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Ecosystem Modeling and Chandeleur Islands Restoration

1 message

Blanchard, Mary Josie <MaryJosie_Blanchard@ios.doi.gov> Tue, Jun 30, 2020 at 1:37 PM
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Through the collaboration process, DOI and the States have determined that for the outstanding proposal on Ecosystem Modeling and Chandeleur Islands Restoration E&D, alternative funding sources might be available. Therefore, DOI is withdrawing our request for funding the Chandeleur Islands E&D under the RESTORE 3b.

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RESTORE Council FPL 3 Proposal Document

General Information

Proposal Sponsor:
U.S. Department of the Interior – U.S. Fish and Wildlife Service

Title:
Ecosystem Modeling and Chandeleur Island Restoration Engineering & Design (DOI/FWS)

Project Abstract:
"Ecosystem Modeling and Chandeleur Island Restoration Engineering and Design" is a planning project to preserve the Chandeleur Islands as part of a holistic restoration strategy for the ecologically interconnected Pontchartrain Basin, Chandeleur Sound, Mississippi Sound, and Mobile Bay system. This system includes portions of three states, which has hampered the ability to pursue restoration comprehensively. To address this challenge, we are proposing two project components. First, is an integrated modeling effort to unify the diverse models that have been developed for this region. By coupling these models, we leverage their individual capacities and gain a regional perspective. The second component is engineering and design (E&D) for the Chandeleur Islands. The Chandeleurs are a barrier island chain that sustains estuaries by providing habitat for fish and wildlife, attenuating wave energy to protect shorelines, and modulating salinity (Reyes et al. 2005, Grzegorzewski et al. 2009, Park et al. 2014). Some predict complete submergence of the Chandeleur Islands within 20 years (Fearnley et al. 2009, Moore et al. 2014). Should these projections prove true, the Chandeleurs would erode into a shoal and its ecosystem services and functions would be lost. Given the importance of the Chandeleurs, restoration planning is required now. The modeling component of this project will cost one million dollars and take two years to complete; the E&D component seven million and three years.

FPL Category: Cat1: Planning Only

Activity Type: Project

Program: N/A

Co-sponsoring Agency(ies):
DOC/NOAA

Is this a construction project?
No

RESTORE Act Priority Criteria:
(I) Projects that are projected to make the greatest contribution to restoring and protecting the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, and coastal wetlands of the Gulf Coast region, without regard to geographic location within the Gulf Coast region.
(II) Large-scale projects and programs that are projected to substantially contribute to restoring and protecting the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, and coastal wetlands of the Gulf Coast ecosystem.
(III) Projects contained in existing Gulf Coast State comprehensive plans for the restoration and protection of natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, and coastal wetlands of the Gulf Coast region.
(IV) Projects that restore long-term resiliency of the natural resources, ecosystems, fisheries, marine

and wildlife habitats, beaches, and coastal wetlands most impacted by the Deepwater Horizon oil spill.

Priority Criteria Justification:
This project meets all four RESTORE Act Priority Criteria, but the project is most applicable to "large-scale", due to its modeling scope and cross-border habitat and resiliency benefits. The extent of the modeling is large-scale, covering portions of three states, ensuring future restoration investments are aligned to the portfolio of projects that would collectively provide the greatest contribution to natural resources without regard to geographic location. The E&D work specific to the Chandeleurs is foundational to sustaining the estuarine character of this system. The size (>1000 acres over 50-mile length) and expected duration of this project reflect a commitment to restoration at a large scale that enhances long-term resiliency. The Chandeleurs are included in the Louisiana Department of Wildlife and Fisheries' Louisiana Wildlife Action Plan (Holcomb et al. 2015) and are consistent with Louisiana's Coastal Master Plan (Coastal Protection and Restoration Authority of Louisiana 2017).

Project Duration (in years): 3

Goals

Primary Comprehensive Plan Goal:
Restore and Conserve Habitat

Primary Comprehensive Plan Objective:
Restore , Enhance, and Protect Habitats

Secondary Comprehensive Plan Objectives:
Improve Science-Based Decision-Making Process

Secondary Comprehensive Plan Goals:
N/A

PF Restoration Technique(s):
Create, restore, and enhance coastal wetlands, islands, shorelines and headlands: Sediment placement
Improve science-based decision-making processes: Develop tools for planning and evaluation

Location

Location:
This project is focused on the hydrogeomorphologically and ecologically interconnected Pontchartrain Basin, Chandeleur Sound, Mississippi Sound, and Mobile Bay systems (Figure 1). This area represents the extent of the regional modeling component of this project. The E&D component of this project is focused on the Chandeleur Island Chain.

HUC8 Watershed(s):
South Atlantic-Gulf Region(Mobile-Tombigbee) - Mobile Bay-Tombigbee(Mobile Bay)
Lower Mississippi Region(Lower Mississippi-Lake Maurepas) - Lake Maurepas(Lake Maurepas)
Lower Mississippi Region(Lower Mississippi) - Lake Pontchartrain(Liberty Bayou-Tchefuncta)
Lower Mississippi Region(Lower Mississippi) - Lake Pontchartrain(Lake Pontchartrain)
Lower Mississippi Region(Lower Mississippi) - Lake Pontchartrain(Eastern Louisiana Coastal)
South Atlantic-Gulf Region(Pascagoula) - Pascagoula(Pascagoula)
South Atlantic-Gulf Region(Pascagoula) - Pascagoula(Escatawpa)
South Atlantic-Gulf Region(Pascagoula) - Pascagoula(Mississippi Coastal)
South Atlantic-Gulf Region(Pearl) - Pearl(Lower Pearl)

State(s):
Alabama
Mississippi
Louisiana

County/Parish(es):
AL - Baldwin
AL - Mobile
LA - Plaquemines
LA - St. Bernard
MS - Hancock
MS - Harrison
MS - Jackson

Congressional District(s):
LA - 1
AL - 1
MS - 4

Narratives

Introduction and Overview:

The goal of this project is to advance and use best available science to restore the Chandeleur Islands – a foundational component of the northern Gulf ecosystem. Restoring these islands also protects developed shorelines, providing an opportunity to implement the two-fold restoration – environmental and economic – originally envisioned by the RESTORE Act. The first component of this project is an Integrated Ecosystem Modeling effort to synthesize the large number of modeling efforts that have been conducted for different aspects of the broader Pontchartrain Basin, Chandeleur Sound, Mississippi Sound, and Mobile Bay system. This synthesis will help address limitations of individual models. Some models cover a broad region but have low spatial resolution in locations more distant from their primary focus area. Other models include only a subset of the factors influencing an area of interest. Thus, these models lack predictive power for assessing effects on ecosystems because they have poor resolution across broad areas or lack critical drivers of hydrogeomorphology in an area. For example, many models for the Mississippi Sound fail to include areas in Chandeleur Sound, precluding their ability to predict impacts to salinity, dissolved oxygen, or tidal patterns from restoration projects or other water management actions that occur there. Understanding these foundational, landscape variables helps resource managers predict secondary impacts to living marine resources (e.g., oysters, marine mammals, etc.) and other conditions (e.g., hypoxia, red tide, etc.). The intent of this integrated modeling is to build upon the significant investments already made in ecosystem modeling and to identify and implement strategies to interconnect the models. In this way, individual models will continue to serve the purpose for which they were initially designed but will also have the enhanced functionality associated with greater resolution and spatial extent. This effort will offer insight into how landscape features and localized habitats (e.g., barrier islands, shoals, passes, etc.) interact within a broader regional context and will enable us to better utilize existing models as a decision support system in the northern Gulf. In light of the scope and scale of projects planned or completed within this system (i.e., closing of the Mississippi River Gulf Outlet, large-scale restoration of barrier islands under the Mississippi Coastal Improvements Program [MSCIP], proposed river diversions, and Chandeleur Island restoration, among others), a comprehensive understanding of interactions is necessary to ensure the sustainability and efficacy of these investments.

These models will highlight key landscape features that significantly influence system-wide hydrologic and ecological conditions. This can inform design of individual projects – whether restoration or other development – by identifying specific points of synergy and highlighting potential conflicts among projects. Most of the restoration projects in this region have been designed and implemented in relative isolation. Modeling at this scale will provide insights into how projects, both past and presently planned, might influence one another, which would enhance our ability to protect the investments already made. Likewise, modeling can contribute to an integrated understanding of the factors influencing key aspects of the Pontchartrain Basin-Chandeleur Sound-Mississippi Sound-Mobile Bay system to influence future restoration planning. The cost of this component is one million dollars and will be accomplished within two years.

The second component of this project is E&D for restoration of the Chandeleur Islands, a 50-mile long island chain in the northern Gulf of Mexico that includes a large portion of Breton National Wildlife Refuge. The Chandeleurs protect coastal communities from the effects of storms; promote oyster habitat and fisheries; and provide habitat for threatened and endangered species and nesting and migratory birds. Unfortunately, the Chandeleurs have lost 87% of their area since 1855 and are projected to disappear by 2037 (Fearnley et al. 2009, Moore et al. 2014). Although the Chandeleurs have recently lost significant acreage due to large hurricanes, the islands have a natural resilience and have historically rebounded from these immediate impacts relatively quickly because sand mobilized from the islands becomes redistributed elsewhere in the chain (Kahn 1986, sensu Suir and

Sasser 2019). The larger issue facing the Chandeleurs is the natural loss of sand from the island platform – something that nearly all barrier islands experience over time (Otvos 2018) – leading them towards becoming shoals. Compared to barrier islands, submerged shoals provide limited habitat for terrestrial wildlife, offer lower resistance to wave energy, and serve as a poor boundary for high salinity oceanic waters. Once the Chandeleurs become shoals, much of the estuarine character of the system will be diminished and restoration will require significantly greater effort, given the acceleration of loss that occurs at this stage (FitzGerald et al. 2018). Thus, restoration is urgently needed now to maintain the Chandeleurs as barrier islands and to ensure the natural resource benefits they provide to this entire system are retained.

Assuming that the problem facing the Chandeleurs is the loss of sand from the islands, turning the clock back and reversing the current trajectory requires bringing sand back to the islands (Knotts et al. 2007, Rosati and Stone 2009, Khalil et al. 2013). Although all options will be assessed during E&D, we envision the restoration project on the Chandeleurs concentrating on approaches that dredge sand and strategically place it where sediment has been depleted. In the context of the Chandeleurs, this approach is called sand backpassing. What remains unknown – and is the focus of the E&D – is where to get the sand, where to place it, and what other techniques to potentially use in concert (e.g., vegetative planting, sand fencing, shoreline protection, etc.)(FitzGerald et al. 2015). These questions are particularly important given the potential influence of the Chandeleurs on the larger system in which they occur: where do we place sand to maximize benefits to the islands and the larger system (e.g., maintenance of proper salinity regimes in Mississippi Sound)? These broader questions will both inform and be informed by the integrated modeling component of this project – necessitating that the modeling and E&D components be initiated simultaneously.

The Department of the Interior (DOI), through the U.S. Fish and Wildlife Service (USFWS), will work directly with the Department of Commerce (DOC) through the National Oceanographic and Atmospheric Administration (NOAA) to engage the diversity of state and federal resource managers within this ecosystem and design a project that accommodates multiple stakeholder needs. The RESTORE Council offers a unique opportunity for developing this project as all stakeholders can collectively fund this work and have equal voice in ensuring the ultimate restoration project benefits all. The approach of strategically placing sands on, around, and offshore of the islands is one that is increasingly being used in restoration in the Gulf to produce sustainable results, including on the barrier islands of Mississippi as part of the MSCIP (Byrnes and Berlinghoff 2012). This technique harnesses natural processes (particularly overwash and along-shore currents for sediment transport) to facilitate restoration. The proposed E&D will reduce the uncertainties and validate the assumptions of this approach by assessing sediment supplies, exploring transport models, and identifying strategic sand placement scenarios that maximize ecosystem benefits. If through design we recognize issues with our planned approaches, we will adapt and adjust accordingly to ensure a durable solution. The cost of this component is seven million dollars and will be accomplished in three years.

