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Comprehensive Conservation and Management Plan 2019



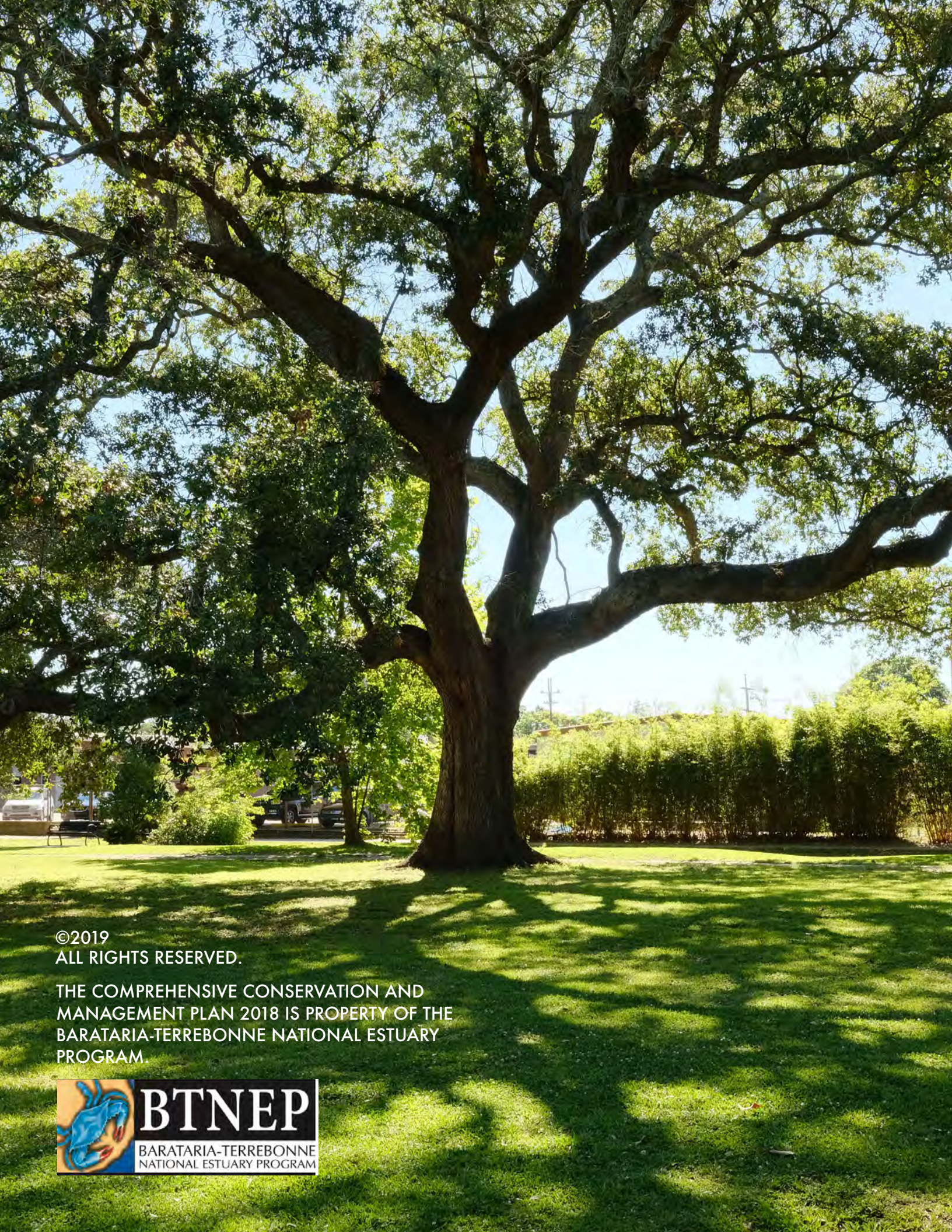
Estuary Issues
Scientific Research
Water Quality
Community Outreach

Education
Habitat Restoration
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Species Assessments



Comprehensive Conservation and Management Plan 2019

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by the Barataria-Terrebonne Estuary Program**



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Lake Verret, Assumption Parish. Image: Lane Lefort Photography



Image: Lane Lefort Photography

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Designed by: Hannah Fulton & Phyllis Lear



Image: Keri Turner

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August 6, 2019

Dear Friends of the Estuary,

I am pleased to share with you this newly revised Comprehensive Conservation and Management Plan (CCMP) developed by the Barataria-Terrebonne National Estuary Program (BTNEP) Management Conference. Since its inception in 1990, the Management Conference has represented a diverse set of stakeholders ranging from business and industry to fisheries and agriculture, from oil and gas to environmentalists, hunters, local and state government agencies. These parties have all agreed that in order to address the fundamental problems facing this national significant estuary at the mouth of the largest drainage basin in the nation, both collaboration and commitment are necessary.

The new CCMP is the product of nine different committees made up of 117 individuals from 47 different agencies, volunteering hundreds of hours to consolidate what were previously 51 action plans to 36 action plans. Twenty-nine years have passed since the creation of BTNEP, and 23 years have passed since the release of the last CCMP. Five new action plans were added to reflect a new understanding of landscape changes. These are: Emergency Response, Recovery, and Resilience; Flood Risk Reduction and Coastal Resilience; Urban Green Spaces; Improvement of Water Quality through the Reduction of Inshore and Marine Debris; and Protection of Drinking Water Sources.

The newly revised CCMP will guide the conservation, restoration, enhancement, and protection of the Barataria-Terrebonne Estuary System and its communities over the next 25 years. Since the hurricane season of 2005, Louisiana has had a coastal master plan to align efforts across the coast. The revision of the CCMP reflects this alignment and incorporates feedback from the staff at the Coastal Restoration and Protection Authority (CPRA) to ensure consistency.

I look forward to seeing us work together to implement this plan. My staff and members of the BTNEP staff and Management Conference are available to you for further information.

Sincerely,

A handwritten signature in black ink, appearing to read "John Bel Edwards".

John Bel Edwards
Governor
State of Louisiana

ACRONYMS

Acronym	Full Name
AFWA	Association of Fish and Wildlife Agencies
APHIS	Animal and Plant Health Inspection Service
APT	Action Plan Team
ARMi	Amphibian Research and Monitoring Initiative
ARS	USDA Agricultural Research Service
ASSET	Aquifer Sampling and Assessment Program
ATTAINS	Assessment and Total Maximum Daily Load Tracking and Implementation System
BEACH	Beaches Environmental Assessment and Coastal Health
BICM	Barrier Island Comprehensive Monitoring
BLFWD	Bayou Lafourche Fresh Water District
BLM	Bureau of Land Management
BMP	Best Management Practice
BoR	Louisiana Board of Regents
BoR/LUM-CON	Board of Regents' Louisiana Universities Marine Consortium
BTB	Barataria and Terrebonne Basins
BTE	Barataria-Terrebonne Estuary
BTEF	Barataria-Terrebonne Estuary Foundation
BTNE	Barataria-Terrebonne National Estuary
BTNEP	Barataria-Terrebonne National Estuary Program

Acronym	Full Name
BTNEP MC	Barataria-Terrebonne Management Conference
BTPO	Barataria-Terrebonne Program Office
BUDMAT	Beneficial Use of Dredged Material
CCMP	Comprehensive Conservation and Management Plan
CCR	Consumer Confidence Reports
CELCP	Coastal and Estuarine Land Conservation Program
CFR	Code of Federal Regulations
CHRIS	Chemical Hazards Response Information System
CIAP	Coastal Impact Assistance Program
CLIWS	Center for Louisiana Inland Water Studies (University of Southwestern Louisiana)
CPRA	Coastal Protection and Restoration Authority
CRC&D	Capital Resource Conservation & Development Council
CRCL	Coalition to Restore Coastal Louisiana
CRMS	Coastwide Reference Monitoring System
CUP	Coastal Use Permit
CWA	Clean Water Act
CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act
CWSRF	Clean Water State Revolving Fund
DODT	Louisiana Department of Transportation
DPS	Department of Public Safety and Corrections
EBI	Environmental Baseline Inventory
EDA	Economic Development Administration

Acronym	Full Name
EDMS	Electronic Document Management System
EMAP	Environmental Monitoring & Assessment Program
EMS	Emergency Management Information System
EPA	US Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
EROS	Earth Resources Observation and Science
ESA	Endangered Species Act
FDA	U.S. Food and Drug Administration
FRP	Facility Response Plan
GDP	Gross Domestic Product
GIS	Geographic Information System
GIWW	Gulf Intracoastal Waterway
GLPC	Greater Lafourche Port Commission
GOMA	Gulf of Mexico Alliance
GOMP	Gulf of Mexico Program
GOMRI	Gulf of Mexico Research Initiative
GPS	Global Positioning Unit
GU	Groundwater UDI Surface Water
GUISW	Ground Water Under the Influence of Surface Water
GUP	Purchased Groundwater UDI Surface Water
GW	Groundwater
GWP	Purchased Groundwater

Acronym	Full Name
HAB	Harmful Algal Bloom
HNC	Houma Navigational Canal
HSDRRS	Hurricane Storm Damage and Risk Reduction System
HUD	Louisiana Department of Housing and Urban Development
IAP2	International Association for Public Participation
IR	2016 Water Quality Integrated Report
ISAPT	Invasive Species Action Plan Team
KAB	Keep America Beautiful
KLB	Keep Louisiana Beautiful
LA SAFE	Louisiana Strategic Adaptations for Future Environments
LaSTEP	Louisiana Small Town Environmental Program
LAWEN	Louisiana Water Economy Network
LCA	Louisiana Coastal Area
LCES	Louisiana Cooperative Extension Service
LCRP	Louisiana Coastal Resources Program
LDAF	Louisiana Department of Agriculture and Forestry
LDCRT	Louisiana Department of Culture, Recreation, and Tourism
LDEQ	Louisiana Department of Environmental Quality
LDHH	Louisiana Department of Health and Hospitals
LDNR	Louisiana Department of Natural Resources
LDNR OC	Louisiana Department of Natural Resources Office of Conservation
LDOE	Louisiana Department of Education

Acronym	Full Name
LDWF	Louisiana Department of Wildlife and Fisheries
LEEC	Louisiana Environmental Education Commission
LEH	Louisiana Endowment for the Humanities
LiDAR	Light Detection and Ranging
LOSCO	Louisiana Oil Spill Coordinators Office
LOSPRA	Louisiana Oil Spill Prevention and Response Act
LPB	Louisiana Public Broadcasting
LPBF	Lake Pontchartrain Basin Foundation
LPCCP	Louisiana Pollinator Cooperative Conservation Program
LSPMB	Louisiana Seafood Promotion and Marketing Board
LSTA	LA Science Teacher's Association
LSU	Louisiana State University
LUMCON	Louisiana Universities Marine Consortium
MMPA	Marine Mammal Protection Act
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MRBI	Mississippi River Basin Healthy Watersheds Initiative
MR&T	Mississippi River and Tributaries Project
NBS	National Biological Service
NDRC	National Disaster Resilience Competition
NEP	National Estuary Program
NEPA	National Environmental Policy Act

Acronym	Full Name
NGO	Non-governmental Organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NPS	Nonpoint Source
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NRDA	Natural Resource Damage Assessment and Restoration Program
NSSP	National Shellfish Sanitation Program
NWF	National Wildlife Federation
NWIS	National Water Information System
NWQI	National Water Quality Initiative
NWRC	National Wildlife Research Center
O&M	Operations and Maintenance Program
OM&M	Operations Maintenance and Monitoring
OCM	Office of Coastal Management
OPA'90	Oil Pollution Act of 1990
OSDS	Onsite Sewage Disposal System
PITs	Priority Issue Team
QA/QC	Quality Assurance/Quality Control
RCPP	Regional Conservation Partnership Program
RESTORE Act	Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economies of the Gulf Coast States Act
SBDC	Small Business Development Center

Acronym	Full Name
SCPDC	South Central Planning & Development Commission
SLEC	South Louisiana Economic Council
SLWDC	South Louisiana Wetlands Discovery Center
SONRIS	Strategic Online Natural Resources Information System
SPCC	Spill Prevention, Control and Countermeasures
SPSOC	Significant Potential Sources of Contamination
STORET	STorage and RETrieval and Water Quality eXchange
SW	Surface Water
SWAP	Source Water Assessment Program
SWAMP	System Wide Assessment and Monitoring Program
SWCD	Soil and Water Conservation Districts
SWP	Purchased Surface Water
TEDA	Terrebonne Economic Development Authority
TLCD	Terrebonne Levee and Conservation District
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TPCG	Terrebonne Parish Consolidated Government
UDI	Under the Direct Influence
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency

Acronym	Full Name
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USNPS	U.S. National Park Service
WATERS	Watershed Assessment, Tracking and Environmental Results System
WIG	Water Institute of the Gulf
WIPS	Watershed Implementation Plans
WQX	Water Quality Exchange
WRDA	Water Resources Development Act
WSFR	Wildlife & Sport Fish Restoration



Image: Lane Lefort Photography

FOREWORD

The Barataria-Terrebonne National Estuary Program (BTNEP) has been engaged in the protection and restoration of the 4.2 million acres of land and water that are at the heart of Louisiana's land loss crisis since 1990.

