing nonstructural measures (elevating, relocating, or flood proofing structures) and coastal restoration (marsh restoration, shoreline protection/stabilization, and chenier restoration). Institutional significance is exemplified because the NER benefits are recognized in laws and policy and acknowledgment is given to the restoration and protection of these resources in the project area by the following (for example): the National Environmental Policy Act of 1969, our basic national charter for protection of the environment and involvement of the public in decisions, such as this proposed action, which could beneficially affect the quality of the human environment; the Estuary Protection Act of 1968; Clean Water Act of 1972 and amendments, etc.

Restoration of water environment resources within the project area exemplifies institutional significance because of law and policy and the acknowledgment given to these resources by the following: National Environmental Policy Act of 1969; Clean Water Act of 1972 and amendments; Coastal Barrier Resources Act; Rivers and Harbors Act of 1899; Watershed Protection and Flood Prevention Act of 1954; Submerged Land Act of 1953; Coastal Zone Management Act of 1972; and the Estuary Protection Act of 1968.

Benefits from the proposed action would result in restored and protected wetland marshes, barrier shorelines, and chenier vegetation which provide essential and critical habitat for various fish and wildlife, endangered species (e.g., piping plover), and numerous species of neotropical migrating birds. Restored coastal wetlands and vegetation resources serve as the basis of productivity, contribute to ecosystem biodiversity, provide various essential and critical habitat types, and are an indicator of the health of coastal habitats. Natural environment resources are institutionally significant because restoration of these areas is exemplified by the law and policy recognition and acknowledgment given to these resources in the project area. Significance is supported by many laws, plan, policies, and treaties. The following provides an example of species and their associated laws:

Endangered Species Act of 1973, as amended;

Piping Plover (Charadrius melodus)	Threatened
Red knot (Calidris canutus rufa)	Threatened
Red-cockaded woodpecker (Picoides borealis)	Endangered
Sprague's pipit (Anthus spragueii)	Candidate
Gulf sturgeon (Acipenser oxyrinchus desotoi)	Threatened
West Indian Manatee (Trichechus manatus)	Endangered

Green sea turtle (Chelonia mydas)	Threatened
Hawksbill sea turtle (Eretmochelys imbricata)	Endangered
Kemp's ridley sea turtle (Lepidochelys kempii)	Endangered
Leatherback sea turtle (Dermochelys coriacea)	Endangered
Loggerhead sea turtle (Caretta caretta)	Threatened

The Migratory Bird Treaty Act of 1918;

Egret: Cattle, Bubulcus ibis, Little, Egretta garzetta, Reddish, Egretta rufescens, Snowy, Egretta thula
Bluebird: Eastern, Sialia sialis
Bunting: Indigo, Passerina cyanea
Chickadee: Carolina, Poecile carolinensis
Mallard, Anas platyrhynchos

Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended:

Red Drum
Lane Snapper,
Cobia,
Bull shark.

The study area supports many different significant species and habitats that are institutionally significant as supported by the following:

Coastal Barrier Resources Act of 1982; Coastal Zone Management Act of 1972; Estuary Protection Act of 1968; Wild Bird Conservation Act of 1992; North American Wetlands Conservation Act of 1989; Fish and Wildlife Coordination Act of 1958, as amended; Marine Mammal Protection Act of 1978; and E.O. 13186 Responsibilities of Federal Agencies for Protecting Migratory Birds.

Public Recognition

Restored and protected coastal wetland resources are publicly significant because of the high priority that the public places on their aesthetic, recreational, and commercial value. Restoration of this coastal habitat positively affects the long-term health of the coastal Louisiana ecosystem which supports the well-being of the southwest Louisiana human culture, with the attendant positive monetary impacts of wetland-related human uses. Restoration helps support the fisheries industry which encompasses commercial fishing, harvesting, distribution, and processing, fisheries support industry, boat building, and recreation fishing/hunting support (marinas, fishing charter/guide services, camps, bait/tackle shops).

This resource is publicly significant because the public demands reduced risk of damage from hurricane storm surge, protection of estuaries and floodplains, and because the public demands clean water and healthy wildlife and fishery species for recreational and commercial use. Outdoor activities are very popular throughout the study area and include such activities as bird watching, recreational fishing, hunting, boating and other forms of aquatic recreation, cooking and food preparation (especially utilizing the various species that utilize the surrounding marshes and wetlands), and through cultural events such as the Marshland Festival held each July. The loss of or a reduction in the extent of the coastal ecosystem threatens the unique southwest Louisiana culture, which is closely tied to surrounding ecosystem. Numerous comments and letters were received supporting the NER RP, with many calling for even more restoration features to be included. Some significant commenters including Cameron Parish Gravity Drainage Districts No. 4 & 5 and the Audubon Society each representing thousands of individuals.