This project furthers the commitments set forth in the 2016 Comprehensive Plan Update (Gulf Coast Ecosystem Restoration Council 2016) by taking a regional, ecosystem-based approach to restoration. This project also exemplifies the commitment to leveraging resources and partnerships, particularly coordinating, collaborating, and connecting Gulf restoration activities. The modeling component builds upon existing efforts by leveraging their individual strengths to enhance our ability to assess the ecosystem. Further, DOI anticipates leveraging funding from other sources, potentially including the Louisiana Trustee Implementation Group (LA TIG), to complete construction once the E&D is complete. Indeed, in the Programmatic Damage Assessment and Restoration Plan (PDARP; Deepwater Horizon Natural Resource Damage Assessment Trustees 2016) the Trustees target $22 million for restoration of submerged aquatic vegetation (SAV) in the Chandeleurs. Trustees are

contemplating additional funding to support work there as well. Funding E&D through the RESTORE Council enables all parties who could be affected by a Chandeleur Islands restoration project – namely, Alabama, Louisiana, Mississippi, NOAA, and the USFWS – to participate as co-equals in its design, even if construction funding is provided via other sources in which all these partners are not directly involved.

Proposed Methods :

The goal of the Integrated Ecosystem Modeling component of this project is to advance science-based screening, planning, and implementation of restoration projects in the Pontchartrain Basin, Chandeleur Sound, Mississippi Sound, and Mobile Bay system. Considerable resources have been devoted to developing predictive models, data access portals, and decision-support tools for planning in the Gulf of Mexico. Despite these investments, leveraging of existing tools in project planning is often limited. Planners often support costly development of customized tools for their specific needs or, where resources are limited, rely on best professional judgement to inform restoration projects. Opportunities to leverage existing tools and models for new projects are often missed because either the models are not put to use after their project-specific needs are met or resources are not devoted to disseminating them to broader audiences.

Given these challenges, we will approach this model integration from two different perspectives:

1. Development of an integrated model that can serve as a decision-support tool to allow restoration practitioners to use existing data and model output in the screening of restoration projects, and
2. Advancement of a science-based restoration community of practice, including development of an online integration hub for connecting available data, modeling, and researchers to restoration project planners.

The first aspect of the modeling component will be developing a conceptual framework that integrates various models by linking outputs of one to inputs for another. Differences in resolution, time intervals, and intended application are often the most significant hurdles to model integration. By mapping these opportunities, we can crosswalk and cross-validate models and potentially identify specific metrics that can be reliably passed among existing models. This will expand the functionality of individual models and outline how they fit within the broader needs of those implementing restoration. We also envision that this framework will enable decision-makers to assess alternative portfolios of potential restoration projects. The base of this framework will be a Bayesian network that uses existing data and tools to predict environmental responses to changing conditions (Zeigler et al. 2017) and management objectives (Dalyander et al. 2016). This framework will allow decision-makers to make a first estimate of the probability that a restoration project will meet its goals. They can then use that estimate to decide whether to proceed with a more costly, detailed project evaluation.

The second aspect of the modeling component of this project will foster a science-based restoration community of practice through the connection of decision-makers and modelers in facilitated workshops to address specific stakeholder objectives. This component will develop an “integration hub” that provides an online forum to facilitate the use of science-based models in restoration project planning and should increase the use of available data and models for the region through organized access to existing databases, portals, and model archives. The integration hub will be patterned after innovation hubs, which are used in the private sector as a way to enable customers to engage directly with developers of products to identify high-priority needs and opportunities for solutions (Kandampully et al. 2016, Longo et al. 2013, Romero and Molina 2011, Zhang and Kandampully 2015). This approach combines elements of social media and online message boards with a user-friendly information visualization and access platform to enable decision-makers to familiarize themselves quickly with existing tools relevant to their needs and to connect with

researchers and modelers whose expertise is relevant to their needs.

The goal of the second component of this project is to enhance the sand budget of the Chandeleurs by preserving existing sand and increasing it in areas that have been eroding. Although other options will be considered in the course of E&D, initial designs will concentrate on sand backpassing. Sand backpassing is a beach management concept where sand being lost from a coastal system is recycled by mechanically transferring it from accreting areas (the deepwater sink north of the Chandeleur Islands) to eroding areas along the shoreline. At the Chandeleurs, the central sector of the islands was the original deltaic point source for much of the sand that ultimately built the island arc. However, sand supplies in that central section have been depleted, and as a result, a zone of accelerated erosion and conversion from an island to submerged shoals is gradually occurring in both north and south directions, away from the depleted central sand source. Sand is transported away from this zone to the north and south. In the north, sand ultimately leaves the island and is deposited north of Hewes Point in a large subaqueous spit that is filling a deep (~50 foot) tidal channel (Georgiou and Schindler 2009, Miner et al. 2009, Thomson et al. 2010).

We propose a barrier island management strategy that aims to replicate the natural processes of island development by: (1) reintroducing sand that was lost to deepwater sinks at updrift feeder sites (i.e., backpassing), (2) using shoreface retreat to liberate sand from feeder sites into the littoral system for lateral distribution over the long-term, and (3) establishing salt marshes upon back barrier sand placement sites to hold the sand and slow erosion. This comprehensive plan derives from extensive studies (e.g. Suter et al. 1988, Lavoie et al. 2009) on long-term geomorphic evolution and short-term changes – driven primarily by loss of sand from the barrier system, relatively rapid sea level rise, and hurricanes – to provide the barrier system the means to be sustainable for generations.

The concept of sand backpassing is not new to coastal management; however, it is often not a feasible technique on an eroding coast because it requires a zone downdrift from the project that is accretionary with excess sand or, as is the case with the Chandeleur Islands, a zone where coastal sand is being lost downdrift to a deepwater sink. A similar, more common, technique is mechanical sand bypassing, where sand is excavated from the accretionary side of a jetty and transported as a slurry through a pipeline to the eroding section of downdrift beach (the opposite of backpassing). Backpassing and bypassing projects rely on similar principles and have been implemented worldwide. They provide significant cost savings and long-term effectiveness as a management tool when compared to more traditional beach nourishment and barrier island restoration projects (i.e. Schwartz 1967, Bruun 1990, 1993, Boswood and Murray 2001). As currently envisioned, this proposed project would develop a strategy for sand backpassing at the Chandeleur Islands that would reintroduce sand at a rate similar to or in excess of the long-term background losses along the island arc. Building from designs proposed by Bruun (1990), Visser and Bruun (1997), and others, a mobile (e.g. mounted on a lift boat or resting on seafloor) underwater hydraulic excavator could be installed at Hewes Point (or some other reliable source of sand accumulation). During design, options for creating a sand trap (a strategically located excavation where the excavator is placed to fluidize trapped sand and pump it to shore) would be explored. The sand would be pumped through a pipeline (possibly submerged in the backbarrier Chandeleur Sound) to the central portion of the island arc. However, it might be determined that a long-distance pipeline is not needed if a small, shallow draft hopper dredge is more efficient and would transport the sand to dedicated pumpout sites along shore. Because the natural processes of wind, waves, and tidal currents would be employed to transport the sand once placed downdrift, there would be no need for extensive shaping with large land-based equipment such as bulldozers. There would also be potential for pumping to fill some areas in the backbarrier to mimic washover deposits and create new marsh platforms that can be planted with native black mangrove and Spartina alternaflora. The focus of the

engineering and design would be determination of the source of sand and volumes needed in light of expected sea-level rise and storm frequency, evaluation of options for sediment transport, and identification of strategic pump out sites. The integrated modeling being pursued as part of this project will help address those questions as well as provide insight into additional design features (e.g., strategic gaps in the island) that would meet additional restoration objectives related to water quality parameters.

We anticipate initiating these two interconnected components of this project simultaneously upon funding. The engineering and design component will take longer than the modeling component, but the latter will be completed prior to the completion of the 30% design report for the Chandeleur Islands restoration component. We will then utilize the modeling component to analyze the preliminary design in the ecosystem context provided by the models and use that analysis to inform final design.

Environmental Benefits:

Restoration of the Chandeleur Islands is a model for holistic ecosystem restoration (Powell et al. 2019). As such, there are a myriad of environmental and societal benefits to be realized from this project. In recognition of the importance of the Chandeleurs to fish and wildlife resources, this island chain was designated as Breton National Wildlife Refuge by President Theodore Roosevelt in 1904. The site has also been identified as a globally Important Bird Area by the American Bird Conservancy, in association with The Nature Conservancy (Cecil et al. 2009). As such, restoration and maintenance of this site preserves our national natural history legacy. The sandy beaches, back bay marsh and mangroves, and seagrass beds of the Chandeleurs provide important habitats for many birds, including nesting brown pelicans (historically the largest colony in the Gulf), snowy plovers, Wilson's plovers, reddish egrets, American oystercatchers, black skimmers, and a variety of other terns, including the largest sandwich tern and royal tern nesting colonies in North America. The Chandeleurs are also the only known breeding location of the Chandeleur gull – a species that has emerged as a hybrid cross between herring and kelp gulls that uniquely co-occur there (U.S. Fish and Wildlife Service 2008, Remsen et al. 2019). The Chandeleurs also serve as important habitat for wintering waterfowl, notably one of the larger concentrations of redheads – a species for which >80% of the global population winters in the Gulf. Shorebirds (e.g., sandpipers, dunlin, sanderling, etc.) are also abundant on the islands and the site has been identified as a critically important wintering site by the Western Hemisphere Shorebird Reserve Network. The Chandeleurs are designated as critical habitat for the federally threatened piping plover and recent surveys suggest they may also winter the largest population of federally threatened red knots in the entire Gulf. The Chandeleurs provide habitat for many other federal threatened and endangered species as well, including loggerhead, green, and Kemp's-ridley sea turtles and the West Indian manatee.

The Chandeleur Islands attenuate wave energy from the open Gulf, which enables the existence of some of the only seagrass beds in this region outside Mississippi Sound and in the entire state of Louisiana. These seagrass beds serve as important nursery habitat for many commercially and recreationally important fishes and provide a steady source of recruitment for these populations, particularly when poor conditions prevail at more in-shore seagrass habitats (e.g., summer of 2019). These wave attenuation benefits are also realized farther afield, and the Chandeleurs provide protection to other restoration projects and communities in the region (Grzegorzewski et al. 2009). The Chandeleurs enhance the sustainability of ~$150 million of prior and planned restoration investments in living shoreline projects in Biloxi Marsh and Hancock County, oyster restoration in both Louisiana and Mississippi, and on Cat Island. This project will also interact and enhance the restoration outcomes associated with the proposed mid-Breton Sediment Diversion. The primary and secondary benefits of Chandeleur Islands restoration confers significant protection to coastal communities and precludes the need to only rely on hard infrastructure to protect the built environment further enhancing environmental benefits.