The U.S. Environmental Protection Agency (EPA), the State of Louisiana, and local partners formed a novel partnership at that time. The goal of BTNEP was to protect the estuary from further degradation and to undertake programs that would begin to check human-made damage that had already occurred to habitats throughout the estuary. That mission continues today. The base funding for this program is provided through Section 320 of the Clean Water Act (CWA) and a State match in funds.

A Comprehensive Conservation and Management Plan (CCMP) was created to coordinate actions to address the needs of the estuary. This document is a revision of the original CCMP. This CCMP revision continues to work specifically to overcome the priority issues identified for the estuary by enlisting all of the effected stakeholders, establishing priorities, and synchronizing efforts. The priority problems addressed are: hydrologic modification, sediment reduction, habitat loss, eutrophication, pathogen contamination, toxic substances, and changes in living resources. The 36 action plans contained in this document work to directly address these problems as well as numerous institutional and societal factors which contribute to them.

The commitment of local people and their ongoing love of the land, water, culture, and each other have made the estuary's perils an international issue. What happens to this estuary and its people will showcase the adaptive capacity of communities living in a dynamic system.

As changes continue to manifest themselves in environmental exposures, BTNEP stands ready to address the issues through a science-based, stakeholder-led, consensus-driven plan of actions that uses a unique partnership approach focused on the estuary's rich cultural, economic, and natural resources.

Many opportunities exist to make positive changes to improve our ecosystem and human interaction with nature.

We invite you to join us in our efforts.



Image: Lane Lefort Photography

UNDERSTANDING BTNEP

Mission, Vision, Goals, and Priority Issues

What is BTNEP?

The Barataria-Terrebonne National Estuary Program (BTNEP) works to protect and preserve the land, water, people, and culture located between the Mississippi and Atchafalaya Rivers in southeast Louisiana. BTNEP is one of the 28 National Estuary Programs throughout the United States and its territories. The National Estuary Program (NEP) was established by Congress through Section 320 of the Clean Water Act (CWA) of 1987. The Barataria-Terrebonne estuarine complex became a National Estuary in 1990. In 1990, BTNEP Management Conference (BTNEP MC) was created to provide direction and oversight of the Comprehensive Conservation Management Plan (CCMP) implementation. The BTNEP MC consists of diverse stakeholders who collaborate to address the preservation and restoration of the estuary through a science-based, collaborative decision making process while addressing and supporting stakeholder interests. The long-term dialogue and continued commitment of this partnership drives the success of BTNEP.

BTNEP was established in recognition of the national significance of this estuary system. An estuary is classified as an area where freshwater from rivers, streams, or bayous meets the saltwater of the sea. The range of habitat types found in estuaries makes them some of the most ecologically productive systems in the world.

This estuary provides a host of resources to the nation. Oysters, shrimp, finfish, goods transported through our ports, oil and gas and their related infrastructure are all integral to our country. Our estuaries also provide for unique cultural experiences and tourism opportunities. BTNEP MC members work to nurture the land and water of this estuary.

BTNEP and the stakeholders of the area have made a concerted effort to improve the estuary and tackle tough environmental problems since the early 1990s. This first revision of the original CCMP keeps the public-private partnership pledge to work together to reestablish a chemical, physical, and biological balance in the estuary and engages future generations to assist with the estuary's recovery. BTNEP and its partners continue to acknowledge the importance of this estuary in our environmental, cultural, and economic well-being. The people living, working, and recreating in the Barataria and



Terrebonne Basins believe that we should have a balanced ecosystem.

Mission

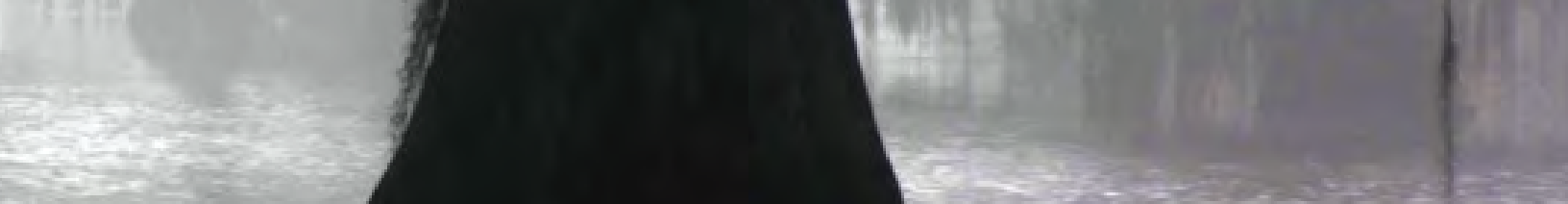
The official mission of BTNEP is to preserve and restore the Barataria-Terrebonne Estuary System (BTES), the 4.2 million-acre region between the Atchafalaya and Mississippi Rivers. BTNEP strives to rebuild and protect the estuary for future generations through the collaborative decision making process of the BTNEP MC to implement a science-based, stakeholder-led, consensus-driven plan using partnerships focused on the estuary's rich cultural, economic, and natural resources.

The people of Louisiana and the Barataria Terrebonne estuarine basins believe that the Barataria-Terrebonne ecosystem is a national treasure which represents a unique multi-cultural heritage. It is further recognized that our communities' ongoing stewardship is critical to its preservation, restoration, and enhancement. This science-based stewardship can be maintained only by the wisdom of the BTNEP MC, the active support of those who live in the basin, and those who use its abundant resources locally, statewide, and throughout the nation.

Acknowledging the importance of this estuary to our environmental, cultural, and economic well-being, the people living and working in these two basins



Volunteers cleaning the beach at Elmer's Island. Image: Lane Lefort Photography



believe that we should have a balanced ecosystem that includes:

- public education and informed citizen participation.
- local, state, and national recognition and support.
- maintained multi-cultural heritage.
- sustained and restored wetlands that support viable fish and wildlife resources.
- pollution abatement to protect the health of plants, animals, and people.
- environmentally-responsible economic activity.
- environmentally-compatible infrastructure (roads, bridges, levees, railroads, etc.).
- comprehensive, integrated watershed planning among all users.
- harmonious use of the resources by many interests and resolution of user conflicts.

Public involvement in the BTNEP process has been extensive and has occurred at two levels. First has been the strategy of inclusion in which individuals from throughout the estuary have been invited to become active members of the BTNEP MC to assist in plan formulation. The second level has been the strategy of information dissemination in which BTNEP has participated; BTNEP Action Plan Teams (APT), volunteer events, education activities, and events have all been instrumental in moving BTNEP forward.

Our overarching goal of BTNEP is to maintain multi-level, long-term, comprehensive watershed planning that improves the quality of life for people of the estuary.

The BTNEP MC and the community have pledged to work together to implement a plan to reestablish a chemical, physical, and biological balance in the BTES so that diverse plant and animal communities and human health and welfare can be improved and sustained for present and future generations.

Goals

The intention of BTNEP is the support of activities that sustain:

- the estuary's public water quality.
- shellfish, fish, and wildlife habitat and populations.
- recreational and commercial opportunities for estuary residents.
- the protection and preservation of our unique cultural heritage.

The BTNEP MC delineated the fundamental goals of BTNEP in 1992. These goals provide the basis for all Action Plans found in the CCMP. The goals of BTNEP are to:

- implement comprehensive education and awareness programs that enhance public involvement and maintain cultural heritage.
- preserve and restore wetlands and barrier islands.
- realistically support diverse, natural biological communities.
- develop and meet water quality standards that adequately protect estuarine resources and human health.
- promote environmentally responsible economic activities that sustain estuarine resources.

- generate national recognition and support.
- create an accessible, comprehensive database with interpreted information for the public.
- create clear, fair, practical, and enforceable regulations.
- develop and maintain multi-level, long-term, comprehensive watershed planning.
- be compatible with natural processes.
- forge common-ground solutions to estuarine problems.
- formulate indicators of estuarine ecosystem health and balance estuary use.

BTNEP Priority Issues

BTNEP MC members have identified priority problems in the estuary that are contributing to land loss: habitat modification; the decline in certain animal populations; water quality issues related to fish, shellfish, and humans; and contamination of sediment in the marshes. Each of the priority problems, in some way, affects the next, making the resolution of each of the problems that much more pressing and complex. The Action Plans that are located in the CCMP work to directly address these problems as well as the numerous institutional and societal factors that contribute to them.

In general, the overall health of the Barataria and Terrebonne Basins (BTB) shows signs of years of abuse and neglect. The following seven problems



Levee construction. Image: BTNEP



Aerial view of Larose-Golden Meadow, Louisiana, looking south to the Gulf of Mexico. Degradation of the marsh due to canals and subsidence is evident. Image: Coastal Protection and Restoration Authority

must be overcome to prevent further degradation of the habitats, ecosystems, and cultural heritage that are so unique to the system.

The seven priority problems are:

- Hydrologic Modification
- Sediment Reduction
- Habitat Loss
- Changes in Living Resources
- Eutrophication
- Pathogens
- Toxic Substances

Hydrologic Modification is considered a “linchpin” problem of the basins, indicating that all other problems revolve around it and are often affected by it. When we build levees, dredge canals,

or cut through natural ridges, the natural flow of water is changed. In some cases, such changes accelerate erosion. In other cases, it can result in changed salinity of water bodies. As a result, fresh marsh can be changed to a more “salt tolerant” type. In more extreme cases, marsh can be converted to open water.

Because of flood protection measures demanded by the public and then instituted by Congress following the Great Flood of 1927, in conjunction with those of private landowners and the State of Louisiana prior to the flood, constructed levees now line much of the Mississippi River. The levees’ unintentional consequences prevent sediment and water from being dispersed into the surrounding wetlands through periodic flooding and levee breaks. Concrete mattresses placed along the channel bank have prevented the natural tendency of the River to change course. In fact, the length of the River has been shortened by approximately 150 miles by cutoffs in the central portion of the lower Mississippi River. Both shortening of the River and placement of

concrete mats on the banks have reduced the River area exposed to erosion. In the past, soil from the River's edges was the primary source of sediment that fed the marshes.

Canals for navigation and oil and gas exploration and production are another type of hydrologic modification. When canals are constructed, the excavated material is placed alongside the canal, creating spoil banks. The impact of this type of activity can be threefold. First, the canal itself creates paths of ingress for waters of higher salinity, forcing animals to either adapt or relocate. Native plants have little choice but to adapt to their new environment or die. Second, erosion can occur along the canal banks with the passing of each vessel, converting more land to open water. Third, the dredged material alters the natural flow of water across the estuary landscape, sometimes creating lakes and in other cases, depriving large areas of water, nutrients, and sediments.

Impacts of canals are not, however, all necessarily

negative. Canal banks do provide some diversity of habitat, especially in coastal areas. Canals provide significant recreational opportunities and aquatic production potential as well.

Probable Causes of Hydrologic Modification:

- Diking and leveeing of wetlands
- Maintenance dredging; spoil banks
- Excavation of channels and canals for navigation and/or oil, gas, and mineral exploration; particularly those excavations deeper than surrounding waters
- Diversions of freshwater flows and sediment loads for navigation, flood control, or water supply purposes

Probable Impacts of Hydrologic Modification:

- Reduced sediment flows
- Habitat loss/modification



Construction of the Morganza Spillway. Image: U.S. Army Corps of Engineers.