Human environment resources are publicly significant because of the direct experience by southwest coastal Louisiana citizens regarding human health, welfare, and the decline of the economic and social well-being due to adverse impacts associated with coastal land loss and hurricane storm surge damages throughout the project area. Some of the effect of this condition could be lessened by the proposed NED and NER RPs.

Technical Recognition

The loss of this habitat affects an entire ecosystem that serves as important nursery grounds for numerous species, stop-over habitat for migrating birds, and as a complex and inter-related food chain. The scarcity of this habitat is becoming more pronounced as thousands of wetland acres are eroded away each year. Water environment resources are technically significant because the proposed NED RP and NER RP could reduce the adverse impacts of hurricane storm surge damage to the human and natural environment. Water quality would be improved by wetland creation which supports most physical, chemical, geological, and biological processes throughout the entire southwest coastal Louisiana estuarine system. A collapsed ecosystem cannot support the diverse number of species that rely on the study area for their survival. Restoration of wetlands would play an important role in increasing the survival, distribution, and benefits to plants, wildlife, and fisheries resources and would increase biodiversity in the study area.

Human environment resources are technically significant because the proposed action could reduce the costs associated with hurricane storm surge flooding. Coastal wetland restoration would provide a buffer for hurricane storm surge and could help offset the impacts of hurricane storm surge damage by elevating or otherwise flood proofing structures throughout the study area. This would positively affect the social and economic welfare of citizens within the study area and the Nation.

Scarcity

Scarcity is a measure of a resource's relative abundance within a specified geographic range. Coastal wetlands are limited in range throughout the United States and are imperiled throughout their range. The Louisiana coastal area represent 40 percent of the wetlands in the nation and accounts for 90 percent of national wetland loss. The study area represents approximately 30 percent of the Louisiana wetlands total. The Southwest Coastal Louisiana area is unique in its composition of wetlands, ridges, and coastal wetlands. The area is composed of complete beachfront, coastal cheniers, and estuarine complex. The coastal geomorphology formed by the coastal cheniers is unique to the nation.

Representativeness

The study area exemplifies a natural coastal estuarine wetland habitat. There is a significant abundance of representative species and coastal landforms, because of the unique nature of the coastal cheniers in close association with estuarine complexes. The cheniers are similar in form and scale as they were prior to human settlement. The cheniers retain a large number of native oak and other hardwood tree and shrub species.

Connectivity

The connectivity of this transitional coastal estuarine system extends well beyond the study area. For example, the estuary provides nursery, foraging, hiding cover, and other essential fish habitats for marine aquatic organisms that utilize both the gulf and the estuary for various life stages and requirements. These estuaries also provide important, critical, and essential habitats for species that migrate throughout the gulf (Manatee, Bottlenose Dolphin, Gulf Sturgeon, Cobia, King Mackerel, Sea Turtles, commercial and recreational fisheries), continental (Mallard, Teal, Pintails, Redhead, Shovelers, and others), and hemisphere (Neotropical migratory birds; humming birds, warblers, sparrows, birds of prey, dabbling and diving ducks). Restoration within the study area would nourish and protect the continued and improved use of important critical and essential fish and wildlife habitats.

Limiting Habitat

This is habitat that is essential for the conservation, survival, or recovery of one or more species. The RP is protecting gulf shoreline beach which is designated critical habitat for the threatened piping plover and also used by the threatened rufia sub-species of the red knot which is critical for the survival and recovery of these two species.

The RP also restores cheniers which provides important stopover habitat for neotropical migratory birds. The area also contains 72,000 acres of Wetland Conservation area designated for an experimental population of threatened Whooping Crane. There are 84 miles of shoreline habitat designated for the threatened Piping Plover within the study area as well. The RP provides resilience that supports the sustainability of these habitats.

Biodiversity

This study area is extremely diverse and is utilized by resident as well as migratory fish and wildlife species. For example the study area is part of the central flyway for migratory waterfowl and neotropics which consists of hundreds of species and millions of individuals. This study area hosts a large percentage of this population. The study area has freshwater, estuarine, and migratory fisheries consisting of hundreds of species. That diversity in numbers is exemplified in the numbers of recreational users utilizing the area.