Beyond the wave attenuation benefits, the Chandeleurs also modulate salinities in the region. Without the island chain in place, the high salinity waters of the Gulf would penetrate further into Chandeleur Sound and be transported into Mississippi Sound and elsewhere (Reyes et al. 2005). These shifts in salinity would significantly alter the estuarine character of the entire system and would likely cause large-scale shifts in the abundance and distribution of many species (Park et al. 2014). Of particular note are the potentially detrimental impacts to oysters, which thrive in harvestable numbers in moderate salinities where spat can set but predators are not abundant. Loss of the Chandeleurs would increase salinity ranges permitting increased predation on adult oysters by oyster drills. Thus, maintenance of the Chandeleurs would promote sustainable oyster reefs by preventing catastrophic collapse of numbers in the region – enhancing not only the environmental benefits of healthy reefs but also promoting a robust oyster fishery in the region.

Metrics:

Metric Title: PRM010 : Research - # studies used to inform mgmt.: Planning, Research, Monitoring
Target: 1
Narrative: The final report for the Integrated Ecosystem Modeling component of this project is a technical report that will serve as a framework for synthesizing the existing modeling capacity of the region. Given that this report and this model will be used to inform the engineering and design of the Chandeleur Islands restoration component of this project as well as other restoration projects in this region, we are characterizing this report as a study for the purposes of identifying metrics for this component of this project.

Metric Title: PRM005 : Monitoring - # monitoring plans developed: Planning, Research, Monitoring
Target: 1
Narrative: A Monitoring and Adaptive Management Plan for the Chandeleur Islands component of this project will be developed. This plan will follow guidelines established by the Council Monitoring and Assessment Working Group as well as those of the Natural Resource Damage Assessment Trustee Council's Cross-Trustee Implementation Group Monitoring and Adaptive Management Work Group (Deepwater Horizon [DWH] Natural Resource Damage Assessment Trustees 2017).

Metric Title: PRM011 : Restoration planning/design/permitting - # E&D plans developed: Planning, Research, Monitoring
Target: 3
Narrative: The final deliverable will be a single Engineering and Design report that reflects a 95% design of the project. However, we will also require interim reports at 30% and 60% design thresholds. We recognize that numerous other standard engineering reports will be required in association with the design of this project (e.g., magnetometer surveys, geotechnical investigations), but we anticipate these reports will be included as appendices to the primary design documents – even when initially developed and reviewed independently.

Metric Title: PRM013 : Restoration planning/design/permitting - # environmental compliance documents completed : Planning, Research, Monitoring
Target: 14
Narrative: As part of the design process, we anticipate completing environmental compliance to the extent practicable to ensure this project can be implemented quickly. Specifically, we will be seeking consistency, concurrence, and/or permits under the following regulatory requirements:
Bald and Golden Eagle Protection Act, Clean Water Act, Coastal Barrier Resources Act, Coastal Zone Management Act, Endangered Species Act, Fish and Wildlife Coordination Act, Magnuson-Stevens Fishery Conservation and Management Act, Marine Mammal Protection Act, Migratory Bird Treaty Act, National Environmental Policy Act, National Historic Preservation Act, National Wildlife Refuge

Improvement Act, Rivers and Harbors Act, and Wilderness Act. We recognize that this might not be a complete list of applicable regulations and note that the terms and conditions of all necessary federal, state, and local permits will be complied with during the course of implementing the project.

Risk and Uncertainties:

As a planning project, risks to success are relatively low. For the modeling component, there are uncertainties related to the ability to find connections among models and make them interoperable, given limitations of spatial and temporal resolution and the specificity of input variables. Nevertheless, we anticipate data manipulations will be able to accommodate any issues that might arise. Additionally, for the modeling component, there is always a risk associated with investment in any web application – particularly with the long-term strategy for management and maintenance. We plan to manage this risk by building the application in open source code, storing it in an open source repository, and enabling wide availability and usage of the tool. We will take advantage of various forums to demonstrate the tool (e.g., webinars, tools cafes, conferences, etc.) and reach out to practitioners on both the modeling and management sides of coastal restoration.

Risk related to implementation of engineering and design is also relatively low. A seasoned project manager will be tasked to ensure successful achievement of milestones and timely completion of deliverables on budget. With that said, sea-level rise and storms are risks to the ultimate restoration project that will be considered in the engineering and design of the Chandeleur Islands project to ensure restoration achieves desired outcomes under a range of plausible future scenarios. Sea-level rise (including subsidence) will be explicitly incorporated into design alternatives, based on the scenarios in Sweet et al. (2017) and the risk tolerance demonstrated by the design team's selection of an exceedance probability. Subsidence will also be explicitly incorporated into these estimates by using data from the Grand Isle gauge. This site demonstrates some of the highest subsidence rates in the Gulf – which will incorporate a level of conservatism in the design (Byrnes et al. 2019). To assess potential impacts of storms on the project, we will use a similar approach to that applied to North Breton Island (Long et al. 2020). There, the impacts of storms were simulated under different restoration design alternatives and the potentials for erosion, overwash, and inundation of the pre- and post-restoration island were assessed. By using this information directly in design decisions, the risk of storm impacts can be directly addressed.

Monitoring and Adaptive Management:

Monitoring specific to this proposed project will be relatively straightforward. As a planning project, the primary deliverables are meetings and reports (hard copy and web-based content). To ensure adequate progress is being made on this project in a timely manner, at least biweekly calls for each component will be held among DOI and DOC (the two co-sponsors of this project) and any subcontractors. More frequent meetings are likely during times of high activity. These calls will be established and facilitated by a dedicated project manager, who will also be responsible for all performance reporting. For the engineering and design component, monthly calls of the broader Project Management Team (including AL, LA, and MS; see Collaboration section below) will be held to ensure engagement and involvement of all stakeholders. This will also allow early identification of any concerns so they may be resolved before becoming larger issues requiring significant time and attention. Standard project management practices and financial oversight will occur.

Monitoring will also be an outcome of this project, as a Monitoring and Adaptive Management Plan associated with the restoration of the Chandeleur Islands will be developed. This plan will follow guidelines established by the Council Monitoring and Assessment Working Group as well as those of the Natural Resource Damage Assessment Trustee Council's Cross-Trustee Implementation Group Monitoring and Adaptive Management Work Group (Deepwater Horizon [DWH] Natural Resource Damage Assessment Trustees 2017).

Data Management:
Data management is a critical aspect of this project's success. The Integrated Ecosystem Modeling will require identification and collation of significant metadata on each model, including information related to model name and versioning, input variables, output variables, spatial domain, spatial resolution, vertical resolution, time period, and temporal resolution. These data will be stored in standard ISO formats on ScienceBase (https://www.sciencebase.gov/catalog/), which enables web services and translation to JSON for easy machine and application interoperability. Conceptual models and final reports will similarly be stored on ScienceBase. We will also rely on open source code (e.g., R Shiny) to develop the web application interface for the innovation hub. We anticipate storing the open access R code on GitHub (https://github.com/) – an open source repository dedicated to hosting code. Data and deliverables associated with the engineering and design component of this project will be stored on NOAA's public-facing DIVER site (https://www.diver.orr.noaa.gov/) to ensure products are readily available to various Trustees and the public. In contemplation of future funding for construction, these documents will be included in a formal administrative record for this project. Specifics on all project data will be provided in the formal data management plans and observational data plans required of all Council-funded projects.

Collaboration:
Collaboration is a defining feature of this project and a primary reason why funding is being pursued through the RESTORE Council. For the modeling component, we will enhance connectivity and collaboration not only among modelers that typically operate independently but also between modelers and resource managers that do not frequently connect their decision-making processes. For the Chandeleur Islands component, we will continue conversations that have already occurred to develop this project. The range of members represented through the RESTORE Council provides a relatively unique forum in the Gulf for all the stakeholders that will be ultimately affected by a Chandeleur Islands restoration project to participate directly in funding and design. With each stakeholder invested in the project, we ensure an equitable consideration of objectives and approaches. To this end, development of a Project Management Team has already been discussed with Alabama, Mississippi, LA, DOC, and DOI.

Public Engagement, Outreach, and Education:
Initial work has begun on the integrated modeling component of this project. Funding from NOAA and DOI has supported a review of the hydrogeomorphic models of the region and facilitated two meetings of modelers and resource managers. The advancement of a community of practice and the application of an integrated model into a decision support system are a direct result of the discussions that occurred in these forums. Additional meetings and outreach to these groups will be required to successfully implement this project and generate broad support and participation in the community of practice. We also anticipate providing presentations at both science- and management-oriented conferences, as well as to existing groups and partnerships both in-person and remotely (i.e., webinar). We recognize the potential to connect this work to other communities of practice already operating in the Gulf (e.g., Monitoring Community of Practice) and will actively pursue this opportunity when funded.

The concept of a Chandeleur Islands restoration project – the second component of this proposal – has been discussed in a variety of forums over the last few years and enjoys broad support from the public. The Chandeleurs are covered by a number of existing conservation plans, including the Breton National Wildlife Refuge's Comprehensive Conservation Plan (U.S. Fish and Wildlife Service 2008) and the Louisiana Department of Wildlife and Fisheries' Louisiana Wildlife Action Plan (Holcomb et al. 2015). The project is also consistent with Louisiana's Coastal Master Plan (Coastal Protection and Restoration Authority of Louisiana 2017). Chandeleur Islands restoration was listed as

a top priority by Audubon in their 2018 report, “Audubon’s Vision: Restoring the Gulf of Mexico for Birds and People” (Lankford et al. 2018). The Chandeleurs are also identified in the Lake Pontchartrain Basin Foundation’s “Multiple Lines of Defense Strategy to Sustain Coastal Louisiana” (Lopez 2006). Numerous other non-governmental organizations have expressed support for Chandeleur Islands restoration, and we will work closely with these groups to further educate the public about the unique role of the Council in pursuing collaborative coastal restoration work. Furthermore, as we contemplate pursuing at least a portion of the construction funding from NRDA, there will be ample opportunity for public engagement on final E&D alternatives through formal public comment related to restoration planning.

Leveraging:

Funds: $216,000.00
Type: Adjoining
Status: Received
Source Type: Other Federal
Description: Funds provided by USFWS to The Water Institute of the Gulf to initiate activities associated with modeling component of this project.

Funds: $25,000.00
Type: Adjoining
Status: Received
Source Type: Other Federal
Description: Funds provided by NOAA to The Water Institute of the Gulf to initiate activities associated with modeling component of this project.

Funds: $3,000,000.00
Type: Bldg on Others
Status: Received
Source Type: Other
Description: Conservative estimate of collective expenditures associated with previous modeling efforts in the Pontchartrain Basin-Chandeleur Sound-Mississippi Sound-Mobile Bay system.

Environmental Compliance:
Given that this project is considered a planning effort, the Council’s Categorical Exclusion for the National Environmental Policy Act applies. However, during the course of this project, field sampling might be required, which could trigger compliance documentation of one or more laws. All applicable federal, state, and local regulations will be complied with in the course of implementing this project. As E&D progresses, we will also pursue completion of all environmental compliance documents that cover the ultimate construction of the Chandeleur Islands restoration component of this project. We have not listed these here as they are not necessary to implement this phase of the project, but we have captured these activities as a metric of success for this project.