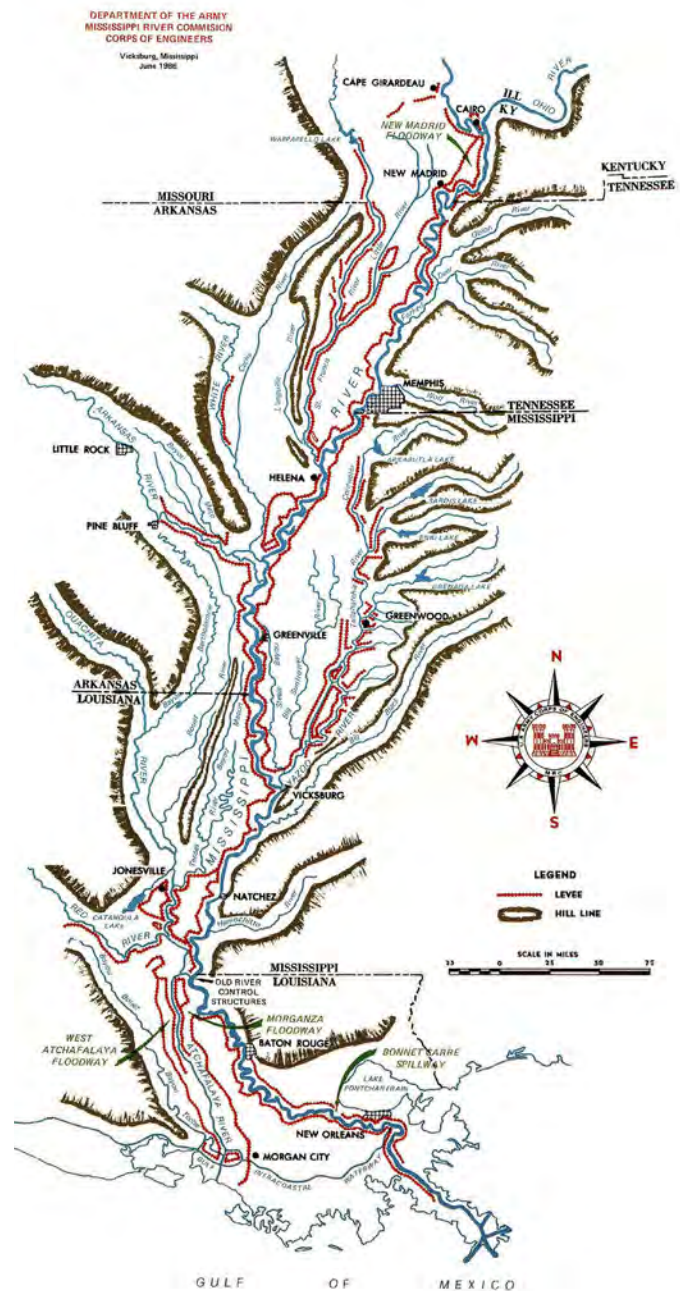
- Changes in living resources
- Eutrophication
- Pathogen contamination
- Toxic substances

Sediment Reduction is tied directly to hydrologic modification. Louisiana marshes need a source of sediment to survive. Historically, the Mississippi River provided the sediment. Now, however, levees confine the sediment to the River thus bypassing the marshes, ultimately depositing it on the continental shelf in the Gulf. Our coastal marshes constantly undergo a natural process called “subsidence” which results in the land slowly sinking. In the past, the rate of sediment building equaled or surpassed the rate of sinking, and the level of the marsh remained about the level of the sea.

Currently, subsidence is caused by cumulative natural and human-induced factors. As the Mississippi River has changed course over thousands of years, the ancient, abandoned deltas sank due to lack of sediment input. Additionally, natural sediment compaction, sediment loading, geochemical processes, and underlying geological growth faults also contribute to subsidence.

The construction of extensive human-made levees throughout the estuary have also starved the wetlands from receiving annual nourishment from riverine waters filled with nutrients and sediments. New sediment deposition no longer keeps up with subsidence. Also, forced drainage for flood control accelerates subsidence by removing pore water and accelerating oxidation of organic matter in soils. Removal of underground oil and gas has also contributed to subsidence and land loss.

In a 2017 study conducted by Tulane University, subsidence rates as high as 10.6 millimeters per year were determined using surface elevation change and vertical accretion. This coastal subsidence causes land loss and degrades the integrity of infrastructure and wetland services.



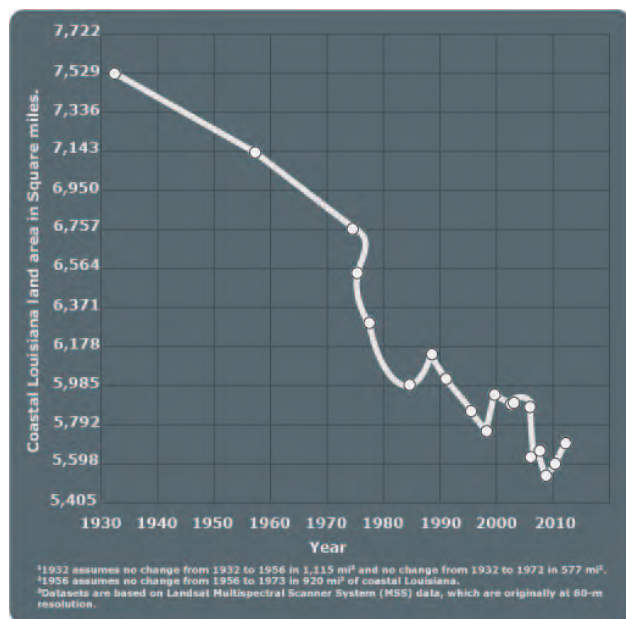
Principal Tributary Basin Improvements of Mississippi River. Image: U.S. Army Corps of Engineers.

Today, the River carries up to 80 percent less sediment than it did a century ago. Dams, reduction in land, clearing and tilling, and implementation of conservation measures that reduce erosion upriver are the major causes of the reduction. Thus, even if all of the levees along the Mississippi River were removed today, the marshes would still receive significantly less sediment than they did in the 1800s.

Still, some sediment does move into coastal marshes during hurricanes and winter cold fronts when wind-driven waves stir mud on the bottom of shallow bays. The volume of the sediment, however, is usually inadequate to counter the effects of subsidence. The existence of levees, canal banks, roadbeds, railroad embankments, and changes upriver all contribute to the problem of inadequate sediment distribution in our coastal marshes.

Probable Causes for Sediment Reduction:

- Navigation and oil/gas extraction canals
- Levees



Land area in coastal Louisiana, 1932–2010. Coastwide, net land area decrease from 1932 to 2010 was 1,883 mi². Image: USGS.

- Diking and leveeing of wetlands
- Spoil banks from dredging activities
- Upstream diversions of the Mississippi River into other basins resulting in less water and sediments available for the estuarine complex
- Locks and dams on the Missouri, Ohio, and upper Mississippi rivers

Probable Impacts of Sediment Reduction:

- Sedimentation rate becomes less than the rate of apparent water level rise (subsidence and sea level rise)
- Submergence and mortality of wetland vegetation
- Internal fragmentation of wetlands
- Lowered productivity of wetland vegetation

Habitat Loss is a function of hydrologic modification and sediment reduction. What is known about the rate of habitat conversion, and ultimately land loss in the coastal areas of the BTB, is that it is alarmingly high. According to a U.S. Geological Survey (USGS) study completed in 2010, “Land Area Change in Coastal Louisiana from 1932 to 2010,” the BTES has lost a total of 865.57 square miles since 1935.

The BTB continue to have the highest land loss rate in Louisiana. Subsidence and sea level rise are major factors in the land loss. Episodic events such as hurricanes and severe winter storms have significantly contributed to land loss. The hurricanes of 2005 (Katrina and Rita) caused storm induced stress. Since 1935, the two basins have lost 865.37 square miles of land or 287,724 acres.

Land loss is not evenly distributed across the BTB. Hot spots of land loss can be seen at the southernmost tip of the basins near the mouth of the Mississippi River in the Barataria basin, moving northward in a narrow band following the river and extending



Work on the Algiers Lock in New Orleans. Workers descend on the dewatered structure to complete repairs. U.S. Army Corps of Engineers. Image: Kirk Dietrich.

westward to Bayou Perot and Rigolettes. A second hot spot occurs along western Barataria Bay to the Gulf. In Terrebonne Parish, the area of greatest marsh loss occurs in the marshes north of Terrebonne Bay, extending south along the western edge of Terrebonne Bay.

Habitat loss can occur due to many activities. As noted earlier, sediment loss, in conjunction with the natural sinking of marsh, is by far the most significant problem in the estuary. Sea level rise and erosion also contribute to the problem, as can human activities such as canal dredging and construction of navigation channels. Additionally, overgrazing by mammals, such as nutria and hogs, destroy plant communities that hold soil in place. Studies have indicated that hurricane damage is increased in marshes that have been heavily grazed by nutria or wild hogs.

Storm surges and winds associated with severe tropical storms and winter fronts are additional

natural forces that account for significant habitat alteration and land loss in the estuary. During storms or periods of floods, habitats are subjected to changes in water chemistry and extended periods when they are totally submerged. When a wetland plant experiences sustained and deep flooding, growth suffers. If the flooding stress is sufficient, the plant dies. In the case of saltwater intrusion from the Gulf, some plant species have adapted and exclude salt from their tissues, but their tolerance of salt varies widely. Most fresh marsh species, however, are unable to survive exposure to high salinity waters. When fresh marsh plants die quickly from salt-water exposure, their roots can no longer hold the soil, and massive soil loss can occur.

Probable Causes of Habitat Loss:

- Hydrological modifications and wetland subsidence resulting in saltwater intrusion

- Spoil banks and diking or leveeing of wetlands resulting isolation, submergence, and mortality of wetlands
- Wetland erosion and internal fragmentation
- Shoreline erosion by commercial and recreational boat wakes
- Filling of wetland for agriculture and other development
- Invasive Species
- Development

Probable Impacts from Habitat Loss:

- Decreases in sport and commercial fish and shellfish populations
- Changes in fur-bearing and waterfowl populations with sport and commercial value

- Reduced recreation and commercial value of wetlands and estuaries
- Decreased acreage available to treat pollution inputs resulting in increased levels of eutrophication, pathogen contamination, and toxic substances
- Decreased capacity to buffer storm energy
- Decreased habitat for neotropical migratory birds and other species such as the black bear

Changes in Living Resources are monitored by BTNEP and BTNEP MC members. Living Resources are considered animals that live in the estuary. Living resources use the diverse habitats of the estuary. Approximately 735 species of birds, finfish, shellfish, reptiles, amphibians, and mammals spend all or part of their life cycle in the BTE. Several of the species are categorized either as threatened or



Blue crabs, fresh from the Gulf of Mexico. Image: Louisiana Sea Grant.



Trash deposit near a water body. Image: Lane Lefort Photography

endangered. Many factors contribute to declines in animal populations.

Change in habitat is a significant factor for most of the organisms. Pollution can also have a negative impact on the health of species and their ability to reproduce. Additionally, over-harvesting by fishermen, hunters, and trappers can harm animal populations.

In spite of threats that face animal species throughout the BTB, data indicate that many have not experienced continuous declines in population over the past thirty years. This is true for all estuarine dependent finfish and shellfish and for most of the wading birds and raptors.

For some species that have seen significant declines in population over time, there have been success stories. At the same time, some species of concern have recovered. Alligators, the Louisiana black bear, and birds, such as the American bald eagle and the brown

pelican, have recovered following near extinction in the area due to reproductive failure caused by pesticides or over hunting. Recovery efforts have made a significant increase in the numbers and health of these animals. Several species have been removed from the U.S. Fish and Wildlife Service (USFWS) threatened and endangered species list. Migratory waterfowl that winter in the region are monitored to help track continental trends.

New concerns about overfishing of blue crabs remind residents of the need for conservation. In February 2017, Louisiana hosted the first blue crab fishing closure to identify if this technique might have an effect on crab populations. Additionally, female crabs should not be harvested if they are immature (those with triangular aprons on their bellies) or if they are in the “berry” stage (carrying the eggs of the young on the abdomen – locally called pom-pom crabs).

Hunters and fishers are reminded to check the Louisiana Department of Wildlife and Fisheries (LDWF) site, <http://www.wlf.louisiana.gov/>, annually for changes to the regulations.

Probable Causes for Concern in Changes in Living Resources:

- Historic habitat loss/modification
- Commercial fishing (over-fishing)
- Historic wildlife hunting (over-harvesting)
- Aquaculture
- Water pollution (eutrophication, pathogens, toxins)
- Conflicts between recreational and commercial fisheries
- Introduction of exotic species

Probable Impacts from Changes in Living Resources:

- Decreases in sport and commercial fish and shellfish populations
- Changes in furbearing and waterfowl populations with sport and commercial value
- Reduced recreation and commercial value of wetlands and estuaries
- Decreased populations or extinction of some native species

Eutrophication occurs when too many nutrients, such as phosphorus and nitrogen, enter the water. The process begins with an accelerated growth of algae with the result being that oxygen in the water is depleted as plant matter decays, killing fish and shellfish.

All of these affects combined can select for only certain species of fish that are low-oxygen tolerant species and decrease fish diversity.