Status and Trends

Although the coastal wetlands and forested chenier habitats in the study area are declining at a rate less than the remainder of coastal Louisiana, the loss of these transitional estuarine wetlands and cheniers continues to threaten the terrestrial and aquatic organisms that utilize the area. This continued loss further exacerbates the nationwide scarcity of coastal wetlands and continues impairing the connectivity between the Gulf, transitional estuaries, and interior terrestrial habitats.

4.2.9 Synergy of the NED/NER Plans and Management of Residual Risk

Integration of the NED/NER Plans

The integration of the SWC NED and NER RP's is rooted in the evaluation of critical landscape features identified tin the Louisiana Coastal Protection and Restoration (LACPR) study. Work undertaken in the LACPR study to review the ADCIRC storm surge modeling output for the 100-year, 400-year, and 1,000-year base condition runs allowed the identification of landscape components that tend to produce significant effect on surge. These landscape features currently exist independent of any proposed alternative action. While some of these features might be incorporated directly into alternative risk reduction plans, the fact that they are already existing contributors to systemic risk reduction demonstrates that there are landscape benefits being derived even with no action. This also indicates that maintenance of these features, independent of any proposed alternative risk reduction plan, would be beneficial to a system of comprehensive risk reduction. The LACPR report suggested that these landscape features would merit priority, or focus for restoration, based on their identifiable contribution to risk reduction wherever they might have been incorporated into an alternative plan, or for maintenance wherever they represent elements of existing publicly-supported projects. While the performance of the NED RP is not dependent on any of these landscape features, their continued function would serve to increase the reliability and resilience of other NED risk reduction features.

The features identified in the LACPR effort ranged from critical wetland segments to natural ridges to manmade embankments. The features generally demonstrated performance in altering storm surge across all surge conditions (100-year, 400-year, and 1,000-year). The effects of these features observed in the LACPR effort are generally either a relatively rapid decrease, or a pronounced "stacking" preceding a decrease, in the forecast surge elevation. It is reasonable to suggest that these marked changes in surge elevation, and the landscape components associated with them, represent a beneficial restriction to the movement of surge further inland. These observed landscape effects are based on the modeling and output of multiple storm tracks and intensities, which subsequently represent statistical water surface effects. The actual performance of any landscape features varies widely when considering the impacts of individual storm tracks and intensities.

In the Southwest Coastal area (LACPR, Planning Unit 4), the critical landscape features identified included the entire barrier-shoreline, Grand Chenier, and the wetland areas between Vermilion Bay and the GIWW, the Freshwater Bayou channel bank, and Highway 82. In this area, the modeling indicates consistent stacking of surge at the coast with significant reduction of surge elevation inland from that point. Grand Chenier

contributes to this effect along the entire eastern portion of the planning unit. The wetland area between Vermilion Bay and the GIWW, Freshwater Bayou and Highway 82 at the eastern end of the area provides a similar effect and results in significant reduction of surge elevation in the interior of the basin. The SWC NER RP features tie into and support all of these identified critical landscape features, as well as other portions of the shoreline, connecting ridges and existing roadways.

The NER RP tiered implementation assures that those features will be implemented in a manner that will address the most potentially far reaching impacts. These impacts also represent the most likely threat to these critical features. The interface between the NER RP and these identified critical features produces additional resilience in the geomorphic structure and sustainability of the area and adds reliability in the ability of the landscape to support risk management. This in turn allows the NED RP features to perform in the most effective and efficient manner for the greatest possible duration.

Synergy of the NED/NER Plans with Parish Hazard Mitigation Plans

All three Parishes in the Southwest Coastal study area have updated their Hazard Mitigation Plans consistent with the State's Hazard Mitigation Plan in 2015. In addition to reducing life safety and property damage risk, each Parish, in identifying its hazard mitigation goals, lays out a theme of facilitating recovery and reducing risk to the infrastructure that supports recovery. The NED/NER RPs, and their integrated performance allow the direct management of the greatest identified risks and extend the performance and effectiveness of local hazard mitigation actions, as well as increase valuable ecosystem outputs. A general overview of the activities for each Parish is provided below.

The Calcasieu Parish Office of Planning and Development provides oversight for building permits and codes, land use planning, and all parish ordinances. Calcasieu Parish and its jurisdictions ensure that all adopted building codes are enforced and in compliance relating to the construction of any structure within the boundaries of the parish. Building permits are required prior to beginning any type of construction or renovation projects, installation of electrical wiring, plumbing, or gas piping, moving manufactured/modular or portable buildings, and reroofing or demolitions. While local capabilities for mitigation can vary from community to community, Calcasieu Parish as a whole has a system in place to coordinate and share these capabilities through the Calcasieu Parish Government and through their Parish Hazard Mitigation Plan. Calcasieu Parish lists only 15% of its total land area as urban/developed.