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Budget

Project Budget Narrative:
The total budget for this project is $8,000,000, divided between two planning components: $1,000,000 for integrated modeling and $7,000,000 for E&D. Given that neither component is a construction project, there are no funds identified for implementation or contingency. Monitoring and Adaptive Management funds identified below are specific to development of the Monitoring and Adaptive Management plan for the Chandeleur Islands restoration project. Monitoring and adaptive management for the activities identified in this proposal are captured in the planning category as oversight. Data management for this project is relatively intensive, given the large volumes of information that will be synthesized under component one (integrated modeling) and generated under component two (E&D). Each of these components is associated with half ($200,000) of the total data management budget ($400,000). For the planning activities, the modeling work accounts for $700,000 and the E&D $5,940,000. Project management accounts for 10% of total project costs and includes monies for project participation and oversight by co-sponsors and other Council members.

Total FPL 3 Project/Program Budget Request:
$ 8,000,000.00

Estimated Percent Monitoring and Adaptive Management: 2 %
Estimated Percent Planning: 83 %
Estimated Percent Implementation: 0 %
Estimated Percent Project Management: 10 %
Estimated Percent Data Management: 5 %
Estimated Percent Contingency: 0 %

Is the Project Scalable?
Yes

If yes, provide a short description regarding scalability.:
This project has two components and is, therefore, scalable by nature. However, given the foundational nature of these two components and the time sensitives they have – both in terms of urgency and sequencing – scaling this project would cause loss of valuable synergies and benefits. As we anticipate the modeling and E&D to inform one another – modeling to help assess ecosystem effects of alternative design and stakeholder values identified in design shaping model integration – we believe these components should be initiated simultaneously to most effectively leverage these components. Opportunities to align additional components within this geography could be considered (i.e., “scaling up”), but only with individual member support and approval.

Environmental Compliance[1]

Environmental Requirement	Has the Requirement Been Addressed?	Compliance Notes (e.g.,title and date of document, permit number, weblink etc.)
National Environmental Policy Act	Yes	Council NEPA Categorical Exclusion for planning will be utilized. Additional Categorical Exclusion may be required for field sampling
Endangered Species Act	N/A	Note not provided.
National Historic Preservation Act	No	May be required for field sampling
Magnuson-Stevens Act	N/A	Note not provided.
Fish and Wildlife Conservation Act	N/A	Note not provided.
Coastal Zone Management Act	N/A	Note not provided.
Coastal Barrier Resources Act	N/A	Note not provided.
Farmland Protection Policy Act	N/A	Note not provided.
Clean Water Act (Section 404)	No	May be required for field sampling
River and Harbors Act (Section 10)	No	May be required for field sampling
Marine Protection, Research and Sanctuaries Act	N/A	Note not provided.
Marine Mammal Protection Act	N/A	Note not provided.
National Marine Sanctuaries Act	N/A	Note not provided.
Migratory Bird Treaty Act	N/A	Note not provided.
Bald and Golden Eagle Protection Act	N/A	Note not provided.
Clean Air Act	N/A	Note not provided.
Other Applicable Environmental Compliance Laws or Regulations	N/A	(National Wildlife Refuge Improvement Act and Wilderness Act)

[1] Environmental Compliance document uploads available by request (restorecouncil@restorethegulf.gov).

Maps, Charts, Figures

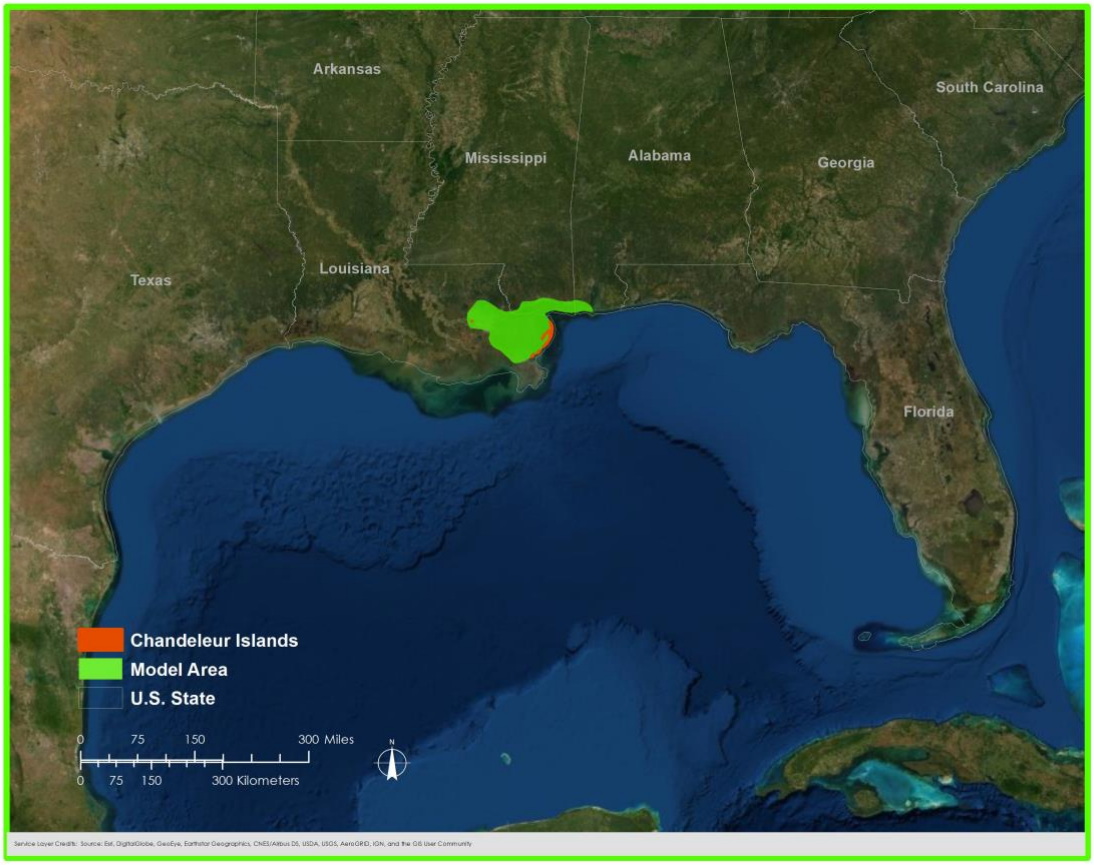

Figure 1. Chandeleur Island project location

FPL 3b Internal Staff Review of Proposal Submitted 4/24/2020

Project/Program	Ecosystem Modeling and Chandeleur Island Restoration E&D (DOI/FWS)		
Primary Reviewer	Jean Cowan	Sponsor	DOI
EC Reviewer	John Ettinger	Co-Sponsor	

1. Is/Are the selected Priority Criteria supported by information in the proposal?	Yes
Notes	

2. Does the proposal meet the RESTORE Act geographic eligibility requirement?	Yes
Notes	

3. Are the Comprehensive Plan primary goal and primary objective supported by information in the proposal?	Yes
Notes	

4. Planning Framework: If the proposal is designed to align with the Planning Framework, does the proposal support the selected priority approaches, priority techniques, and/or geographic area?	Yes
Notes	

5. Does the proposal align with the applicable RESTORE Council definition of project or program?	Yes
Notes	

6. Does the budget narrative adequately describe the costs associated with the proposed activity?	Yes
Notes	

7. Are there any recommended revisions to the selected leveraged funding categories?			No
Notes			

8. Have three external BAS reviews been completed?	More information needed
Notes	Please see the external BAS review comments, and external reviews summary attached with these review comments.

9. Have appropriate metrics been proposed to support all primary and secondary goals?	Yes
Notes	Appropriate metrics have been proposed by the sponsor to support the primary goal; however, an additional metric for tracking development of the online integration hub (e.g., PRM012 - # tools developed) is recommended.

10. Environmental compliance: If FPL Category 1 has been selected for the implementation component of the project or program, does the proposal include environmental compliance documentation that fully supports the selection of Category 1?	N/A
Notes	If this activity is included in FPL 3b, the subsequent award document would require compliance with all applicable laws in the event that field sampling is required in association with the proposed planning, engineering and design.

11. Geospatial Compliance: Have the appropriate geospatial files and associated metadata been submitted along with a map of the proposed project/program area?	More information needed
Notes	The submitted GIS project boundaries intersects more locations (CD/Counties/watersheds) than identified. If the submitted model area is correct, Council staff recommends the following locational selections: **Watersheds**: 8090301 - East Central Louisiana Coastal, 8090203 - Eastern Louisiana Coastal, 8070204 - Lake Maurepas, 8090202 - Lake Pontchartrain, 8090201 - Liberty Bayou-Tchefuncta, 8090100 - Lower Mississippi-New Orleans, 3180004 - Lower Pearl, 3170009 - Mississippi Coastal, 316020 - Mobile Bay, 3170006 – Pascagoula, 8070205 – Tangipahoa; **State/County-Parish**: ALABAMA - MOBILE, LOUISIANA – JEFFERSON, ORLEANS, PLAQUEMINES, ST. BERNARD, ST. CHARLES, ST. JOHN THE BAPTIST, ST. TAMMANY, TANGIPAHOA, MISSISSIPPI – HANCOCK, HARRISON, JACKSON; **Congressional Districts**: AL-01, LA-01, LA-02, LA-06, MS-04

FPL 3b BAS Review Summary
Ecosystem Modeling and Chandeleur Island Restoration E&D (DOI/FWS)
May 2020

The external Best Available Science reviews for *Ecosystem Modeling and Chandeleur Island Restoration E&D* (DOI/FWS) point to strengths and weaknesses of the proposal. Reviewers (2 and 3) feel that reasonable justification that the scientific basis for the proposed project is supported by peer-reviewed data is lacking for some components of the work. Specifically, reviewers request support for the models and modeling efforts. Although recommending additional references for inclusion (Reviewers 1 and 2), reviewers generally feel that the scientific basis of this project is justified using science that maximizes the quality, objectivity, and integrity of information.

Reviewers 1 and 3 agree that the project has clearly defined goals and objectives, however, Reviewer 2 believes that the goals do not get at the success of modeling (e.g., validation) and restoration activities. Reviewer 2 also requests additional budgetary details, milestones and timelines be provided, but it should be noted that such detailed information is not required at the FPL 3 proposal stage, and, in some cases, proposal authors are limited by submission guidelines word count constraints. Reviewers 2 and 3 are concerned that the sponsor has not provided measures of success (i.e., metrics) to assess the efficacy of the substantial engineering work being proposed, and therefore also question whether the sponsor has identified a monitoring strategy that will support the measurement of project success. However, Reviewer 1 is satisfied that metrics aligning with the primary project goals are identified, and finds that the Monitoring and Adaptive Management Plan is sufficient as a monitoring strategy to support these metrics.

All reviewers raise concerns over whether the proposal clearly defines and provides appropriate justification for the project methods. Reviewers 2 and 3 believe information on the modeling component is wholly missing and should be provided, such as what models will be used, their drivers, variables, and boundary conditions, and the methods for merging models. Reviewer 1 believes that the methods, while justified, bring the scientific soundness of the project into question, explaining that model development--rather than the proposed method of unifying existing models--would be needed to produce a numerical model capable of informing E&D. Reviewer 1 also feels that the spatial domain described in the proposal would be inadequate, suggesting that to capture the governing hydrodynamics, a high-resolution grid for the north-central Gulf of Mexico would need to be nested within a coarser grid for the entire Gulf. Apart from the aforementioned desire for information supporting the modeling component of the work (Reviewer 2), reviewers feel the proposal objectives and methods are justified using peer-reviewed literature and publicly available information (though Reviewer 1 again recommends important references from recent literature for inclusion). Reviewer 2 also notes that not all peer-reviewed references are freely available; however, it should be noted that this is not a proposal requirement.