Probable Causes of Eutrophication:

- Malfunctioning sewage treatment plants
- Malfunctioning septic tanks
- Urban runoff
- Agricultural runoff
- Mississippi River diversions
- Channelization of runoff directly into the estuary
- Channel dredging and loss of wetlands resulting in reduced capacity of the estuary to filter out nutrients

Probable Impacts of Eutrophication:

- Algal blooms, floating masses of algae and noxious odors
- Reduced recreational value of beaches and water bodies
- Anoxic conditions resulting in fish kills
- Changes in species composition and population
- Decreases in wildlife populations with sport and commercial value
- Reduced recreational and commercial value of wetlands and the estuaries

Pathogens are disease-producing organisms such as bacteria and viruses. The sources of these organisms are human waste, pasture runoff from animal waste, and waste products of marsh animals such as nutria and birds. Examples are described below. Bacteria commonly found in sewage pollution can be of serious concern as it causes infection, rashes, and other serious diseases. *Vibrio* bacteria can cause both food borne and wound related illnesses.

Physical contact with natural marine pathogens while swimming or eating raw seafood can harm people who are predisposed to liver, blood, or stomach problems or are in other ways immunocompromised. Eating



Aerial view of an algae bloom. Image: Eutrophication&hypoxia.org

shellfish contaminated by human fecal pathogens can also cause illness such as gastroenteritis, salmonellosis, and hepatitis A, and, in more severe cases, death for people suffering from certain immune system disorders or who are immunocompromised.

To reduce the risk of illness associated with consumption of shellfish contaminated by pathogens, state agencies have been forced to close oyster beds where tests have indicated high fecal coliform levels in the water.

In spite of the development of plans for a parish-wide sewage treatment facility and regional efforts to prevent direct dumping of sewage at camps, fecal coliform continues to be a persistent problem.

Probable Causes of Pathogens:

- Community and municipal sewage plants

- Failing septic tanks and individual home sewage treatment plants
- Hunting and fishing camps
- Urban runoff
- Agricultural runoff
- Naturally occurring pathogens, particularly in warm water with high salinity
- Illegal disposal of medical waste

Probable Impacts from Pathogens:

- Food poisoning
- Closure of oyster beds
- Loss of revenue and employment

Toxic Substances exist in the BTB. Water, animal tissue, and sediment testing have identified a variety of toxic substances in the BTB. Some of the substances are known cancer-causing agents while others affect reproduction. When some animals consume contaminated food, the toxic concentration is magnified. Human consumption of highly contaminated seafood poses health risks. Toxics found throughout the system come from point sources, such as industry, and non-point sources, such as urban runoff.

Numerous potential sources of these toxicants exist within the BTB. The toxic substances include: herbicides used in aquatic weed control, inputs from a variety of petrochemical and chemical industries along the Mississippi River, light industry and domestic inputs from population centers, storm and urban runoff, atmospheric deposition, recreational and commercial boats/ships, drilling fluids and produced waters from oil and gas production, runoff and leachate from hazardous waste sites, and

pesticides and herbicides from agriculture

The greatest inputs of toxic substances into the BTB are from discharges along the eastern margins of the basins because of heavy industries, large urban centers, and agricultural areas along the river corridor.

The factors which determine a pollutant's risk to people and the ecosystem include toxicity concentration, bioavailability (the extent to which an organism can take up these pollutants), and persistence. Environmental contaminants may be very stable, toxic at low concentrations, and bioavailable. Moreover, several may have carcinogenic effects. These characteristics increase the likelihood of toxic effects in the environment itself as well as on human health.

Probable Causes of Toxic Substances:

- Emission of toxic material from hazardous waste, recycling, and disposal facilities
- Drilling fluids and produced waters



Shucking oysters fresh from the Louisiana coast. Image: Louisiana Sea Grant



High school students participating in BTNEP Youth Marine Debris Prevention and Education Program. Image: Lane Lefort Photography

- Illegal dumping of toxic, industrial, and commercial wastes
 - Agricultural runoff with pesticides and herbicides
 - Sewage plants
 - Aquatic weed control
 - Mississippi River diversions
 - Atmospheric deposition
 - Accidental spills including oil spills
 - Leachates from hazardous waste in landfills and inactive hazardous waste dumps
 - Storm and urban runoff
 - Outfalls of industrial effluents containing heavy metals, PCBs, and other toxins
 - PCBs from leakages of petrochemical pipelines and storage facilities
- Probable Impacts from Toxic Substances:***
- Poisoning of wildlife and fish and the reduction of reproduction
 - Decrease in wetland vegetation
 - Contamination of oyster beds
 - Decreases in submerged aquatic vegetation



Nicholls State University Science Camp. Image: Lane Lefort Photography

- Loss or reduction of commercial and sport fish and wildlife populations
- Contaminations and closure of commercial and recreational fisheries

will certainly improve the health and well-being of the BTES and its residents.

Priority Problems Addressed through the CCMP

The value of having a CCMP is that these priority problems can be addressed in a comprehensive manner that includes all of the BTNEP stakeholders. The CCMP takes the interactions of the problems into account and identifies solutions.

The health of the BTES and the quality of its bayous, bays, fish, and wildlife are critical to our regional economy and the substance of our nationally-unique culture. Addressing these priority problems directly

Protect and Preserve BTNEP

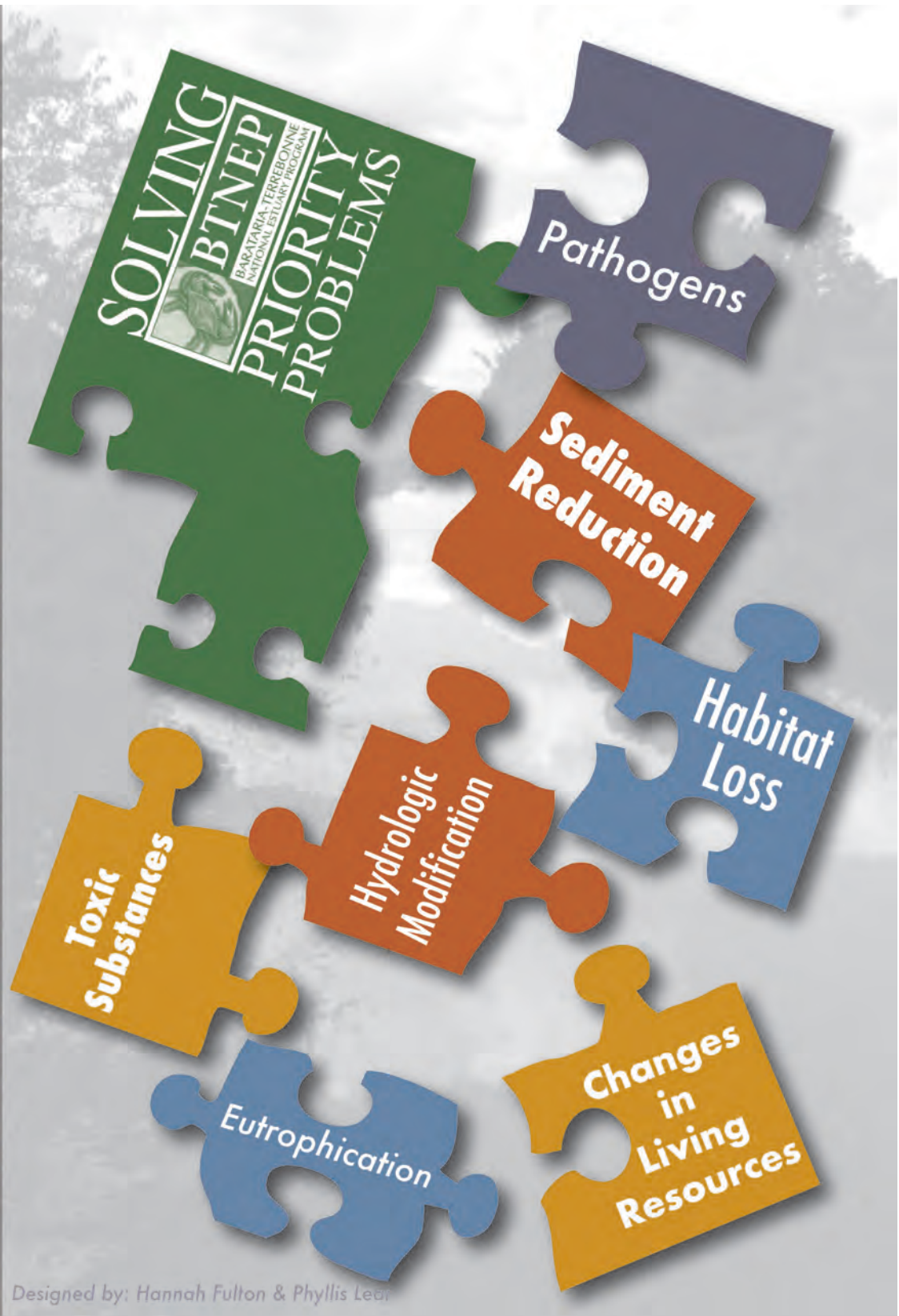




Image: Keri Turner

HABITATS OF BTES

Fastest Disappearing Land Mass on Earth: Description and Graphic of Habitats within the Estuary

All living creatures are directly tied to the habitats that sustain them. Barataria-Terrebonne contains some of the most diverse and fertile habitats in the world. The 4.2-million-acre wedge-shaped area between the Mississippi and Atchafalaya Rivers contains agricultural lands, forests, swamps, marshes, levees, islands, bays, bayous, ridges, and other habitats. Strictly speaking, the BTES consists of two different estuaries, Barataria and Terrebonne, separated by Bayou Lafourche which runs generally north to south. This estuary is the youngest part of the United States and was built by accumulating Mississippi River sediment over thousands of years.

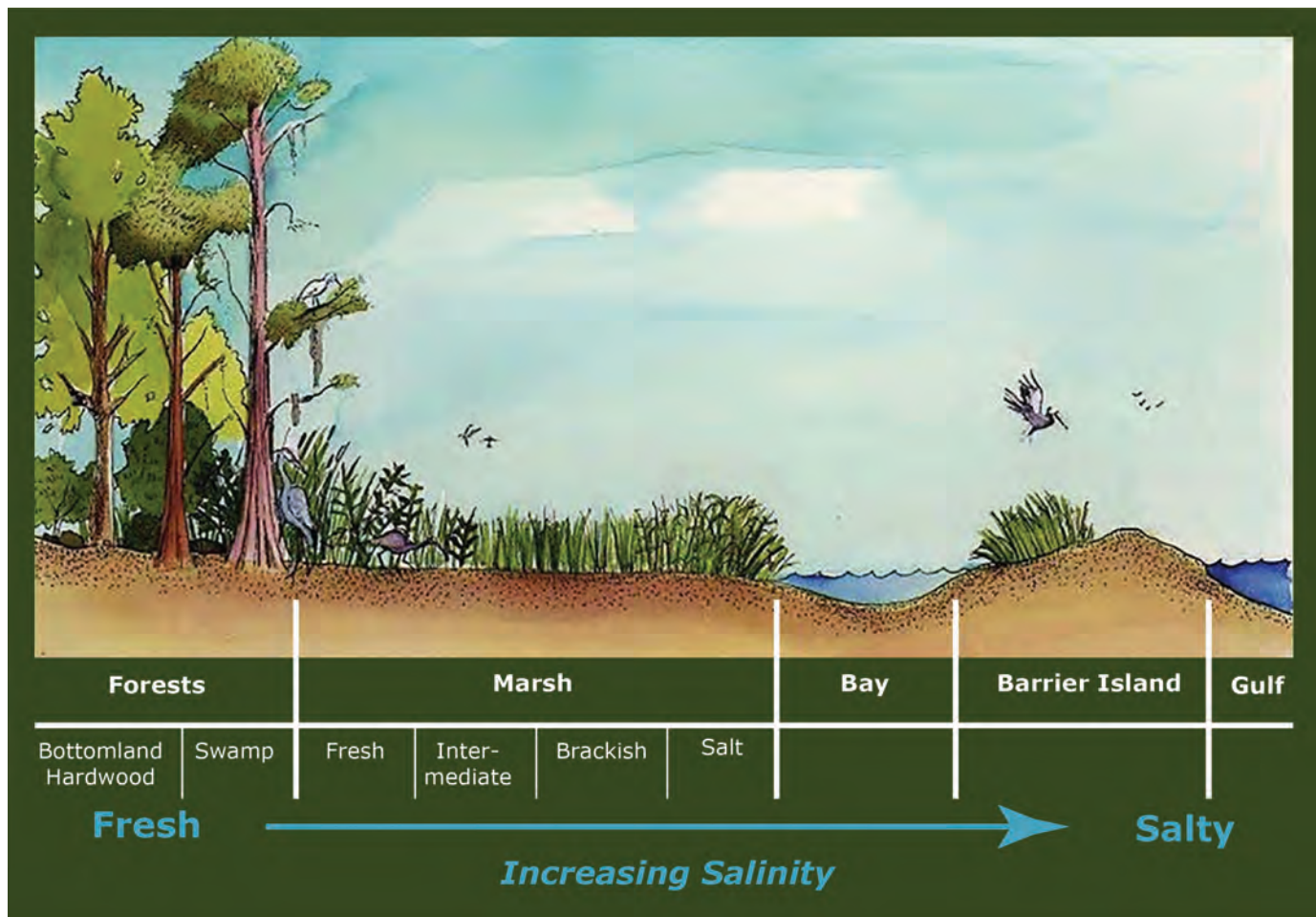
Agricultural Lands

Starting at the northern most part of the estuarine system, the Mississippi River meets the uplands of the continent where the BTES extends north of Port Allen into Pointe Coupee Parish. The Mississippi River has ranged across this terrain countless times as it changed its path through time. In contrast to coastal areas, little danger exists of this land turning into open water. Although it is only 20 to 30 feet above sea level, it is the highest land in the BTES.