Calcasieu Parish has established hazard mitigation goals that include:

1. Reduce or prevent injury and loss of life;
2. Reduce or prevent damage to property and material assets;
3. Reduce or prevent future damage to critical facilities (fire, rescue, law enforcement, communications, command and control) essential for protection and public safety;
4. Reduce or prevent future damage to special facilities, including schools, nursing homes, health care facilities, prisons, and historical and cultural resources;
5. Reduce or prevent future damage to infrastructure, including stormwater conveyance structures, utility systems, pipelines, railroads, highways, bridges, and navigable waterways;
6. Reduce or prevent future damage to commercial facilities; and,
7. Reduce or prevent future damage to higher risk facilities that, if damaged, may result in significant loss of human life, damage to the environment, or significant harm to the local Economy. These facilities include hazardous material handling facilities, dams, flood control facilities, and other high security facilities.

Calcasieu Parish has completed actions to harden critical facilities, to acquire and elevate some properties, and has taken steps to reduce future floodplain development. The Parish, and various communities within the Parish, have also identified 120 additional actions, most with target dates of 5 years or less, to achieve their hazard mitigation goals.

Cameron Parish ensures that all building codes adopted are enforced and in compliance relating to the construction of any within the boundaries of the parish. The Cameron Parish Planning and Development Office is responsible for all building code, permitting, land use planning and ordinances. The Parish has a Flood Damage Prevention Ordinance, Coastal Use Permits, and a Coastal Zone Program that are followed. As a community, Cameron Parish has administrative and technical capabilities in place that may be utilized in reducing hazard impacts or implementing hazard mitigation activities. Such capabilities include staff, skillset, and tools available in the community that may be accessed to implement mitigation activities and to effectively coordinate resources. Cameron Parish lists only 1% of its total land area as urban/developed.

Cameron Parish has established hazard mitigation goals that include:

1. Reduce the loss of life or property;
2. Protect critical public facilities and thoroughfares;
3. Ensure post-disaster operability of strategic facilities and thoroughfares;
4. Develop incentive and community outreach/education programs that assist homeowners in protecting residential properties;
5. Provide a long term mitigation solution in locations which experience repetitive hazard damage;
6. Provide a cooperative, inter-jurisdictional / inter-agency solution to a problem;
7. Show development and implementation of comprehensive programs, standards, and regulations that reduce future hazard damage;
8. Avoid inappropriate future development in areas that are vulnerable to hazard damage;
9. Reduce the level of hazard vulnerability in existing structures and developed property; and,
10. Restore or protect natural resources, recreational areas, open space, or other environmental values

Cameron Parish has completed actions through FEMA to acquire and elevate some properties and has taken steps to reduce future floodplain development. The Parish is also pursuing 16 additional actions with target dates of 5 years or less to achieve their hazard mitigation goals.

Vermilion Parish and its jurisdictions' capabilities include planning, regulatory, administrative, technical, financial, and education and outreach resources. There are a number of mitigation-specific acts, plans, executive orders, and policies that lay out specific goals, objectives, and policy statements which already support or could support pre- and post-disaster hazard mitigation. Vermilion Parish and its jurisdictions ensure that all building codes adopted are enforced and in compliance, relating to the construction of any building within the boundaries of the parish. Some jurisdictions have extensive zoning regulations, which address use and height of buildings, density of populations, open space limitation, and lot and occupancy requirements. Before the Parish Council enacts or amends development regulations or takes any land use action, and before the Zoning Board may make any recommendation to the Parish Council regarding a proposed development regulation or land use action, the Planning Department, or other department responsible for providing findings, recommendations, papers, correspondence, and records related to the regulation, amendment, or action shall provide a written recommendation to the Council and Zoning Board regarding the consistency with the plan. The land use, zoning, and ordinance requirements address many different types of districts in the parish and its incorporated jurisdictions, ranging from suburban, conservation, and mixed-use to industrial. Vermilion Parish lists only 3% of its total land area as urban/developed.

Vermilion Parish has established hazard mitigation goals that include:

1. Identify and pursue preventative structural and non-structural measures that will reduce future damages from hazards;
2. Enhance public awareness and understanding of disaster preparedness;
3. Reduce repetitive flood losses in parish and municipalities;
4. Facilitate sound building practices in the parish and municipalities so as to reduce or eliminate the potential impact of hazards; and,
5. Improve the ability of the parish and municipalities to rapidly recover and restore facilities and services to the public.