Most reviewers agree that all literature sources used to support the proposal are accurately and completely cited, and represented in a fair and unbiased manner (though Reviewer 3 again raises the lack of supporting information from the literature for the modeling component of the project). Reviewer 2 notes an internal citation that is omitted from the list of references. In general, reviewers feel that the information discussed and used for project justification is recent and relevant to the proposed activity.

Reviewers 1 and 2 agree the proposal evaluates uncertainties and risks in achieving its objectives over time, but that the risk the model may not be able to guide E&D is higher than stated. Reviewer 2 finds it concerning that the potential inability to connect and make models interoperable is a risk when it is fundamental to the project. Reviewers 2 and 3 suggest that the research on available models and understanding of the effort needed to integrate models should be apparent from the proposal but are not. All reviewers raise additional short-term implementation risks to address, such as environmental and socioeconomic risks and mitigation strategies. While reviewers agreed that the project's vulnerability to long-term environmental risks are discussed, Reviewer 1 believes the risks hurricanes and storms pose to achieving E&D objectives are understated, and Reviewer 2 raises the need for more detail on how environmental risks will impact modeling and be monitored. Those issues aside, Reviewer 1 feels that the proposal provides reasonable justification that the risks and uncertainties of the scientific basis for the project are clearly communicated. Reviewer 2 disagrees, based on the fact that the treatment of uncertainty in the model is not addressed. Reviewer 3 requests additional science-based justification for the selection of exceedance probabilities, stating that this will have a large influence on the cost and probability of project success.

All reviewers believe the environmental benefits of the proposed activity are well-defined, but that the successes and failures of similar projects are not adequately evaluated, particularly for the remote sensing and modeling components. Based on the information provided in the proposal, none of the reviewers feel well enough informed to determine whether the project sponsor or their partners have demonstrated experience in implementing a similar project.

Reviewer 2 provides the following final comment (edited for formatting): "The main strengths of this proposal include: (1) the potential outcomes and [benefits] of the restoration work proposed as part of Phase 2 of the study [because] of its potential to help maintain ecosystem function because of the role that the Chandeleur Islands play in regulating salinity; (2) its use of existing research and data; (3) its use of partnerships between federal entities; and (4) its alignment with other restoration and conservation initiatives taking place or proposed in the region. The main weaknesses of this proposal include: (1) methods to be used are largely superficially explained; particularly as it relates to integration of models needed for Phase 1 work; (2) it is unclear whether all of the Phase 1 work, which is the majority of the budget, is really necessary to accomplish Phase 2; (3) too few metrics of assessment for the Phase 2 work; and (4) focusing on sand backpassing as the primary restorative technique--the efficacy of this method will heavily depend on future storm frequency, and methods to estimate or understand future storm frequency are largely unexplored in the proposal."

FPL 3b BAS Review Summary and Responses
Ecosystem Modeling and Chandeleur Island Restoration E&D (DOI/FWS)
June 2020

We appreciated the thorough review provided on our proposal. We worked hard to incorporate suggestions and address comments from the Reviewers and believe the proposal is improved for their input. A large structural change that was made (and we want to call out here at the outset) was dividing the Scope of Work among 3 Components rather than the initial two that we used. Originally, the proposal was framed to include two components:

1. Development of a probabilistic screening tool (Integration Ecosystem Modeling – IEM) and facilitation of a community of practice to improve initial screen of coastal restoration projects with the Chandeleur Islands as a specific use-case; and
2. Engineering and Design of a Chandeleur Islands Restoration project.

The BAS review reflected confusion on the objectives, methods, and expected outcomes of each of these components. Specifically, several types of modeling exercises are necessary to inform restoration at the Chandeleurs. To enhance clarity, the proposal has been reframed into three components:

1. Development of the IEM and a site-specific hydro-geomorphic model.
    a. **IEM**. The IEM is designed as a screening tool that can be broadly applied throughout the northern Gulf of Mexico beyond its value at the Chandeleurs. This probabilistic model capitalizes on existing data and model output to relate changes in hydrodynamic forcing to island response parameterized in discrete metrics (berm height, subaerial acreage) and links island characteristics to restoration objectives on the local and regional scale.
    b. **Hydro-geomorphic model**. The hydro-geomorphic model is site-specific for Chandeleurs. It informs and assesses (validates) the IEM as a screening tool; gives complementary information on the physical processes at the Chandeleur Islands as part of a science-based assessment of *when*, *where, and how* to focus sediment nourishment of the island; and provides a model framework that can be leveraged in components (2) and (3) in planning, permitting, and E&D at the Chandeleurs.
2. Preliminary E&D for restoration of the Chandeleur Islands. This component focuses on *how* to restore the islands based on the best available science encapsulated in the IEM and will leverage the hydro-geomorphic model developed in (1 above) to test specific restoration design alternatives. This component also includes restoration permitting and environmental compliance.
3. Final engineering and design (E&D) for Chandeleur Islands. This component includes the development of final plans and specifications, including necessary updates to geotechnical and topographic/bathymetric surveys and the completing of construction implementation, management, and monitoring plans and specs.

We point out that the overall scope of work envisioned in this proposal has not changed, but we believe this re-frame clarifies the specific steps with the additional detail.

The response to the rest of the comments are included below.

The external Best Available Science reviews for *Ecosystem Modeling and Chandeleur Island*

Restoration E&D (DOI/FWS) point to strengths and weaknesses of the proposal. Reviewers (2 and 3) feel that reasonable justification that the scientific basis for the proposed project is supported by peer-reviewed data is lacking for some components of the work. Specifically, reviewers request support for the models and modeling efforts. Although recommending additional references for inclusion (Reviewers 1 and 2), reviewers generally feel that the scientific basis of this project is justified using science that maximizes the quality, objectivity, and integrity of information.

We have added numerous references, particularly related to the models and modeling efforts. Of note is the inclusion in the Methods and Leveraging sections of Dalyander et al. 2020, which documents the diversity of modeling efforts upon which we will build. This report was published between our initial submission and this BAS response, and we believe its inclusion here addresses the need identified by multiple reviewers.

Reviewers 1 and 3 agree that the project has clearly defined goals and objectives, however, Reviewer 2 believes that the goals do not get at the success of modeling (e.g., validation) and restoration activities. Reviewer 2 also requests additional budgetary details, milestones and timelines be provided, but it should be noted that such detailed information is not required at the FPL 3 proposal stage, and, in some cases, proposal authors are limited by submission guidelines word count constraints.

We revised the Methods section to add a morphological modeling aspect that can simulate sediment transport at the Chandeleurs. This morphological modeling provides a greater linkage between the Integrated Ecosystem Model (IEM) and the Engineering and Design work on the Chandeleurs and serves as a test case and validation for the probabilistic and regional IEM. By re-framing the scope of work as three components rather than two, we are also able to provide additional detail on the budget, milestones, and timelines for more refined portions of the overall project in the Methods section.

Reviewers 2 and 3 are concerned that the sponsor has not provided measures of success (i.e., metrics) to assess the efficacy of the substantial engineering work being proposed, and therefore also question whether the sponsor has identified a monitoring strategy that will support the measurement of project success. However, Reviewer 1 is satisfied that metrics aligning with the primary project goals are identified, and finds that the Monitoring and Adaptive Management Plan is sufficient as a monitoring strategy to support these metrics.

To address the concerns of Reviewers 2 and 3 regarding identification of a monitoring strategy to support measurement of project success, we provide that a monitoring plan will be developed to track sediment transport post-construction, and the modeling tools will be applied to inform and quantify project performance metrics, while considering adaptive management.

All reviewers raise concerns over whether the proposal clearly defines and provides appropriate justification for the project methods. Reviewers 2 and 3 believe information on the modeling component is wholly missing and should be provided, such as what models will be used, their drivers, variables, and boundary conditions, and the methods for merging models. Reviewer 1 believes that the methods, while justified, bring the scientific soundness of the project into question, explaining that model development--rather than the proposed method of unifying existing models--would be needed to produce a numerical model capable of informing E&D.

Reviewer 1 also feels that the spatial domain described in the proposal would be inadequate, suggesting that to capture the governing hydrodynamics, a high-resolution grid for the north-central Gulf of Mexico would need to be nested within a coarser grid for the entire Gulf. Apart from the aforementioned desire for information supporting the modeling component of the work (Reviewer 2), reviewers feel the proposal objectives and methods are justified using peer-reviewed literature and publicly available information (though Reviewer 1 again recommends important references from recent literature for inclusion). Reviewer 2 also notes that not all peer-reviewed references are freely available; however, it should be noted that this is not a proposal requirement.

We appreciate the perspectives of the reviewers and took this feedback to heart; concern around the justification of our methods led us to reframe the project. We added text in the Methods to clarify that the Integrated Ecosystem Model (IEM) is a probabilistic tool that leverages existing data and model output in one framework without merging or directly linking models end-to-end. We redescribed the methods in a more detailed manner. As mentioned previously, the addition of the morphological modeling component describes how the regional scale IEM is applied at the project scale with a more focused deterministic modeling approach.

We agree with Reviewer 1 that model development rather than just unifying existing models would be needed to produce a numerical model capable of informing E&D. We have added details in the Methods section about the numerical model that will inform E&D under Component 1. Similarly, to address comment by Reviewer 1 about spatial domain, we have added for multiple nested domains in the hydro-geomorphic model at different spatial domains and that is now explicitly described as part of Component 1 in the Methods. Lastly, we added additional references for the modeling component – importantly a new reference for the model inventory and community of practice recently developed for this geography (Dalyander et al. 2020).

Most reviewers agree that all literature sources used to support the proposal are accurately and completely cited, and represented in a fair and unbiased manner (though Reviewer 3 again raises the lack of supporting information from the literature for the modeling component of the project). Reviewer 2 notes an internal citation that is omitted from the list of references. In general, reviewers feel that the information discussed and used for project justification is recent and relevant to the proposed activity.

We added additional references for the modeling component – importantly a new reference for the model inventory and community of practice recently developed for this geography (Dalyander et al. 2020). The internal citation that was missing (actually identified by Reviewer 3) has been added to the Literature Cited section (Zhang and Kandampully (2015)).

Reviewers 1 and 2 agree the proposal evaluates uncertainties and risks in achieving its objectives over time, but that the risk the model may not be able to guide E&D is higher than stated. Reviewer 2 finds it concerning that the potential inability to connect and make models interoperable is a risk when it is fundamental to the project. Reviewers 2 and 3 suggest that the research on available models and understanding of the effort needed to integrate models should be apparent from the proposal but are not. All reviewers raise additional short-term implementation risks to address, such as environmental and socioeconomic risks and mitigation strategies. While reviewers agreed that the project's vulnerability to long-term environmental risks are discussed, Reviewer 1 believes the risks hurricanes and storms pose to achieving

E&D objectives are understated, and Reviewer 2 raises the need for more detail on how environmental risks will impact modeling and be monitored. Those issues aside, Reviewer 1 feels that the proposal provides reasonable justification that the risks and uncertainties of the scientific basis for the project are clearly communicated. Reviewer 2 disagrees, based on the fact that the treatment of uncertainty in the model is not addressed. Reviewer 3 requests additional science-based justification for the selection of exceedance probabilities, stating that this will have a large influence on the cost and probability of project success.

To address the concern of Reviewer 1 and 2 related to capturing the risk that the model won't be able to guide E&D, we added detail in the Methods section about the Chandeleurs morphological model that will be developed and has guiding E&D as an explicit objective. We contend that Reviewer 2's concerns about the potential inability to connect models reflects confusion related to the perception that the Integrated Ecosystem Model would directly link models through output/input passing, which would be more akin to what's needed for E&D. We have added text to the Methods section to provide more clarity on the use of existing data and models as part of a probabilistic model, which does not rely on direct input/output passing.