Much of the land in the northern part of the estuary is used for agriculture. The ridges are cultivated; sugar cane is the dominant crop. Soybeans, pecans, wheat, and corn are also important crops of this part of the estuary. Cattle are the primary range animal.

Forests

The largest expanses of bottomland hardwood forests found in the BTES occur in the northern area east of the Atchafalaya Floodway. These seasonally or occasionally flooded forests support the largest number of tree and shrub species of any habitat in the system and include ash, hackberry, oak, and



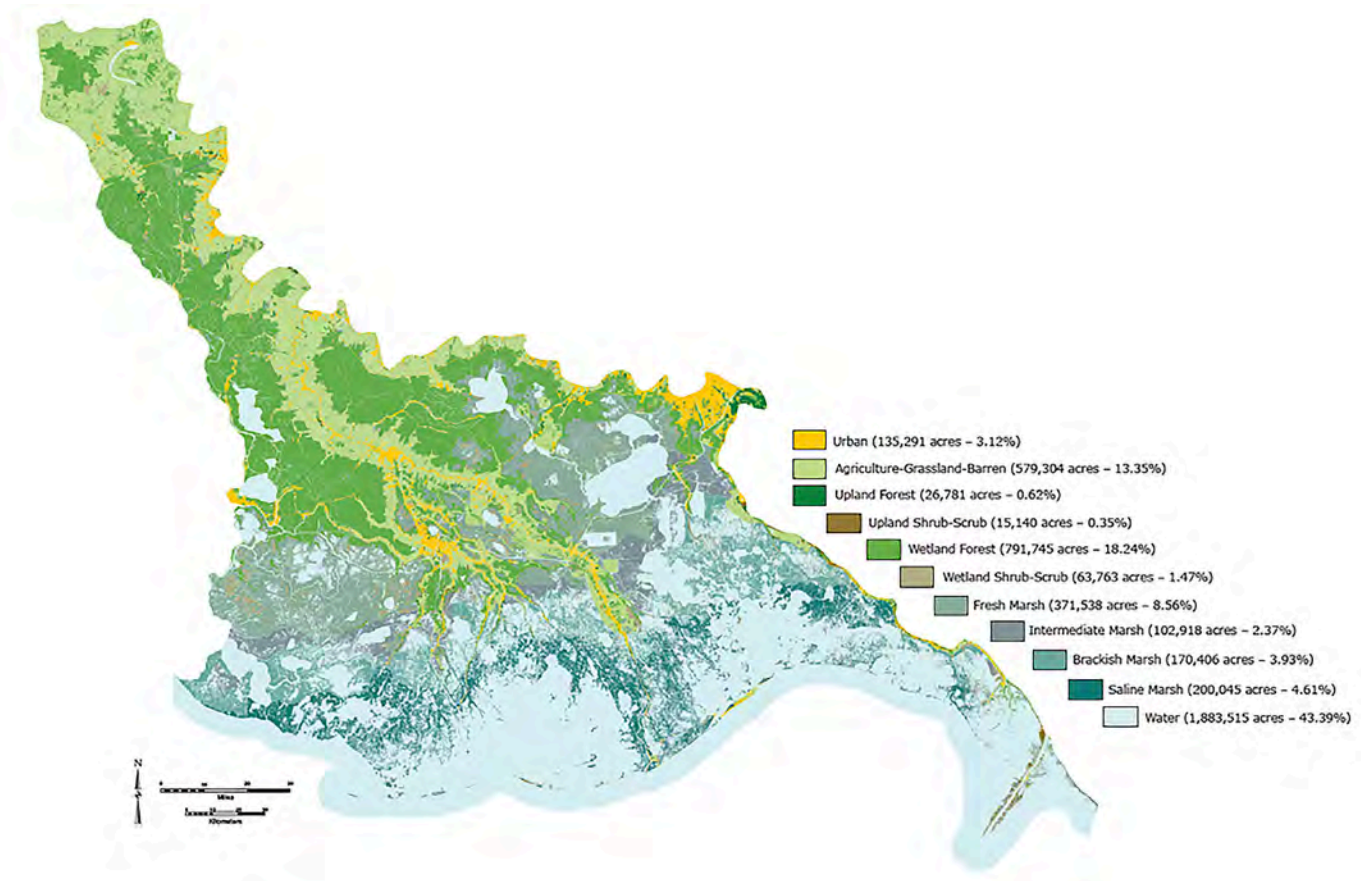
Diverse habitats within the BTES. Image: BTNEP

maple. These forests sustain Louisiana black bear and provide nesting habitat for bald eagles and migratory songbirds. They are also prize hunting areas for deer, squirrel, and wood duck.

Swamps occur in the BTES along stream bottoms like Choctaw Bayou and Bayou Corne. Swamps become more prevalent farther south where they surround large lakes like Verret and Palourde. The swamp is the dominant habitat in the part of the Barataria basin around Lac des Allemands and Bayou Boeuf.

The tranquil swamp with its tea-colored water, cathedral-like stands of bald cypress, and moss-draped water tupelo is a hallmark of Louisiana. The swamp is home to crawfish and choupique and is an ideal nesting habitat to herons, ibises, and egrets.

However, much of the swamps and bottomland hardwood forests in the BTES have been drained. About 200,000 acres of its forested wetlands have been converted for agriculture or urban use since the late 1950s, and many of the species that depended on



Different environments of the BTES. Image: BTNEP

these areas—such as the Louisiana black bear—are now rare.

Marshes

Marshes that extend for miles are found farther south in the BTES. Marsh plant roots bind the soil, creating the fabric that holds the wetlands in place. Marshes also offer food and shelter to animals. Decomposed marsh plants are the foundation of this part of the estuary's food chain. The food chain begins with the

microorganisms that flourish on the decomposing plants. These microorganisms are a primary food source for many bottom-dwelling invertebrates that, in turn, provide food for small fish, shellfish, birds, and mammals. Marsh habitats can be divided into four zones that extend roughly parallel to the coastline: fresh marsh, intermediate marsh, brackish marsh, and salt marsh.

Fresh marshes are found mostly in northern marshes of the BTES near Lake Penchant, Lake Theriot,



Marsh with a ridge of trees and vegetation adversely affected by salt water intrusion. Image: Lane Lefort Photography

Lac des Allemands, and Lake Salvador as well as alongside the mouths of the Atchafalaya and Mississippi Rivers. Of all Louisiana marshes, fresh marshes accommodate the most diverse array of plant life, including such species as maiden cane, bulltongue, and spikerush. Fresh marshes are home to a broad range of animals such as frogs, turtles, ducks, alligators, muskrats, mink, otters, egrets, herons, and hawks.

Flotant marshes are an unusual feature in Louisiana. Some marshes survive the sinking of the land by floating when water rises. This ability of the marsh to break away from the underlying sediment creates the mysterious “trembling prairies” or “flotants” that are found in fresh and intermediate marshes throughout the BTES. The areas surrounding Lake Boeuf and Bayou Penchant exemplify floating marshes. Three quarters of the BTES’s fresh marshes are flotant. Some are so buoyant that they undulate when walked

on; others are so firm that it is difficult to tell that they are floating. Wildlife use the flotants frequently because they provide a “dry land” refuge in regions where flooding is frequent.

Intermediate marshes are found in areas where slightly salty water mixes with fresh water. Plants found in these marshes can tolerate infusions of slightly salty water and include a mixture of spikerush, wiregrass, three-square grass, arrowhead, and deer pea. Depending on the season, waterfowl, wading birds, marsh hawks, and fur bearers are commonly found in these habitats.

Intermediate marshes provide nursery habitat for brown shrimp, blue crab, gulf menhaden, and a variety of other commercially and recreationally valuable fishery resources. Intermediate marshes are located near Clovelly, Chauvin, south of Lake Salvador, and around Lake De Cade.

Brackish marshes are flooded by moderately salty water and vegetated by wire grass, salt grass, and other plants. The BTES's brackish marshes stretch across the system in a band that includes Fourleague Bay, Galliano, Golden Meadow, and Little Lake. Louisiana's fisheries rely on the productive vitality of brackish marshes. Blue crab, shrimp, speckled trout, and redfish flourish in brackish marshes as do muskrats, raccoons, mink, otters, and other mammals.

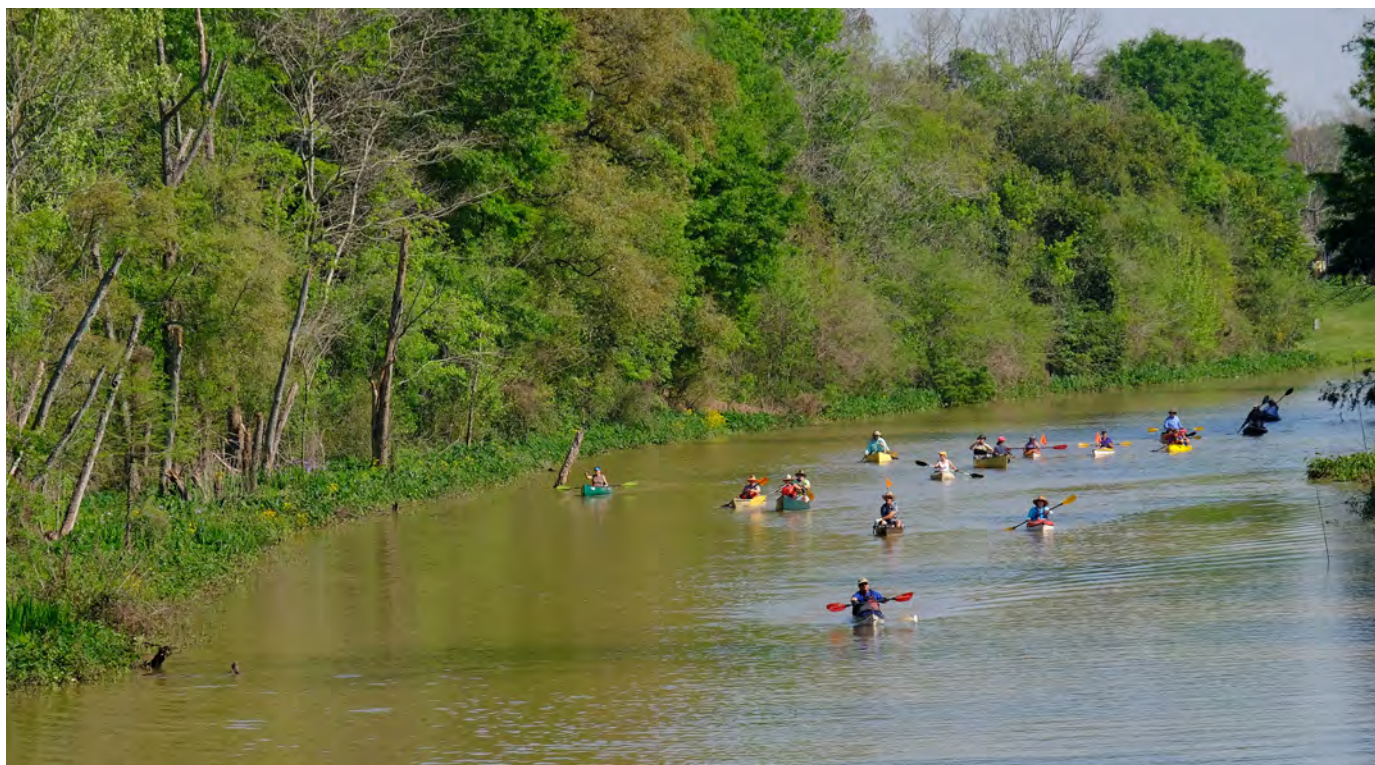
Salt marshes occur where salinity is highest in a band that stretches from the Gulf Coast, along the edges of Barataria and Terrebonne bays, to north of Leeville and Cocodrie. The Gulf regularly floods salt marshes, creating conditions where oyster grass is common, but few other plant species survive. To thrive, redfish, speckled trout, blue crabs, and shrimp must move in and out of the salt marsh at different stages in their life cycles. After these species spawn offshore, larval and juvenile fish and shellfish move through the passes into the estuary where they feed and grow. The young tend to reside in shallow water

along marsh edges for access to food and protection. As they mature, juvenile fish and shellfish move into deeper and more open water.