Vermilion Parish, and various communities within the Parish, are pursuing 103 actions to achieve their hazard mitigation goals. Of those action 53 are currently ongoing. All of the actions have target completion dates of 5 years or less.

Synergy of the NED/NER Plans with the Oil and Gas Industry

The Port of Lake Charles has risen steadily from the 26th largest US port in 1980 to the 11th largest today primarily on the import and export of petroleum and natural gas products. Data from the Port of Lake Charles indicates that, in addition to significant existing oil and gas facilities, there is currently $41 billion in ongoing industrial development under construction, with an additional $97 billion pending approval. The New Orleans District has issued 5 permits specifically for LNG and petrochemical facilities over the last 5 years with an additional 4 permits in review. The estimated national economic impact of the port is $6.7 billion in GDP with and additional $4.8 billion projected over the next 10 years. In addition, the area contains major elements of the Strategic Petroleum Reserve (the West Hackberry storage facility contains one third of the total reserve) and the Henry Hub is the establish distribution point for setting the unit price of natural gas for the Nation.

Port of Lake Charles employment represents an estimated 36,000 jobs, or 31 percent of the Lake Charles MSA employment with an additional 13,000 statewide jobs outside the MSA. That is expected to increase by 25 percent over the next 10 years, roughly 9,000 additional jobs in Lake Charles and 12,000 additional jobs statewide. Population and housing data from the Parishes in the study area from 2000-2013 indicate an overall growth trend. Calcasieu Parish, the largest of the three, with the city of Lake Charles, has seen housing growth of 9.1 percent with 14.9 percent in the unincorporated areas. Vermilion Parish has seen housing growth of 12.9 percent with 21.6 percent in the unincorporated areas. This housing growth is significant given that it has occurred even before the recent, and forecast, increases in industrial development and job growth. The growth in housing in the unincorporated areas also underscores the utility of a comprehensive non-structural approach to risk management.

In a manner similar to the synergy between the function of the NED and NER RPs, the resilience and reliability of the extensive oil and gas infrastructure and attendant economy of the Southwest Louisiana area would benefit indirectly from the implementation of those plans. A significant key to the long-term performance of this oil and gas economy is the availability of human resources. The ability to assure these resources, and thereby the performance of this growing industry, is positively effected in two ways by the implementation of the SWC RP. First, as an immediate effect, it enables the more rapid reoccupation and recovery by residents, particularly those most at risk, following storm events. As a result, it also speeds the recovery of the workforce following those events. The recovery of the workforce is key for industries and businesses to return to normal operation, minimize production losses, and control secondary and third order impacts to the overall economy. Second, over the long-term, the availability and viability of housing necessary to support the workforce is enabled by the overall reduction in risk provided by the RP.

4.3 Implementation Requirements

PED and construction practices would follow USACE regulations and standards. Lands, easements, right-of-ways, relocations and borrow/disposal areas (LERRDs) are an NFS obligation (see Appendix E). A preliminary description of the NFS obligations for both the NER and the NED RPs are set forth below.

4.4 Cost Sharing and Non-Federal Sponsor Responsibilities

The CPRA Board is anticipated to be the NFS for the planning, design, construction, operation, maintenance, repair, rehabilitation, and replacement of the project. The cost share for the planning, design, and construction is 65% Federal and 35% non-Federal. Federal implementation of the project is subject to the NFS agreeing in a binding written agreement to comply with applicable Federal laws and policies and with all of the requisite non-Federal obligations, including, but not limited to the provision of all LERRDs deemed necessary by the Government for the construction and OMRR&R of the NED and NER RPs, as well as the OMRR&R of the NED and NER RPs. A more expansive list of NFS obligations can be found in Chapter 7.

4.4.1 Cost Apportionment

Table 4-7 contains a summary of estimated NED and NER costs and benefits for the full RP. Note that costs and benefit numbers have been updated compared to those described in Chapter 2 based on certified cost numbers received from the USACE Cost Engineering Mandatory Center of Expertise (see Appendix B for more details).

Table 4-7: RP summary.