To address the suggestion that we need to further highlight research on available models and the effort needed to integrate models, we have added text that is supported by additional citations, including Dalyander et al. 2020, in the Methods section and Literature Cited.

Related to environmental and socio-economic risk and mitigation strategies, we added information across the Introduction/Background, Methods, Leveraging, and Risk sections on resource agency coordination, environmental consultations and compliance, and permitting. We also noted the unique socioeconomic setting at the Chandeleurs (e.g. single landowner/land manager that is project proponent, no navigation channels that dissect the island, and no structures on land to protect).

Related to the risks that hurricanes and storms pose and how environmental risks will impact modeling, we are now addressing storms in the proposal narrative so that it is clear that the erosion and sediment transport during storms are explicitly considered in this "engineering with nature" project concept. Those high energy events are actually critical for project success as they redistribute the sand placed in backbarrier feeder sites. We also expanded the discussion of storms modeling in Component 1 (restoration strategy development) and made it explicit in Component 2 (design alternative evaluation) that storms will be considered. Risks associated with hurricanes and tropical storms will be addressed during E&D and an explicit analysis of storm risk and procedures to mitigate that risk will be performed then. Additionally, during planning and E&D, we will identify response approaches to consider during construction through a structured decision making process such as that described in Dalyander et al. 2016.

To address Reviewer 2's comment related to adequately addressing uncertainty, we included more details in the Methods section about the local morphological model and how it will be used to validate the Integrated Ecosystem Model. The two uncertainties associated with the hydro-geomorphic modeling under component 1 are epistemic uncertainty, which arises from unknowns and errors associated the model framework itself, and aleatory uncertainty, which arises from the impossibility of predicting what the future environmental forcing will be (storms, sea level rise, etc.). Epistemic uncertainty in the model will be quantified and reduced where possible through calibration and validation. The model will be run over a historic time period and

validated against existing data (lidar, aerial imagery, satellite imagery, etc.), with calibration of appropriate model parameters (e.g., bottom shear stress formulation and thresholds, etc.) to minimize errors. This calibration/validation will focus specific on the key island metrics (identified in component 1) as most relevant to achieving management objectives. Aleatory uncertainty is particularly important in modeling barrier islands, given the substantial impacts that extreme storms can have in changing island morphology on time scales of hours to days. This uncertainty will be evaluated and quantified through testing the sensitivity of island response with and without the use of restoration strategies to different combinations of storm frequency and intensity (e.g., similar to the approach used in Mickey et al., 2020 and Long et al., 2020).

Regarding Reviewer 3's request for additional science-based justification for the selection of exceedance probabilities, we note that we have included this in the Risk section and developed additional verbiage in the Methods section for Component 2. We remain unclear on why the reviewer wants justification for these probabilities ahead of defining them. We will examine this in modeling and design process as risk tolerances are explicitly defined. The selection at that stage will be well-documented and justified.

All reviewers believe the environmental benefits of the proposed activity are well-defined, but that the successes and failures of similar projects are not adequately evaluated, particularly for the remote sensing and modeling components. Based on the information provided in the proposal, none of the reviewers feel well enough informed to determine whether the project sponsor or their partners have demonstrated experience in implementing a similar project.

Reviewer 2 provides the following final comment (edited for formatting): "The main strengths of this proposal include: (1) the potential outcomes and [benefits] of the restoration work proposed as part of Phase 2 of the study [because] of its potential to help maintain ecosystem function because of the role that the Chandeleur Islands play in regulating salinity; (2) its use of existing research and data; (3) its use of partnerships between federal entities; and (4) its alignment with other restoration and conservation initiatives taking place or proposed in the region. The main weaknesses of this proposal include: (1) methods to be used are largely superficially explained; particularly as it relates to integration of models needed for Phase 1 work; (2) it is unclear whether all of the Phase 1 work, which is the majority of the budget, is really necessary to accomplish Phase 2; (3) too few metrics of assessment for the Phase 2 work; and (4) focusing on sand backpassing as the primary restorative technique--the efficacy of this method will heavily depend on future storm frequency, and methods to estimate or understand future storm frequency are largely unexplored in the proposal."

To address comments related to the evaluation of success and failure of similar projects, we not only highlighted additional literature in the Introduction related to backpassing and bypassing projects but also noted recently implemented large-scale barrier island projects using similar techniques at the Caminada Headlands, MSCIP, Whiskey Island, and the Louisiana Sand Berm. We are confused about the "remote sensing" component of our project as there is none.

We did not identify individuals associated with this project, as the project team will be formalized on approval of funds. However, the entities involved in this project – namely DOI, NOAA, and the States of LA, MS, and AL – have a long history of successfully completing similar projects. We do not see this as a barrier to implementation and success and can identify specific

individuals, if needed. There are also numerous firms that have experience with E&D of barrier islands and a reputable, experience firm will be contracted for this task.

We've addressed the list of weaknesses provided by Reviewer 2 as follows:

1. Superficial explanation of methods –We have reworked the Methods section to provide additional detail.
2. The linkage between Phase 1 and Phase 2 is unclear – we believe Reviewer 2 has the budget breakdown backwards as the majority of the budget is for the E&D aspects of the project. Also note that these are Components and not Phases, as some Components occur simultaneously. However, these misrepresentations do not change that the linkage can be more thoroughly described. To rectify this, we have split the Scope of Work into 3 components rather than 2 and believe this approach offer more insight into the workflow and connection among components – particularly how the Integrated Ecosystem Modeling and Morphological Modeling fits into preliminary and final design. This also allows us to parse the budget into more refined tasks. Cost aside, the new information provided in the narrative does a better job of bridging the gap between regional probabilistic modeling tools and the E&D. Also, we have added additional justification in the Introduction on why this 1st component is important to meet the objectives of holistic ecosystem restoration.
3. Too few metrics for Phase 2 work – Note comment above about use of "Phases". We did add E&D milestones and activities in the Methods (e.g. Component 2 milestone is final design with compliance/permits in-hand; component 3 is construction ready plans and specs). This does not change the Metrics table, but offers additional clarity on what is being produced and delivered.
4. Storm frequency and sand backpassing efficacy - Storm frequency and methods to estimate impacts (positive and negative) on the project are now included in the updated narrative (see responses above). Also, language was added in the Introduction and Methods sections to make it clear that once complete, storms are important for redistributing the sand from the constructed backbarrier feeder sites. One more note is that we added language to the Introduction to clarify that the "backpassing" only means reintroducing sand from a downdrift sink back to the updrift erosional source. The mechanical method for backpassing has not been pre-determined and will be part of the planning efforts and E&D. For example, it may be one dredge that moves all material during a single mobilization. Or, it might happen in increments with multiple deployments. It could be direct pump through a pipe from borrow to fill, or it might be transported by hopper dredges or scow barges and pumped out to the fill site. This proposal also contemplates a semi-permanent facility versus temporary construction mobilization. All will be evaluated in planning and E&D.

SCIENCE EVALUATION

Bucket 2: Comprehensive Plan Component

Proposal Title: Ecosystem Modeling and Chandeleur Island Restoration E&D
Location (If Applicable): Gulf-wide
Council Member Bureau or Agency: U.S. Department of the Interior, U.S. Fish and Wildlife Service
Type of Funding Requested: Planning

Reviewed by: Reviewer 1
Date of Review: May 9, 2020

Best Available Science:

These 4 factors/elements help frame the reviewer's answers to A, B and C found in next section:

Question 1.	
Have the proposal objectives, including proposed methods, been justified using peer reviewed and/or publicly available information?	Yes
Comments:	
Yes, for the most part. However, there are important references in recent peer review literature that were not included, such as those that pertain to the state-of-the-art modeling efforts in the study region (including GoMRI and others).	

Question 2.	
If information supporting the proposal does not directly pertain to the Gulf Coast region, are the proposal's methods reasonably supported and adaptable to that geographic area?	Yes
Comments:	
Yes, but please see the comments to Question 1 above.	

Question 3.	
Are the literature sources used to support the proposal accurately and completely cited? Are the literature sources represented in a fair and unbiased manner?	Yes
Comments:	
Yes, the literature sources are accurately cited and the literature is represented in unbiased manner.	

Question 4.	
Does the proposal evaluate uncertainties and risks in achieving its objectives over time? (e.g., is there an uncertainty or risk in the near- and/or long-term that the project/program will be obsolete or not function as planned?)	Yes
Comments:	
The proposal evaluated the risks and uncertainties for the modeling and E&D components. However, I am not convinced that the risks and uncertainties are relatively low as the proposal implies. For example, it is unlikely that a simulation model that would successfully guide the E&D component can be developed by simply integrating the existing models and linking outputs from one model to another. Further, given the uncertainties regarding the future sea level rise and the frequency of tropical storms and hurricanes, the risks in achieving the E&D objectives also appear large.	

Based on the answers to the previous 4 questions, and *giving deference to the sponsor to provide within reason the use of best available science,* the following three questions can be answered:

Question A	
Has the applicant provided reasonable justification that the proposal is based on science that uses peer- reviewed and publicly available data?	Yes
Comments:	
Yes, but please see the comments to Question 1 above.	

Question B	
Has the applicant provided reasonable justification that the proposal is based on science that maximizes the quality, objectivity, and integrity of information (including, as applicable, statistical information)?	Yes
Comments:	
Yes, but please see the comments to Question 1 above.	

Question C	
Has the applicant provided reasonable justification that the proposal is based on science that clearly documents and communicates risks and uncertainties in the scientific basis for such projects/programs?	Yes
Comments:	

Yes, but please see the comments to Question 4 above.

Science Context Evaluation:

Question A	
Has the project/program sponsor or project partners demonstrated experience in implementing a project/program similar to the one being proposed?	Need more information
Comments:	
This question could not be answered based on the information provided. The expertise of the project implementation team was not described and it is unclear if the researchers have sufficient experience to carry out the proposed work.	

Question B	
Does the project/program have clearly defined goals objectives?	Yes
Comments:	
Yes, the project objectives are clearly stated.	

Question C

Has the proposal provided a clear description of the methods proposed, and appropriate justification for why the method is being selected (e.g., scientifically sound; cost-effectiveness)?	Yes
Comments:	
The proposed methods are adequately described. However, the methods that pertain to the modeling component do not appear to be scientifically sound. For example, in order to move to the E&D phase (e.g., sand backpassing or bypassing) a suitable fully operational model must be available that can explore the alternative options and assess whether the proposed construction project would be able to achieve desired restoration objectives. Currently, there are no operational coupled hydrodynamic-wave-sediment transport-water quality models for the northern Gulf of Mexico that can answer the complex questions regarding the sediments transport and fate and resulting water quality chages. The modeling synthesis (Component 1) can certainly develop a conceptual model and review the strengths and weaknesses of the existing numerical models, but "unifying diverse models" is unlikely to produce a numerical model that is required to inform and guide the E&D component of the project. In my opinion, what is needed is further model development as opposed to a synthesis of disparate existing modeling studies. Also, the spatial domain of the model, as depicted in Figure 1, appears inadequate. The northcentral Gulf of Mexico is characterized by extremely complex hydrodynamics, where local and remote winds, riverine freshwater discharges, and open ocean forcing all play important roles. In order to accurately simulate currents, wave dynamics and sediment dynamics within the proposed study area, one would need a high-resolution model grid extending over the entire northcentral Gulf of mexico, nested within a coarser-resolution grid covering the entire Gulf of Mexico basin.	