The valuable functions that marshes perform are threatened by changes to the natural system of the BTES. Just as we need clean air to breathe, good food to eat, and a healthy heart to circulate oxygen, most tidal marshes need the ebb and flood of the tide as well as infusions of sediment to stay healthy.

Bayous

The bayous of the BTES are slow moving channels of water that are often old distributaries of the Mississippi River's abandoned channels. Bayous are primarily fresh water at the northern stretch of the waterway but can be subjected by tidal influence that can cause salt water intrusion. In addition to providing drinking water for many residents, bayous provide a natural habitat for many species of plants and animals. Bayou life is as varied as tiny mosses



Bayou Lafourche during the annual BTNEP paddle. Image: Lane Lefort Photography.

to huge cypress trees, wading birds, and alligators. Bayous provided the main means of transportation prior to the train and automobile and now act as backyard vistas for many residents.

Levees

The natural plumbing of the BTES has been altered in many ways. Levees were built with the intent of protecting families and local livelihoods. The ground floor of many homes and businesses are five feet below sea level in places like Paradis and only 15 feet above sea level in some “higher” areas like Thibodaux and the westbank of New Orleans.

The only natural land more than 20 feet high in the region is located north of Donaldsonville. Because communities are built on such low-lying land, most of the BTES’s people are surrounded by flood protection levees. Massive levees contain the Mississippi and Atchafalaya Rivers, and smaller levees protect the swamp sides of towns and cities. Morgan City is completely ringed with levees as are the westbank towns of Westwego, Gretna, and Belle Chasse.

Levees define the boundaries of small communities that extend south of Thibodaux on Bayou Lafourche and along the smaller bayous south of Houma. Levees can prevent water from draining naturally, so residents must depend on pumps to keep their homes dry during heavy rains. Today, drainage problems are still a defining feature for life in the BTES. Artificial levees, which now extend along the entire length of the lower river, prevent sediment and water from being spread into the marshes and swamps, and most of the sediment is lost to deep water in the gulf.

Ridges

Although not very high, the ridges are perhaps the most important part of the estuarine system for humans because they provide limited protection from flooding. Some ridges that run north to south in the BTES mark the locations of old river channels and are the primary location where residents have built their homes. Each of these channels and associated ridges began as a short and efficient pathway for water to reach the Gulf.



Camps and homes near Elmer's Island. Image: Lane Lefort Photography.

Small maritime forests and associated ridges are found on Grand Isle and Cheniere Caminada. These habitats represent one of many unique habitats in the BTES. These live oak communities offer resting areas during spring migrations for birds such as tanagers and warblers returning from wintering grounds. BTNEP has worked for years to help advance restoration of these unique habitats.

Low ridges and canal banks in the marsh that are too narrow to be developed also provide important habitat for birds, reptiles, and mammals such as songbirds, alligators, rabbits, deer, and squirrels.

Bays

Bays are inlets of the Gulf of Mexico which usually connect to marsh and to the ocean. In the past, navigable narrow waterways connected marshy areas to the coastline. Bays provide safe nursery grounds for many species of shellfish and fish. Changes to the hydrology have caused huge land loss issues and have turned small protected bays into large expanses of open water.

Barrier and Headland Beaches

The southernmost portion of the BTES is bounded by beaches and chains of barrier islands: Isles Dernieres, the Timbalier Islands, the Caminada-Moreau Headland, Grand Isle, and the Plaquemines shoreline. With their fine sand beaches, low dunes, shallow nearshore waters, deep passes, and back-barrier marshes, the islands protect coastal bays from waves and storm surges. Juvenile fish seek refuge in the shallows behind the barrier islands. These sand-bottomed areas are unique to barrier islands and are prime feeding grounds for anchovies, menhaden, mullet, shrimp, crabs, and fish; during warm months, redfish are found in the deep passes and speckled trout in the surf.

Urban/City/Rural Areas

The primary location where residents have built their homes is along banks of bayous and near higher

Examples of Ecosystem Services	
Ecosystem Resource	Uses
Clean Water	Drinking water, cooking water, water for bathing, water for cleaning, and water for gardening and for food production
Plants and Animals	Food such as shrimp, crab, oyster, fish, crops, animals and food from hunting
Timber	Home building, heating, carbon sequestration or storage, and climate regulation
Fuel	Oil and natural gas to power cars and homes
Plants for Clothes	Plants like cotton made into clothes
Pollinators	Bees and other pollinators for food production
Decomposers	Worms and other decomposers for removing organic wastes
Wetlands	Water purification, home to a host of animals and plants, flood control, storm wave reduction, recreation opportunities, carbon storage, climate regulation, cultural resource, recreation, and habitat for fish, birds, mammals, and many other organisms (biodiversity)

ground. Areas throughout the Barataria-Terrebonne Estuary (BTE) consist mainly of small towns, communities, and neighborhoods. The westbank of the Mississippi River near New Orleans is the primary exception; this area acts as a suburb to New Orleans.

The larger communities in the estuary include: Houma, Marrero, Harvey, Gretna, Thibodaux, Belle Chase, Morgan City, and Raceland.

Most of the residents in the BTES live in rural communities influenced by their native surroundings and complex blend of cultures.

BTE: the Fastest Disappearing Land Mass on Earth

No other place on Earth is disappearing as quickly as the BTES where, “on average,” a football field of wetlands turns into water every hour. In 2010, the USGS calculated the land loss rate in Louisiana to be 16.57 mi² per year.

The BTNEP area has lost 865 square miles of land since 1935. That equals to loss of the land that includes: Hollywood, CA; Disney World, FL; Disneyland, CA; Washington, D.C.; New York, NY; and New Orleans, LA.

Not only was the land lost but the effects on ecosystem services and the human dimension continues to be an ever present limiting factor. So what are ecosystem services anyway? “Ecosystem services” is a term

Square Miles	
Barataria Basin Land Loss	415.80
Terrebonne Basin Land Loss	449.57
Total Land Loss	865.37
Hollywood, CA	3.51
Disney World, FL	40.00
Disneyland, CA	47.00
Washington DC	68.34
New York, NY	304.60
New Orleans, LA	350.00
Total Landmass	813.45

scientists use to describe how people benefit from the healthy land and water. Louisiana has abundant resources that come from our land and water. These resources provide humans with provisions or necessities for living.

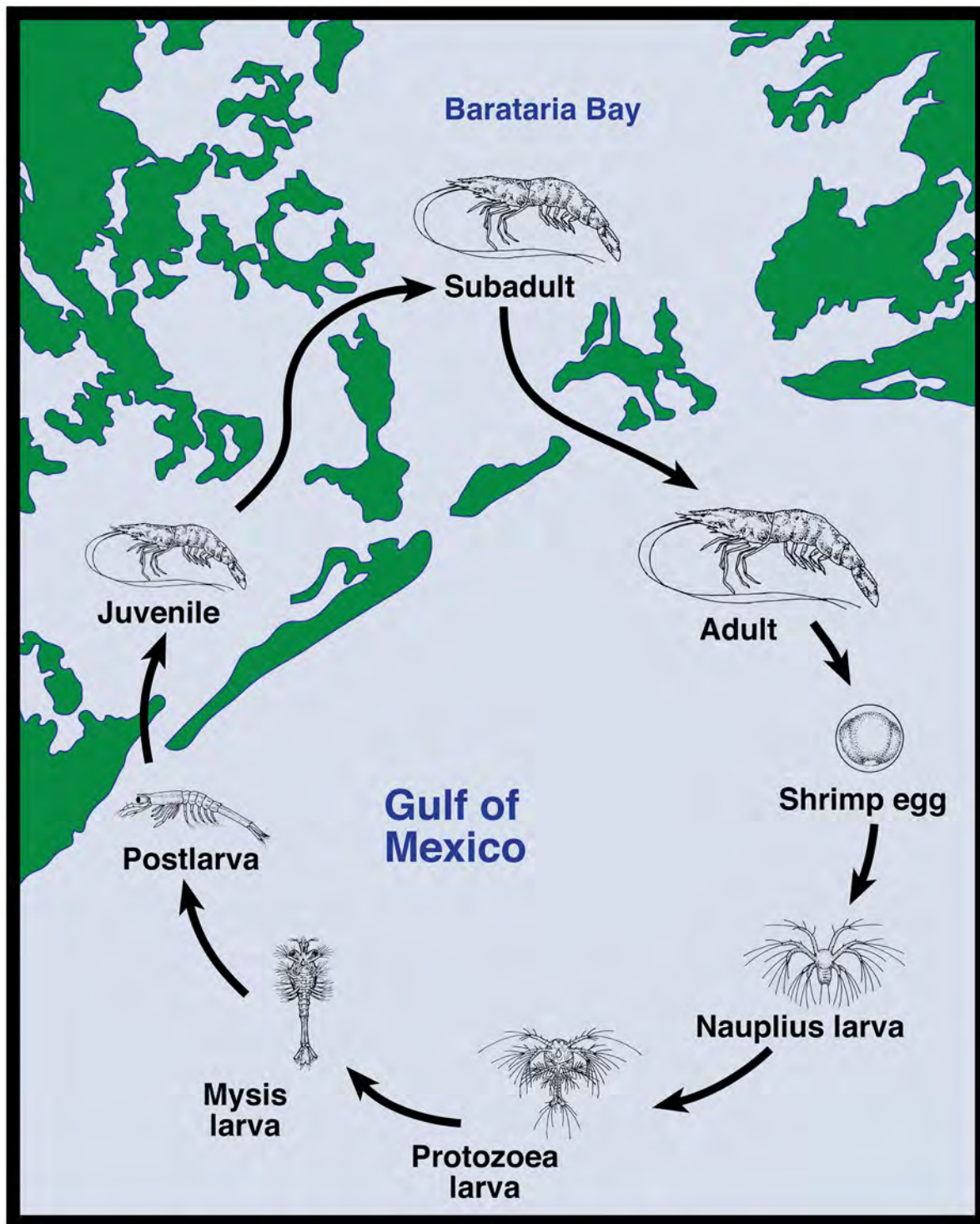
All natural resources are also important in providing cultural resources and fostering creativity. Healthy natural resources provide motivation for humans to be creative through their interactions with nature that spark music, art, dance, and architecture, to name a few.

In the process of this land loss, we are losing not only valuable resources but also a natural flood protection system that absorbs storm water before it can harm low-lying communities. Many have heard about the alarming land loss rates so many times that locals have begun to take them for granted, even as we worry every year about flooding. Fortunately, residents of the estuary can save our “terre bonne,” or “good earth,” and our ways of life if we work together and make smart choices. BTNEP invites

citizens to join this effort now while we still have time to make a difference.

As part of this program, citizens throughout the region are tackling difficult problems. Questions abound: “How can we stop land loss in the BTES? How much fresh water and suspended sediment from the Mississippi and Atchafalaya Rivers can be diverted into the area? What can we do to maintain an abundance of fish and wildlife? How can we ensure that we have clean water to drink?”

This document presents recommendations for action that will help answer these questions by providing information about protecting the landscape, people, and wildlife that make up the BTES. By understanding the challenges facing the estuarine system, we, as a community, can decide how the national treasure that is the BTES should be protected, for ourselves, for our children, and for the nation.



THE LIFE CYCLE OF A SHRIMP

Shrimp are dependent upon intermediate marshes, using them as nursery habitat. Image: Sea Grant Louisiana



Image: Lane Lefort Photography

VALUE OF BTNEP MANAGEMENT CONFERENCE AND BTNEP PROGRAM STAFF

Importance of MC, BTNEP MC
Member List, and NEP's Program
Structure

The Management Conference

Upon inclusion in the National Estuary Program, a diverse group of stakeholders was assembled including government, business, scientists, conservation organizations, agricultural interest, and individuals. This group, the BTNEP MC, ensures a place for the voice of all that live, work, and play in the BTES.