	Storm Damage Risk Reduction (NED)	Ecosystem Restoration (NER)	Total
Project First Cost	$906,091,000	$2,485,025,000	$3,391,116,000
Average Annual Cost	$36,056,000	$66,642,000	$102,698,000
Equivalent Annual Benefits	$203,554,000	4,976 (AAHU's)	
Equivalent Annual Net Benefits	$167,498,000	15,448 (Net Acres)	
BCR	5.65:1	N/A	

Table 4-8 depicts the cost total and Table 4-9 depicts the cost apportionment for the NED and NER RPs. Since NER RP features (124d and 3c1) will be recommended to USFWS for its independent action to obtain Congressional authorization and funding for USFWS implementation, these features are not included in the recommended Corps Plan and will not be included among the NER RP features that USACE will cost-share with the NFS. As a result, this aspect of the NER RP requires two calculations: the total cost of all NED and NER RP features (the "Federal Plan") and the total cost of all NED and NER features that would be cost-shared between the USACE and the NFS (the "Corps Plan"). The Federal Plan cost represents the total Federal investment to fully fund the NED and NER RPs. The Corps Plan cost depicts the Federal Plan cost minus the design, construction, and management costs for the two NER features that would be constructed by USFWS if it chooses to seek and successfully obtains independent Congressional authorization and funding. Preliminary estimates by USACE indicate that the total cost for features 124d and 3c1 is approximately $296,839,000; however, it is likely that USFWS, should it choose to seek authorization and funding, will reevaluate the total cost necessary for implementation by USFWS rather than by USACE. In so doing, it is probable that USFWS would determine a different total cost for these features. The total ecosystem benefits associated with the two features are 1,492 acres and 611 AAHUs. The cost breakouts, and Federal and non-Federal cost apportionments, for both the Federal and Corps plans are provided in this section.

Table 4-8: Costs of the NED and NER RPs (Project First Costs)*.

	Storm Damage Risk Reduction (NED)	Ecosystem Restoration (NER)	Total (Federal Plan)[1]	Total (Corps Plan)[1]
PED	$39,440,000	$420,876,000	$460,316,000	$408,648,000
Construction	$788,900,000	$1,753,666,000	$2,542,566,000	$2,327,265,000
Lands, Easements, & ROW	$61,970,000	$10,932,000	$72,902,000	$72,100,000
Construction Management	$15,778,000	$236,744,000	$252,522,000	$223,456,000
Monitoring and Adaptive Management[2]	$---	$62,807,000	$62,807,000	$62,807,000
Total Project First Costs	$906,091,000	$2,485,025,000	$3,391,116,000	$3,094,276,000
Additional Studies (50/50 cost share)[4]				

CSC Salinity Barrier & Cameron Creole Spillway	$---	$6,000,000	$6,000,000	$6,000,000
Total Costs	$906,091,000	$2,491,025,000	$3,397,113,000	$3,100,276,000

** All table numbers have been rounded to the nearest thousand.*
1 – Construction of all RP features constitutes the 'Federal Cost'. The Federal Cost is 65% of all cost shared features plus 100% of the costs for Features 124d and 3c1 (to be constructed by USFWS). Costs for the 'Corps Cost', which constitutes the RP minus costs for features 124d and 3c1 are also presented.
2 – Details on AM&M cost ranges can be found in Appendix A, Annex L.

Table 4-9: NED and NER RP Cost Apportionment (Project First Costs)*.

	Federal Plan Federal Cost (65%)[1]	Corps Plan Federal Cost (65%)	Non-Federal Cost (35%)
PED	$317,289,000	$265,621,000	$143,027,000
Construction	$1,774,887,000	$1,559,568,000	$767,679,000
Lands, Easements, & ROW	$802,000[3]	$---[3]	$72,100,000
Construction Management	$174,343,000	$145,244,000	$78,210,000
Monitoring and Adaptive Management[2]	$40,825,000	$40,825,000	$21,982,000
Total Project First Costs	$2,308,116,000	$2,011,279,000	$1,082,997,000
Additional Studies (50/50 cost share)[4]			
CSC Salinity Barrier & Cameron Creole Spillway	$3,000,000	$3,000,000	$3,000,000
Total Costs	$2,311,116,000	$2,014,279,000	$1,085,997,000

** All table numbers have been rounded to the nearest thousand.*
1 – Construction of all RP features constitutes the 'Federal Cost'. The Federal Cost is 65% of all cost shared features plus 100% of the costs for Features 124d and 3c1 (to be constructed by USFWS). Costs for the 'Corps Cost', which constitutes the RP minus costs for features 124d and 3c1 are also presented.
2 – Details on AM&M cost ranges can be found in Appendix A, Annex L.
3 – Federal Plan cost consists of private lands required for construction of the two NER features partially located on USFWS property (124d and 3c1).
4 – The Calcasieu Ship Channel Salinity Barrier and the Cameron Creole Spillway are recommended as 3x3x3 compliant studies cost-shared 50/50.