Question D	
Does the project/program identify the likely environmental benefits of the proposed activity? Where applicable, does the application discuss those benefits in reference to one or more underlying environmental stressors identified by best available science and/or regional plans?	Yes
Comments:	
Yes, the likely environmental benefits were identified.	

Question E	
Does the project/program have measures of success (i.e., metrics) that align with the primary Comprehensive Plan goal(s)/objectives? (Captures the statistical information requirement as defined by RESTORE Act)	Yes
Comments:	

Yes, the project metrics have been identified.

Question F	
Does the proposal discuss the project/program's vulnerability to potential long-term environmental risks (i.e., climate, pollution, changing land use)? (Captures risk measures as defined under best available science by the RESTORE Act)	Yes
Comments:	
Yes, but please see the comments to Question 4 above.	

Question G	
Does the project/program consider other applicable short-term implementation risks and scientific uncertainties? Such risks may include the potential for unanticipated adverse environmental and/or socio-economic impacts from project implementation. Is there a mitigation plan in place to address these risks? Any relevant scientific uncertainties and/or data gaps should also be discussed. (Captures risk measures as defined under best available science by the RESTORE Act)	No
Comments:	
The proposal does not consider adverse environmental or socionomic impacts. A mitigation plan is not in place.	

Question H	
Does the project/program consider recent and/or relevant information in discussing the elements above?	Yes
Comments:	
Yes, but please see the comments to Question 1 and Question G above.	

Question I	
Has the project/program evaluated past successes and failures of similar efforts? (Captures the communication of risks and uncertainties in the scientific basis for such projects as defined by the RESTORE Act)	No
Comments:	
No, the past successes and failures of similar projects have not been evaluated.	

Question J	
Has the project/program identified a monitoring and data management strategy that will support project measures of success (i.e., metrics). If so, is appropriate best available science justification provided? If applicable, how is adaptive management informed by the performance criteria? (Captures statistical information requirement a defined by the RESTORE Act)	Yes
Comments:	
Yes, the proposal includes a Monitoring and Adaptive Management Plan.	

Please summarize any additional information needed below:
As stated above, the methods that pertain to the modeling component do not appear to be scientifically sound. For example, in order to move to the E&D phase (e.g., sand backpassing or bypassing) a suitable fully operational model must be available that can explore the alternative options and assess whether the proposed construction project would be able to achieve desired restoration objectives. This is a challenging task given that currently there are no operational coupled hydrodynamic-wave-sediment transport-water quality models for the northern Gulf of Mexico that can answer the complex questions regarding the sediments transport and fate and the resulting water quality changes. As described, the modeling synthesis (Component 1) is unlikely to produce a numerical model that can successfully inform and guide the E&D component of the project. In my opinion, what is needed is further model development as opposed to a synthesis of disparate existing modeling studies. Also, the spatial domain of the model, as depicted in Figure 1, appears inadequate. The northcentral Gulf of Mexico is characterized by extremely complex hydrodynamics, where local and remote winds, riverine freshwater discharges, and open ocean forcing all play important roles. In order to accurately simulate currents, wave dynamics and sediment dynamics within the proposed study area, one would need a high-resolution model grid extending over the entire northcentral Gulf of mexico, nested within a coarser-resolution grid covering the entire Gulf of Mexico basin.

SCIENCE EVALUATION

Bucket 2: Comprehensive Plan Component

Proposal Title: Ecosystem Modeling and Chandeleur Island Restoration E&D
Location (If Applicable): Gulf-wide
Council Member Bureau or Agency: U.S. Department of the Interior, U.S. Fish and Wildlife Service
Type of Funding Requested: Planning

Reviewed by: Reviewer 2
Date of Review: 5/8/2020

Best Available Science:

These 4 factors/elements help frame the reviewer's answers to A, B and C found in next section:

Question 1.	
Have the proposal objectives, including proposed methods, been justified using peer reviewed and/or publicly available information?	No
Comments:	
There is too little information provided about the integrated modeling system. No specific models are identified and there doesn't seem to be any buy-in by other developers. No specific simulations are discussed, no treatment of error, no references to model coupling. The online interface is vaguely described. There is little justification offered for the substantial price tag (e.g. are you hiring the original model deveopers as consultants or will a post doc to navigate through unfamiliar code?). I cannot determine this from the justification. Its not clear if there is any relevant expertise on this project. The restoration part is better justified than the modeling with a few other examples provided of similar projects and alternative tactics. Even then, for a project of this size I would expect some preliminary analysis and forecasts.	

Question 2.	
If information supporting the proposal does not directly pertain to the Gulf Coast region, are the proposal's methods reasonably supported and adaptable to that geographic area?	Yes
Comments:	
N/A. The proposal, methods and research all focus on the Gulf region.	

Question 3.	
Are the literature sources used to support the proposal accurately and completely cited? Are the literature sources represented in a fair and unbiased manner?	No
Comments:	
There is adequate justification provided for the ecological value of the Chandeleur Islands and their value for dissipating wave energy. The threats to the islands are referenced. Previous restoration efforts and techniques are adequately cited. However, no hydrogeomorphological models are identified and there is insufficient review of the state of the art in this modeling field or justification for the proposed model system. There is a body of literature which is not cited on methods to pass information between models and resolve differences in temporal and spatial resolutions. There is no mention of validation tools. No examples are provided on how the models will interface with the engineering project.	

Question 4.	
Does the proposal evaluate uncertainties and risks in achieving its objectives over time? (e.g., is there an uncertainty or risk in the near- and/or long-term that the project/program will be obsolete or not function as planned?)	No
Comments:	

It is concerning that the risks are identified as "the ability to find connections among models and make them interoperable". Isn't this fundamental? It is not apparent from this document that any research has been done on what models are available, or that these models are understood well enough to know what data are tracked or what effort or expertise would be required in terms of new coding in order to extract and standardize variables, resolve spatio-temporal differences, and pass them between models. It is not really even clear what types of models are being considered besides geomorphology models, if any homework has been done it is not made clear here. Seems storm impacts should be considered.There doesn't seem to be adequate treatment of error or variability. What assumptions will your model use on Mississppi R discharge & sedimentation rate, loop current behavior. Are these deterministic simulations?

Based on the answers to the previous 4 questions, and *giving deference to the sponsor to provide within reason the use of best available science,* the following three questions can be answered:

Question A	
Has the applicant provided reasonable justification that the proposal is based on science that uses peer- reviewed and publicly available data?	No
Comments:	
It is not made clear what data are going to be used. What inputs will be used in the modeling? Is there any connection to (basin-scale) hydrodynamic modeling? Monitoring using remote sensing?. They mention climate change but they don't talk about large-scale circulation changes, precipitation changes. What variables are you using from the GCM?	

Question B	
Has the applicant provided reasonable justification that the proposal is based on science that maximizes the quality, objectivity, and integrity of information (including, as applicable, statistical information)?	Need more information
Comments:	
I don't understand what this question is asking. Does the science "maximize the quality of information?" What does that mean? If you're asking whether this project takes advantage of existing data then I would say no. it seems like it could benefit greatly from the extensive Delft modeling by the Water Institute, but none of that is cited. I don't know if the water institute is aware of this as I did not receive a list of investigators or letters of committment. There's no mention of any remote sensing data which seems to have application in planning and measuring success.	

Question C	
Has the applicant provided reasonable justification that the proposal is based on science that clearly documents and communicates risks and uncertainties in the scientific basis for such projects/programs?	No
Comments:	
Again, not clear if the smulations are to be handled in a probabilistic sense, or if there's any monte carlo of parameters, or challenge of structural assumptions in the model, or drving with a range of environmental variables representing possible futures. Seems like inadequate treatment of uncertainty and little acknowledgement of potential problem areas.	

Science Context Evaluation:

Question A	
Has the project/program sponsor or project partners demonstrated experience in implementing a project/program similar to the one being proposed?	Need more information
Comments:	
I don't have sufficient information on the participants to answer this. The roles and commitment of agencies are not defined.	

Question B

Does the project/program have clearly defined goals objectives?	No

Comments:

Their metrics are only for report writing. This is insufficient for a project of this scope with major modeling and engineering components. They should include restoration success metrics including remote sensing observations. Modeling should include milestones and model validation goals against time series and/or spatial data. Specific scenarios should be better described (different subsidence/climate change scenarios). A timeline should be included.

Question C

Has the proposal provided a clear description of the methods proposed, and appropriate justification for why the method is being selected (e.g., scientifically sound; cost-effectiveness)?	No

Comments:

Almost no information on the modeling system provided. What products are being used, what drivers, what variables exchanged, what boundary conditions. I realize this is an exploratory effort but there should be much more clearly defined resources, activities and outputs.

Question D

Does the project/program identify the likely environmental benefits of the proposed activity? Where applicable, does the application discuss those benefits in reference to one or more underlying environmental stressors identified by best available science and/or regional plans?	Yes

Comments:

Proposal does a sufficient job of outlining the ecological benefits and wave dissipating benefits of the islands and documents the threats to the islands adequately. Makes a good case that the islands are important for the greater region.

Question E

Does the project/program have measures of success (i.e., metrics) that align with the primary Comprehensive Plan goal(s)/objectives? (Captures the statistical information requirement as defined by RESTORE Act)	Yes

Comments:

Outlines 4 success metrics. Development of 1) management plans, 2) monitoring plans, 3) Restoration plan (including engineering reports), 4) environmental compliance documents. Project would have benefited from clear restoration targets, not just report writing. The stated justification for only writing reports is that it's just a planning study, but I don't really understand this because there an enormous engineering component. They briefly mention other water quality objectives but this is not explained.

Question F

Does the proposal discuss the project/program's vulnerability to potential long-term environmental risks (i.e., climate, pollution, changing land use)? (Captures risk measures as defined under best available science by the RESTORE Act)	Yes

Comments:

QUESTION F COMMENTS. The proposal does mention climate change, subsidence, but not enough detail is provided on what specific scenarios will be considered, how these will impact modeling, and how these will be monitored as the project is ongoing.

Question G	
Does the project/program consider other applicable short-term implementation risks and scientific uncertainties? Such risks may include the potential for unanticipated adverse environmental and/or socio-economic impacts from project implementation. Is there a mitigation plan in place to address these risks? Any relevant scientific uncertainties and/or data gaps should also be discussed. (Captures risk measures as defined under best available science by the RESTORE Act)	No
Comments:	
QUESTION G COMMENTS: there isn't a lot discussed on unanticipated environmental and socioeconomic risks but this doesn't seem too problematic to me (although I'm not really qualified to comment on the practicality or risks involved in the restoration effort) – this part needs to be evaluated by an engineer. The bigger problem to me is what I've already mentioned, that there isn't sufficient treatment of error or variability in the modeling, and even if there were, it's not clear how this would feed back to the restoration effort.	

Question H	
Does the project/program consider recent and/or relevant information in discussing the elements above?	Yes
Comments:	
As I said, there isn't a lot of discussion regarding short-term environmental and socioeconomic risks. There are no examples provided of where this type of restoration project did or did not result in short term environmental or socioeconomic impacts, or how those situations would be addressed. However, they do provide quite a few references regarding different published methods to achieve their aims and it seems to me that they've given some thought to the different conditions that could arise, although this was more in terms of meeting engineering goals and not necessarily risk management.	