Importance of BTNEP MC

The BTNEP MC, originally convened in 1990 to develop the CCMP, has been the catalyst for producing open and frank discussions about some of the most critical coastal management issues of the nation. The BTNEP MC has several functions. The primary function is to encourage and oversee implementing the CCMP by coordinating and integrating the CCMP actions among agencies and stakeholders. In addition, the BTNEP MC maintains an interchange with other similar federal, state,



BTNEP MC members represent a diverse group of stakeholders. Image: Lane Lefort Photography

and local planning efforts and reviews and modifies the implementation of the CCMP as conditions change over time. Finally, the BTNEP MC fosters and expands the use of participatory, voluntary, and incentive-based approaches to decision-making in the estuary.

The BTNEP MC is not intended to replace or duplicate existing state government. It is not a new agency or authority, and it is not a regulatory body. It is, however, an opportunity to maintain the ongoing dialogue on issues of mutual concern based on the proven structure of the BTNEP MC.

BTNEP MC Member Participation and List

Under the umbrella of BTNEP, the stakeholders listed on the next page, collectively known as the BTNEP MC have volunteered tens of thousands of hours determining the directions the journey must take to safeguard the estuary for future generations.

The major stakeholders represented include industry, business and economic development, federal, state and local governments, academia, environmental organizations, and the general public.

As the CCMP continues to be implemented, it is critical that all interests are represented and that coordinated, integrated decision-making occurs. This process faces several challenges:

Estuarine resources are in demand by many different groups, resulting in multiple-user conflicts. It will always be a challenge to set and follow priorities for the estuary that protect not only natural resources, but also the rights of resource users and the lifestyles of the estuary's residents.

The “reaction and cure” approach to planning and management has proven to be economically, socially, and environmentally expensive. A new philosophy, forwarded by this CCMP, is to anticipate and prevent degradation in the planning stages of development to avoid problematic situations in the

BTNEP MC Member List

- *American Sugar Cane League*
- *Bayou Lafourche Freshwater District*
- *Cajun Music Preservation Society*
- *Coalition to Restore Coastal Louisiana*
- *Coastal Conservation Association of LA*
- *Coastal Protection and Restoration Authority*
- *Commercial Fisheries*
- *Greater Lafourche Parish Port Commission*
- *Iberville Parish Government*
- *Jefferson Parish Government*
- *Lafourche Parish Government*
- *LA Association of Conservation District*
- *LA Association of Levee Boards*
- *LA Department of Ag & Forestry*
- *LA Department of Culture, Recreation & Tourism*
- *LA Department of Economic Development*
- *LA Department of Education*
- *LA Department of Environmental Quality*
- *LA Department of Health & Hospitals*
- *LA Department of Natural Resources*
- *LA Department of Wildlife & Fisheries*
- *LA Forestry Association*
- *LA Independent Oil & Gas Association*
- *LA Landowners Association*
- *LA Mid-Continent Oil & Gas Association*
- *LA Oil Spill Coordinators Office*
- *LA Science Teachers' Association*
- *LA Wildlife Federation*
- *LSU Ag Center & LA Sea Grant*
- *Lowlander Center*
- *LUMCON*
- *Nicholls State University*
- *NOAA National Marine Fisheries Service (NMFS)*
- *Plaquemines Parish Government*
- *Pointe Coupee Parish Government*
- *St. Charles Parish Government*
- *Sassafras Louisiana*
- *South Central Planning & Development Commission*
- *South Louisiana Economic Council*
- *South Louisiana Wetlands Discovery Center*
- *Terrebonne Parish Consolidated Government*
- *The Nature Conservancy*
- *US Corps of Engineers*
- *US Coast Guard*
- *US Depart. Of Ag's Natural Resource Conservation Service (USDA/NRCS)*
- *US Environmental Protection Agency*
- *US Fish & Wildlife Service*
- *US Geological Survey (USGS/ CWPPRA)*
- *US National Park Service*

future. However, it will be a challenge to change an approach that has existed for so long and has been accepted by many as “the way to do it.”

Because of the connections between the BTNEP MC and various government agencies, economic interest, and the public, there may be resistance from those who have experienced frustration in dealing with agencies in the past.

At present, several large scale planning efforts underway at the federal, state, and local levels will affect the overall hydrology of the BTES. The BTNEP MC will continue to coordinate with these efforts to ensure that all ongoing activities support the goals of the CCMP. The BTNEP MC does not have the authority to overrule other federal or state restoration efforts such as Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), Coastal Protection and Restoration Authority (CPRA), or any other plans.

In summary, the BTNEP MC works on implementing and coordinating the CCMP in order to address the common interests of stakeholder groups including public and private interest groups.

BTNEP Structure

In order to maintain engagement, the BTNEP MC meets quarterly to review and discuss various topics related to the BTNEP CCMP. All meetings are held within the estuary and are publicized and open to the public. BTNEP MC meetings use Robert’s Rules of Order for parliamentary procedures. A quorum of the BTNEP MC is a simple majority of the members or their designees. The vast majority of decisions are based on consensus.

APTs build upon the strength of stakeholders by continuing to increase the number and diversity of people involved in implementing the CCMP.

APTs consist of stakeholders with multidisciplinary interests and serve as a mechanism for citizen involvement and personal engagement in implementing the Action Plans.

Experts in specific fields or from interested agencies are members of the APTs as well as concerned residents and individuals.

Each APT member has an equal voice. APTs vary in membership and size but work as a cohesive group



*BTNEP Management Conference meets every quarter to discuss important topics regarding the estuary.
Image: Lane Lefort Photography*



all matters concerning implementing the CCMP and appropriate matters concerning the program and MC. The director is responsible for the orderly, efficient, and effective administration and operation of the office including personnel. The director also represents the BTNEP MC at functions requiring BTNEP attendance and participation. Additionally, budget and financial matters including the funding of program's operation and implementation of the CCMP are required duties of the director.

The deputy director is the advisor to the director and staff on fiscal, technical, and personnel matters. In the absence of the director, the deputy director has signatory authority on all contracts and invoices related to BTNEP. The deputy director has a leadership role among the technical/scientific, administrative, education, and outreach staff. This position requires maintaining a close working relationship with local, state, and federal agencies, other scientists, and special interest groups; monitoring individual projects performed by the BTNEP staff; providing

information to BTNEP staff regarding funding remaining for projects, and supporting staff grant and contract management. This position also serves as the liaison between the EPA and LUMCON fiscal staff.

The administrative staff is usually the first contact between the BTPO and the general public, the BTNEP MC members, and other local, state, national, and international officials. Administrative staff is expected to be generally familiar with past and present projects and products of BTNEP and is also expected to be knowledgeable on a very broad range of administrative matters related to purchasing, payroll, property control, meeting planning, and database management.

The scientific staff provides scientific/technical support for the day-to-day management of BTNEP in his or her area of expertise. Work requires maintaining a close working relationship with the BTNEP MC and with the assigned APTs. It also requires maintaining



BTNEP Program structure.



BTNEP staff. Image: Lane Lefort Photography

a close working relationship with local, state, and federal agencies and special interest groups; monitoring individual research projects; assessing data; developing technical reports; and supporting grant and contract management. Scientific staff is expected to develop, enhance, and promote various scientific projects that implement the CCMP.

Education staff act as the “bridge” between BTNEP and the K-12, university education sectors and informal educators. The education staff modifies or reformats and presents the technical information produced by the BTNEP scientific staff for use by students, educators, and informal educators. The education staff are knowledgeable on a broad range of scientific matters related to habitat restoration, living resources, and water quality issues and are able to condense that knowledge into a form that is easily understood by teachers and their students.

The education staff works with other educational and outreach programs around the country, including the other 27 NEPs, EPA, and various national education organizations and is also involved in a number of general public outreach activities and projects.

Outreach staff duties include creating public support and public advocacy for environmental issues in BTNEP and CCMP Action Plans. Staff work with all venues to establish BTNEP as a source of factual information on the problems that threaten the estuary and its communities. Outreach staff promote program accomplishments with the objective of establishing BTNEP and the program staff as a nationally supported, community-led group representing a broad spectrum of partners with a mission of implementing a state and federally approved restoration plan.

BTPO is physically located on the Nicholls campus



*BTNEP Staff and Management Conference members mingle and share ideas before each quarterly meeting.
Image: Lane Lefort Photography.*

in Thibodaux, LA. BTNEP and Nicholls have Memorandums of Understanding (MOU) with regard to both office space and for BTNEP's Field Operations Center located on the Nicholls farm just south of campus. BTNEP Field Operations Center

houses most of the capital assets used in the field including boats, trailers, tractor, four-wheelers, greenhouse, and shade house.

BTNEP Volunteer Programs



BTNEP's 2016 Derelict Crab Trap Rodeo removed more than

1,000

abandoned derelict crab traps that increased mortality of blue crabs and other species as well as created navigational hazards

BTNEP hosts
25 to 30
volunteer events
a year in communication
with BTNEP's
Native Plant Program



Annually,
BTNEP coordinates
500-800
VOLUNTEERS
to participate in
native vegetation
plantings
as well as
coastal
and inland
debris cleanups



BTNEP's 2016

Lake Fields Cleanup

event removed

close to

EIGHT

TONS

of trash and debris from the Lake Fields area near Lockport, LA



Designed by: Hannah Fulton & Phyllis Lear



Image: Lane Lefort Photography

MAPS OF BTES

Watershed and Basins

Where is the BTES?

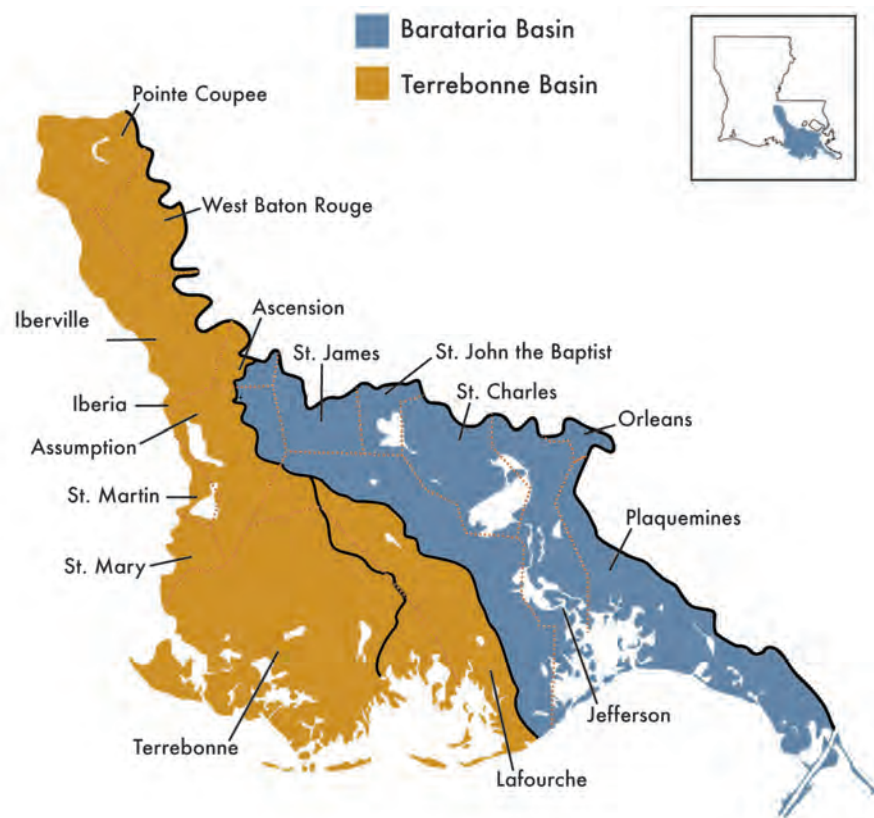
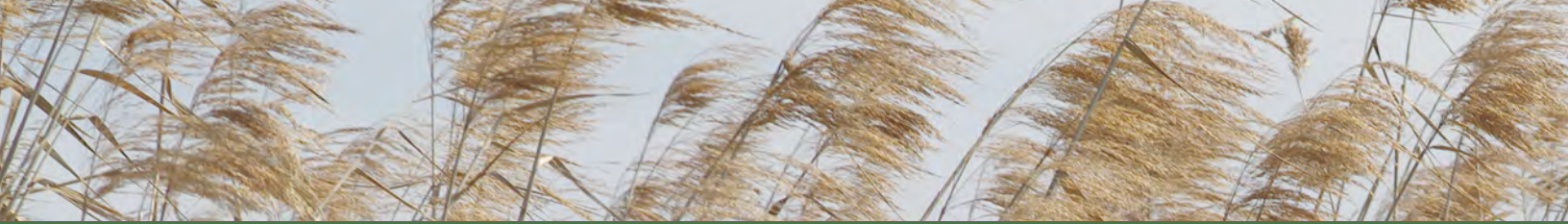
Louisiana is frequently associated with beautiful swamps that provide home to diverse plant and animal communities. Many of these common visuals associated with Louisiana's bayou country are found in this estuary system. The triangular shaped region that lies in the east southeast part of the state is the home of the Barataria-Terrebonne estuary.