4.5 Areas of Controversy and Issues to be Resolved

Areas of Controversy

1. The single-most important area of controversy is based upon over several hundred oral and written comments and signatures on a petition to "PLEASE TAKE IT OUT!"; to completely remove any and all reference or language related to 'eminent domain' and 'involuntary participation' from the study. The property owner's choice to remain at their 'own risk' or possibly without future assistance is considered the only appropriate course of action. Furthermore, the statement has been made that the goal of the plan is to restore and protect the coast and marshes, assist in preserving the unique culture, not remove people from their homes and family lands.

Suggested Resolution: The involuntary aspect of the NED TSP to remove structures that are located in the regulatory floodway, designated as 'Severe Repetitive Loss Structures' as defined by FEMA, or that present a life safety risk, has been removed from the RP. The NED RP is now 100% voluntary and there is no longer a need for the use of eminent domain to acquire structures that met these criteria in the 2015 Revised Draft Report.

2. Over 130 signatures on a petition and several oral and written comments requested that chenier reforestation measures be replaced by shoreline protection measures. As stated in the petition: "Shoreline protection would be a better investment for our coast's future."

Suggested Resolution: Both shoreline protection and reforestation of chenier ridges are warranted in the study area. The PDT prioritized ecosystem restoration measures and determined that, before the chenier ridges are lost, reforestation is necessary. However, the PDT also recognizes the importance and necessity of providing additional shoreline protection measures. Unfortunately, under the current comparisons and benefits of restoration measures, reforestation is weighted more than ecosystem protection that would be provided by additional shoreline protection measures for areas inland from the immediate shoreline.

3. Another area of controversy is the petition's request that a 'Local sponsor' be chosen to have an immediate 'voice' in the remaining planning process of the study. The petition states that local sponsors can assist in making valid and important corrections and local concerns could be immediately addressed. The PDT interprets this to mean including a local area (parish, town, other smaller area) representative on the PDT.

Suggested Resolution: Outreach efforts to interested stakeholders were increased after release of the draft report. These efforts included multiple conference calls, study update presentations to various local government officials, and progress updates to the CPRA Board.

4. Over 130 signatures on a petition and several oral and written comments stated that "our parish deserves 'protection'." Include Parish Priority Project and insert a list of all of the measures and projects proposed in the parishes' existing and proposed Coastal Restoration & Protection Plans. The stated purpose of this is that the inclusion of all such measures and projects will eliminate the unintentional exclusion of projects that were not tentatively selected and will clearly indicate the worthiness for future consideration for funding.

Resolution: Parish Priority Projects have been included as a separate and new appendix (Appendix P) to the Final Report and will include the following recommended statement: "Though not an endorsement of any project under this study effort, Parish Priority Projects that would be provided by the Parishes to the State for consideration as deemed necessary by the Coastal Master Plan for Louisiana and are included in this Appendix only as a reference for future planning under other study authorities."

5. Controversy over perceived insufficient ecosystem restoration throughout the study area. The large study area has numerous areas in need of ecosystem restoration.

Resolution: The PDT took an approach to address those areas in greatest need. The public demands more acres of restoration to this area due to the rapid land loss being experienced.

6. Controversy over an insufficient number of hydrologic/salinity control measures recommended in the TSP/RP, as well as controversy over recommending additional study of hydrologic/salinity control measures for future study instead of providing such measures for immediate construction.

Suggested Resolution: As has been determined by the present and previous ecosystem restoration studies, hydrologic/salinity control measures are quite complex. The hydrologic connectivity within the study area has been significantly altered by natural processes as well as by Federal, state, parish and local entities for a number of often conflicting and opposing purposes. Consequently, such hydrologic/salinity measures must be given full consideration and analysis to determine how best to reestablish hydrologic connectivity and reduce salinity and hurricane storm surge impacts without further exacerbating existing problems. In addition, many hydrologic/salinity measures would involve authorized navigation waterways which must be maintained as authorized. Hence, the PDT recommends future individual study of the existing hydrologic/salinity measures as well as any such measures which may be developed in the future.

7. Controversy over the lack of salinity and flood control measures to prevent the Calcasieu River from flooding areas upstream during storm surge events.

Suggested Resolution: This controversy is similar to controversy #6, above. Due to the complexity of the problem, additional study and significant modeling of the Calcasieu River navigation, salinity, and storm surge

problems must be considered independent of the present proposed action. Consequently, the PDT continues to recommend the CSC Salinity Control Structure as an additional long range study.

8. The 2013 Draft Report primary area of controversy was public demand for design and implementation of structural risk reduction measures (e.g., levees), not nonstructural measures (structure raising, flood proofing, etc.).