Question I	
Has the project/program evaluated past successes and failures of similar efforts? (Captures the communication of risks and uncertainties in the scientific basis for such projects as defined by the RESTORE Act)	No
Comments:	
As far as the engineering goes, they have looked at past projects and have anticipated how their engineering objectives may be met through different strategies – although I would have like to see some examples of remote sensing to montor. Past modeling is not documented and does not adequately inform their effort. There is no local modeling research acknowledged. They say there's a lot but don't cite any.	

Question J	
Has the project/program identified a monitoring and data management strategy that will support project measures of success (i.e., metrics). If so, is appropriate best available science justification provided? If applicable, how is adaptive management informed by the performance criteria? (Captures statistical information requirement a defined by the RESTORE Act)	No
Comments:	
Their metrics of success involve report writing, but I think they should include some measures of success in engineering considering it is a large part of the budget. There's no plan for adaptive management.	

Please summarize any additional information needed below:
This was a difficult proposal to review. I don't know who is involved, there's no, COI, C&P, SOW, CVs, time line. There is not even a real budget or justification. Only 8 sentences for an $8 million project, and nothing is itemized? What overhead rates are you using? How many people are being employed? Who are the subcontractors? What agencies are involved and what are they contributing? This seems more like a statement of interest than a full proposal. I apologize if I have misunderstood what is being asked of me, and I recognize that the applicants may have correctly fulfilled the documentation requirements for this solicitation. In any case, unless there is more information forthcoming I have to strongly recommend against funding this project. It seems they are better positioned to conduct the restoration part then they are to do the modeling. This needs to have a better defined modeling component with clear goals, a strategy for combining models, stated boundary conditions and environmental drivers, clearly defined scenarios, and buy in from other model deveopers. The web application is not well described and it isn't clear who the clients are or how it would work (would it calculate on the fly? This seems impractical for cluster-based hydrogeomorphological or hydrodynamic models – these models take days to run, even weeks. If these are pre-calculated scenarios then what boundary conditions are you using?). The restoration project seems better prepared, but even then there isn't enough attention given to previous efforts-world wide, there isn't sufficient monitoring of success of the restoration program, and there isn't a clear enough feed back mechanism to link the models to the restoration effort. I did not have sufficient information on the particpants to evaluate their qualifications.

SCIENCE EVALUATION

Bucket 2: Comprehensive Plan Component

Proposal Title: Ecosystem Modeling and Chandeleur Island Restoration E&D
Location (If Applicable): Gulf-wide
Council Member Bureau or Agency: U.S. Department of the Interior, U.S. Fish and Wildlife Service
Type of Funding Requested: Planning

Reviewed by: Reviewer 3
Date of Review: May 13, 2020

Best Available Science:

These 4 factors/elements help frame the reviewer's answers to A, B and C found in next section:

Question 1.	
Have the proposal objectives, including proposed methods, been justified using peer reviewed and/or publicly available information?	Need more information
Comments:	
One proposed method was justified using a peer-reviewed publication, but it is not publically available. The proposal states that the methods used in Long et al. 2020 will be used to assess the risk of storm impacts on potential restoration design plans. This publication is peer-reviewed but can only be accessed by members of the American Shore and Beach Preservation Association. All other objectives and methods were justified using peer-reviewed readily available publications.	

Question 2.	
If information supporting the proposal does not directly pertain to the Gulf Coast region, are the proposal's methods reasonably supported and adaptable to that geographic area?	Yes
Comments:	
The proposed work directly pertains to the Gulf Coast region.	

Question 3.	
Are the literature sources used to support the proposal accurately and completely cited? Are the literature sources represented in a fair and unbiased manner?	Yes
Comments:	
There is one citation missing from the bibliography. It is on pg. 6, Zhang and Kandampully (2015).	

Question 4.	
Does the proposal evaluate uncertainties and risks in achieving its objectives over time? (e.g., is there an uncertainty or risk in the near- and/or long-term that the project/program will be obsolete or not function as planned?)	Yes
Comments:	
Two paragraphs in the proposal are devoted to risk and uncertainities. The first deals with these issues tied to the planning phase and the second the implementation of engineering and design tasks.	

Based on the answers to the previous 4 questions, and *giving deference to the sponsor to provide within reason the use of best available science,* the following three questions can be answered:

Question A	
Has the applicant provided reasonable justification that the proposal is based on science that uses peer- reviewed and publicly available data?	Need more information
Comments:	
The proposed work is divided into two phases—a planning phase based on merging exisiting models to develop restoration plans and an engineering implementation phase. The proposal provides ample justification from peer-reviewed, public research for the second phase. The first phase is well supported in peer-review, public literature for the decision frameworks that will be used for planning but there is too little justification and information about the computer models that will be the focus of the planning phase.	

Question B	
Has the applicant provided reasonable justification that the proposal is based on science that maximizes the quality, objectivity, and integrity of information (including, as applicable, statistical information)?	Yes
Comments:	
Click here to enter text.	

Question C	
Has the applicant provided reasonable justification that the proposal is based on science that clearly documents and communicates risks and uncertainties in the scientific basis for such projects/programs?	Need more information
Comments:	

For the most part, Phase 2 of the proposed work uses adequate, science-based justification of risks and uncertainties. The one aspect lacking science-based justification in the Phase 2 compenent is the selection of exceedance probabilities to be used by the restoration design team. This is a big consideration and will have a large influence on the success or failure and will likely influence the total funds needed to successfully implement the restoration design. Will restoration be deisgned to withstand low annual exceedance probability events (500 yr; 1,000 yr; 10,000 yr recurrence intervals)? It would seem reasonable to do so given how strongly storms, and Hurricane Katrina in particular, have the potential to rework the island system. Designing for low AEP events will be more expensive than for the more commonly designed for 100-yr event. Some discussion and planning considering this issue would be beneficial to understanding the true potential for restroration plans to succeed. For Phase 1 aspects of this research, the planning/decision support process is well justified but the aspects of Phase 1 tied to integration of models of different spatial resolution, designed for different purposes is not well justified with scientific, peer-reviewed literature. For example, is it feasible to merge sediment transport models with salinity models designed for different temporal and spatial scales? Not enough review of literature or discussion of the specific models being considered is provided within the proposal to be able to judge the risk of failure.

Science Context Evaluation:

Question A	
Has the project/program sponsor or project partners demonstrated experience in implementing a project/program similar to the one being proposed?	Need more information
Comments:	
From general knowledge of the sponsors involved, I would say they have experience in the proposed activities, but this previous experience is not explicitly discussed in the proposal document.	

Question B	
Does the project/program have clearly defined goals objectives?	Yes
Comments:	
The proposed objects are well explained and the good rationale provided for the objectives.	

Question C	
Has the proposal provided a clear description of the methods proposed, and appropriate justification for why the method is being selected (e.g., scientifically sound; cost-effectiveness)?	Need more information
Comments:	
The proposal would benefit from more explanation of the specific models that will be worked with in Phase 1 and more detailed description of methods used to merge the models. For Phase 2, the proposal states that methods used in Long et al. 2020 will be used to assess the risk of storm impacts on potential restoration design plans. This reviewer could not access this publication because it requires membership in the American Shore and Beach Preservation Association. More details of the methods for planning and estimating risk from storms to restoration plans should be discussed in detail in the proposal.	

Question D	
Does the project/program identify the likely environmental benefits of the proposed activity? Where applicable, does the application discuss those benefits in reference to one or more underlying environmental stressors identified by best available science and/or regional plans?	Yes
Comments:	
The proposal does an excellent job of explaining how the Phase 2 restoration could result in enhancing shoreline protection by increasing wave attenuation, help increase seagrass habitat, and help prevent in-shore migration of high salinity waters that would significantly alter ecosystem states. The proposed project has the potential to benefit the proposed mid-Breton Sediment Diversion, living shoreline projects in Biloxi Marsh and Hancock County and oyster restoration in LA, MS, and Cat Island. The study	

area is included in the Lousisana Department of of Wildlife and Fisheries' Louisiana Wildlife Action Plan and aligns with Lousiana's Coastal Master Plan.

Question E	
Does the project/program have measures of success (i.e., metrics) that align with the primary Comprehensive Plan goal(s)/objectives? (Captures the statistical information requirement as defined by RESTORE Act)	Need more information
Comments:	
For the most part the metrics align with objectives but there are no metrics provided for assessing the efficacy of the restoration work. Only 2% of the budget and very little of the project timeline is devoted to assessment of the efficacy of the restoration measures.	

Question F	
Does the proposal discuss the project/program's vulnerability to potential long-term environmental risks (i.e., climate, pollution, changing land use)? (Captures risk measures as defined under best available science by the RESTORE Act)	Yes
Comments:	
Yes, all the main concerns are raised, including sea level rise, coastal subsidence, storms, changes in sediment availability, and salinity changes.	

Question G	
Does the project/program consider other applicable short-term implementation risks and scientific uncertainties? Such risks may include the potential for unanticipated adverse environmental and/or socio-economic impacts from project implementation. Is there a mitigation plan in place to address these risks? Any relevant scientific uncertainties and/or data gaps should also be discussed. (Captures risk measures as defined under best available science by the RESTORE Act)	Need more information
Comments:	
Yes, consideration is given to adverse environmental impacts towards project implementation. There is less consideration given to socio-economic roadbloacks, other than considering issues of making the integrative model developed as part of Phase 1 easily accessible. This may be because the proposed work aligns so well with ongoing efforts across the region?	

Question H	
Does the project/program consider recent and/or relevant information in discussing the elements above?	Yes
Comments:	
The data souces used to consider relevant environmental implementation risks are up to date. As mentioned in responses to previous questions, more information about the specific models to be integrated and the methods used would be helpful. The risk of failure associated with Phase 1 cannot be assessed without this information.	

Question I	
Has the project/program evaluated past successes and failures of similar efforts? (Captures the communication of risks and uncertainties in the scientific basis for such projects as defined by the RESTORE Act)	No
Comments:	
Click here to enter text.	

Question J	
Has the project/program identified a monitoring and data management strategy that will support project measures of success (i.e., metrics). If so, is appropriate best available science justification provided? If applicable, how is adaptive management informed by the performance criteria? (Captures statistical information requirement a defined by the RESTORE Act)	Need more information

Comments:

Metrics aligned with the planning and development of a decision framework tied to Phase 1 are detailed. But the proposal is lacking metrics explicit to Phase 2 implementation/engineering work. Statistical information to be collected is not explained but the proposal states that assessment guidlelines from the following will be followed: Council Monitoring and Assessment Working Group, Natural Resources Damage Assessment Trustee Council's Cross-Trustee Implementation Group Monitoring and Adaptive Management Work Group (Deepwater Horizon Natural Resources Damage Assessment Trustees, 2017).

Please summarize any additional information needed below:

The main strengths of this proposal include:

(1) the potential outcomes and benfits of the restoration work proposed as part of Phase 2 of the study becaue of its potential to help maintain ecosystem function because of the role that the Chandeleur Islands play in regulating salinity; and
(2) its use of existing research and data;
(3) its use of partnerships between federal entities.
(4) its alignment with other restoration and conservation initiatives taking place or proposed in the region.

The main weaknesses of this proposal include:

(1) methods to be used are largely superficially explained; particularly as it relates to integration of models needed for Phase 1 work;
(2) it is unclear whether all of the Phase 1 work, which is the majority of the budget, is really necessary to accomplish Phase 2;
(3) too few metrics of assessment for the Phase 2 work;
(4) focusing on sand backpassing as the primary restorative technique; the efficacy of this method will heavily depend on future storm frequency; methods to estimate or understand future storm frequency are largely unexplored in the proposal.