Suggested Resolution: Although this was considered the most significant comment on the 2013 Initial Draft Report, there is no reference to this comment with regard to the 2015 Revised Draft Report. The southwest coastal Louisiana area, with the exception of Lake Charles, is not densely populated. Rather, the population is scattered over a wide area. Developing a structural levee alignment that would provide sufficient risk reduction to the sparsely populated and widespread human populations and that would provide a positive benefit-to-cost ratio, was not possible. Consequently, the PDT developed what may be the largest nonstructural alternative the Corps has considered to date.

Issues to be Resolved

1. A primary issue that required resolution in the Final Report was the development of a prioritization for implementation of the NED RP. This Final Report recommends a strategy to implement the nonstructural Project for eligible structures. Structures that have been identified as preliminarily eligible as part of the NED RP are located across the 4,700 mile, three-parish study area. In order to effectively implement the NED RP, clusters of eligible structures that represent the highest risk for storm surge damages (i.e. those with a FFE below the 10-year stage) would be identified and prioritized for construction. Individual structures would be addressed based on a ranking of risk from highest to lowest within the cluster. The ranking of individual structures would be revisited as elevation work is completed, as additional funding is distributed, and as new clusters are identified. Addressing groups of structures within a small geographic area would be more cost-effective, efficient, and would also allow for a more strategic methodology for applying nonstructural measures to at-risk structures. However, it should be noted that the appropriate implementation strategy for the NED RP is highly dependent of the number and location of eligible structures whose owners desire to participate in the NED RP and upon the amount of funding that the NED Project receives over time. For these reasons, additional work on this process is anticipated to be necessary during the design and implementation phase of the NED Project.

2. The second issue to be resolved relates to the costs of structure raising/flood proofing and the potential for significant inflation of these costs. For example, following Hurricane Katrina (2005) the reconstruction of the New Orleans HSDDR system was significantly affected by the increased costs of borrow material. As levee restoration and construction continued, the price of borrow escalated over pre-storm prices. Therefore, the PDT has developed a detailed risk analysis (see Appendix B) to determine if and how much contingency costs may be required to address the supply and demand costs for elevating structures.

4.6 USACE Campaign Plan

The USACE mission is to deliver vital engineering solutions, in collaboration with our partners, to secure our Nation, energize our economy, and reduce risk from disaster. The USACE has set several goals to help achieve this mission. Completing this Feasibility Study and Environmental Impact Statement works towards Goal 2 – Transform Civil Works (Deliver enduring and essential water resource solutions using effective transformation strategies), Goal 3 – Reduce Disaster Risks (Deliver support that responds to, recovers from, and mitigates disaster impacts to the Nation while ensuring sustainable operations), and Goal 4 – Prepare for Tomorrow (Build resilient People, Teams, Systems, and Processes to sustain a diverse culture of collaboration, innovation, and participation to shape and deliver strategic solutions).

4.7 USACE Environmental Operating Principles

The United States Army Corps of Engineers Environmental Operating Principles were developed to ensure that Corps of Engineers missions include totally integrated sustainable environmental practices. The Principles

provided corporate direction to ensure the workforce recognized the Corps of Engineers role in, and responsibility for, sustainable use, stewardship, and restoration of natural resources across the Nation and, through the international reach of its support missions. The Environmental Operating Principles relate to the human environment and apply to all aspects of business and operations. Re-committing to these principles and environmental stewardship will lead to more efficient and effective solutions, and will enable the Corps of Engineers to further leverage resources through collaboration. This is essential for successful integrated resources management, restoration of the environment and sustainable and energy efficient approaches to all Corps of Engineers mission areas. It is also an essential component of the Corps of Engineers' risk management approach in decision making, allowing the organization to offset uncertainty by building flexibility into the management and construction of infrastructure.

The re-energized Environmental Operating Principles are:

- Foster sustainability as a way of life throughout the organization.
- Proactively consider environmental consequences of all Corps activities and act accordingly.
- Create mutually supporting economic and environmentally sustainable solutions.
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments.
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
- Leverage scientific, economic, and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner.
- Employ an open, transparent process that respects views of individuals and groups interested in Corps activities.

The NED and NER RPs have been developed using the Environmental Operating Principles to guide and improve the development, formulation, and evaluation of alternatives under this study effort. Consideration of the environment has been essential in ensuring the hurricane storm surge damage risk reduction and ecosystem restoration missions are developed appropriately, are responsive to area problems and needs, and are supportable by the public and stakeholders.