The Barataria-Terrebonne estuarine complex encompasses the 4.2 million acres of wetlands, ridges, forests, farmlands, and communities between the Mississippi and Atchafalaya River Basins in southeast Louisiana. The southernmost edge of the estuary is bound by the Gulf of Mexico. This land was built by the Mississippi River depositing its sediments over thousands of years. While geologically young, BTNEP's area is approximately 95 times larger than our nation's capital. (The BTES is approximately 4,200,000 acres; Washington D.C., the U.S. capital, is presently approximately 44,000 acres.)

The estuary contains all or part of 16 parishes including: Pointe Coupee, West Baton Rouge, Iberville, Iberia, Ascension, Assumption, St. James, St. John the Baptist, St. Martin, St. Charles, St. Mary, Orleans, Terrebonne, Lafourche, Jefferson, and Plaquemines.

The watershed of the BTES includes the Mississippi River drainage basin. This is the third largest drainage basin in the world. The drainage basin includes all or part of 31 states and two Canadian provinces. It drains 41 percent of the landmass of the 48 contiguous states in the central U.S. The basin acts like a funnel bringing water down to the estuary and Gulf of Mexico.

Although the estuary is at the mouth of the largest drainage basin in North America, it is being deprived of sediments that once built up the land. According to the USGS's analysis in 2016, Louisiana lost an average of 16.6 square miles of land a year from 1985 to 2010, which equates to roughly a football field per hour. In total, the state lost 2,006 square miles of land between 1932 and 2016 — an area over 1.2 times larger than Rhode Island. The BTES is at the heart of the loss. Louisiana's land loss involves three main factors: reduced sediment flow from the Mississippi River and its tributaries, subsidence, and sea-level rise. These factors are both natural and human-made.



Barataria-Terrebonne Basins. Image: BTNEP

Louisiana marshes need a source of sediment to survive. Historically, the Mississippi River provided the sediment. Now, however, levees confine the sediment to the river thus bypassing the marshes and ultimately depositing it on the continental shelf in the Gulf. Today, the river carries up to 80 percent less sediment than it did a century ago. Dams, reduction in land clearing and tilling, and implementing conservation measures that reduce erosion upriver are the major causes of the reduction. Canal dredging and marsh fragmentation added to the loss. Thus, even if all of the levees along the Mississippi River were removed today, the marshes would still receive significantly less sediment than they did in the 1800s.

Our coastal marshes constantly undergo a natural process called “subsidence” which results in the land slowly sinking. In the past, the rate of sediment building equaled or surpassed the rate of sinking and the level of the marsh remained above the level of the sea. Still, some sediment does move into coastal marshes during hurricanes and winter cold fronts when wind-driven waves stir mud on the bottom of shallow bays. The volume of this sediment, however, is usually inadequate to counter the effects of subsidence. The existence of levees, canal banks, roadbeds, railroad embankments and changes upriver contribute to the problem of inadequate sediment distribution in our coastal marshes.

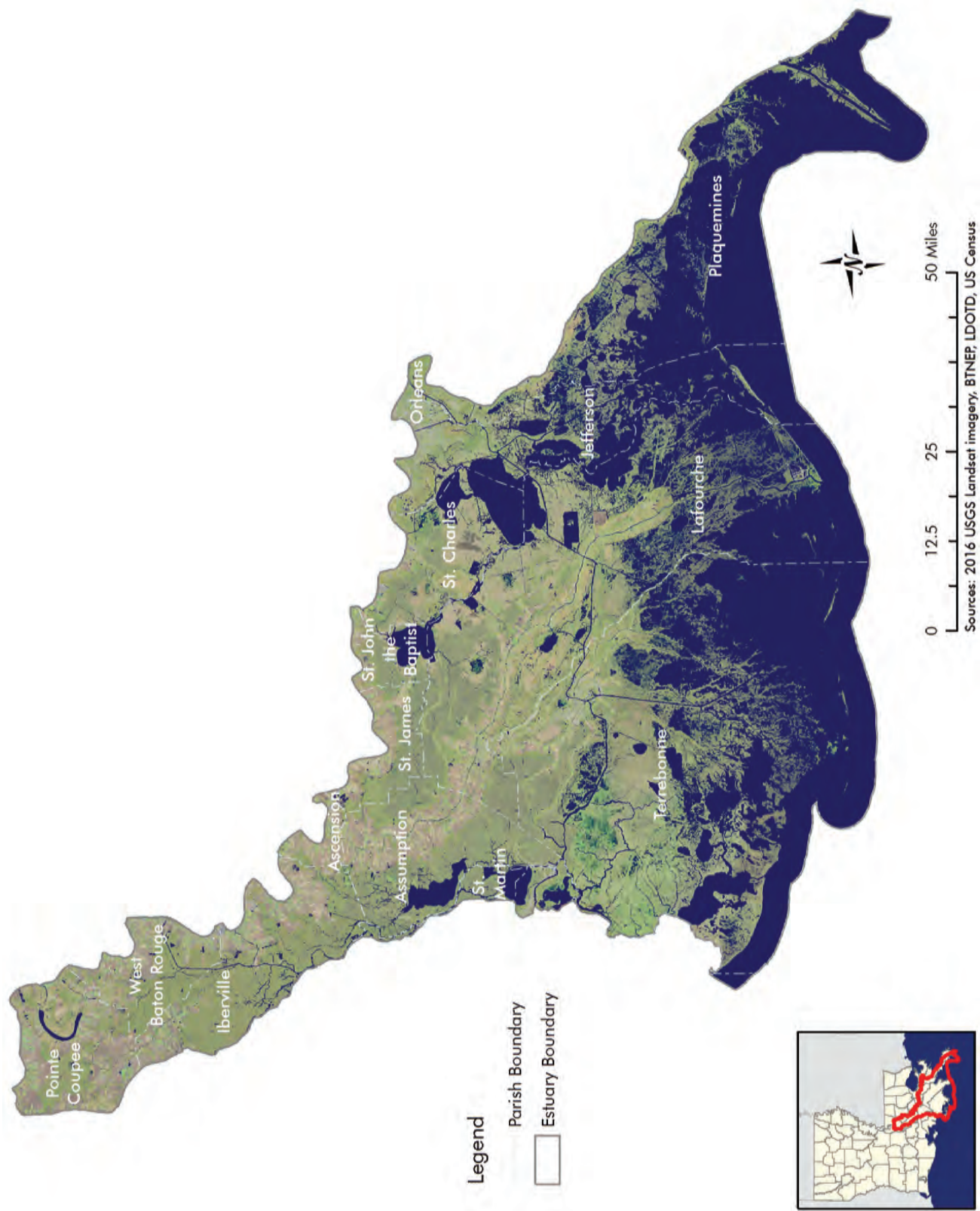


The Mississippi River Watershed is the watershed for the BTES. Image: BTNEP

Relative sea level rise in Louisiana has been estimated to be six times the average rate of other coastal areas because of the amount of subsidence being experienced. Some land loss and sea level rise will inevitably continue, but with awareness of the issues, a strong sense of stewardship, and a commitment of cooperation from all stakeholders, we can turn the tide.

Wetlands are special habitats in our nation and provide homes to a variety of mammals, birds, fishes, shellfish, and amphibians. Wetlands also act as water collectors and water quality improvers. Wetlands clean water that carries non-point source (NPS) pollution. A variety of microorganisms that live in the waters of wetlands consume waste material. Wetlands contain water during heavy rain events, reduce storm surge of hurricanes, and return

surface water to aquifers. Wetlands provide erosion control by trapping sediment and providing a footing for wetland plants. Each of the wetland habitats in the estuary also provides resources that are used for business, economic, social, recreational, and cultural interactions. This fertile estuary also supports people throughout the country who depend on it for its natural resources of shrimp, oysters, crabs, oil and gas, sugar, and lumber as well as recreational activities such as hunting, fishing, or ecotourism.



Map of the Barataria-Terrebonne Estuary

More Than Just Maps

BTNEP CULTURES

Groups Who Live in Louisiana's Estuaries





Image: Lane Lefort Photography

BTNEP ACTION PLANS

Introduction to BTNEP Action Plans

The BTNEP Action Plans are arguably the most important element in the CCMP. The Action Plans identify work to address the seven identified priority problems within the estuary: hydrologic modification, sediment reduction, habitat loss, changes in living resources, eutrophication, pathogens, and toxic substances.

The Action Plans are a product of an ongoing attempt to establish consensus among stakeholders of the estuary to effectively meet the estuary's most critical management needs. With more than a quarter of a century of experience with implementing Action Plans, BTNEP is uniquely positioned to maintain its leadership role in the measures that improve the wetlands and the people who live here.

The Action Plans have been divided into four main categories in keeping with the APT directives. The categories include: Coordinated Planning and Implementation, Ecological Management, Sustained Recognition and Citizen Involvement, and Economic Growth. Each of these categories contains varying numbers of Action Plans; however, they adequately meet the needs of the BTNEP MC guidelines.

Each of the Action Plans contains several elements including:

- objectives
- background/major issues related to the topics
- descriptions of the actions
- lead agencies responsible for implementing the actions
- timelines and milestones
- possible range of costs and sources of funding
- performance measures

These Action Plans serve as an advisory set of plans to provide guidance for the preservation and restoration efforts throughout the BTES over the next 20 years with regular reviews and updates every five years. The Action Plans recognize that our communities have pledged to the ongoing stewardship of our estuary and work to grow on the efforts of the past while looking to the future. Using the combination of science-based wisdom coupled with consensus-driven decision making, these Action Plans make a bold attempt to continue to make improvements to properly manage the abundant resources of the area that provide assets to the local, state, national, and international communities.

Action Plans guide the work of BTNEP. Serious consideration was made to make the new and updated Action Plans implementable.

BTNEP began its revision to its 1996 CCMP in early 2015. BTNEP Staff members were briefed about the need to revise the CCMP and EPA provide a guidance document on July 24, 2015. This EPA guidance document was used to prepare the BTNEP CCMP.

The first external meeting to discuss the updated to the CCMP was held at the August 2015 BTNEP Management Conference (MC) meeting – not one full month after the guidance was received. The BTNEP MC's primary goal of the revised CCMP was to update the Action Plans to make them useful for BTNEP and its partners. One month after the EPA provided the guidance the BTNEP MC began its update. At this time, a full review of the function of the CCMP was discussed at the BTNEP MC meeting as well as the history of the CCMP. BTNEP MC Members were informed that teams would be created to evaluate and update the existing CCMP. CCMP Committee structure was discussed at the February 2016 BTNEP MC meeting. On April 21, 2016, the first CCMP Revision committees began meeting using the aforementioned guidance document.

During the review process, 9 active committees were created to review the 1996 CCMP and make suggestions for the revised 2018 CCMP. A minimum of 47 different agencies or organizations participated in the process with 117 active committee members attending meetings over the course of the two years it took to rewrite the document. Over 1070 volunteer hours were donated by members of these teams to update the CCMP with the primary goal being the Action Plans. The CCMP has been modified from its original 51 Action Plans to 36 Action Plans. The majority of the changes are in consolidating Action

Plans in Coordinated Planning and Implementation and Sustained Recognition and Citizen Involvement. Table NEW BTNEP CCCMP Action Plans 2018 found in Appendix 1 on pages 319 - 320 summarizes these consolidations. New Action plans include: CP-2 Emergency Response, Recovery, and Resilience; EM-7 Flood Risk Reduction and Coastal Resilience; EM-13 Urban Green Spaces; EM-17 Improvements of Water Quality through the Reduction of Marine Debris; and EM-18 Protection of Drinking Water Sources have been added as these are emerging issues for the estuary.

BTNEP provided the public an opportunity to review and comment on the CCMP. The comment may be seen on the web at CCMP.BTNEP.org. The comments are titled *BTNEP CCMP Combined Comments Appendix*.



Sugar Cane Field. Image: Lane Lefort Photography



PROGRAM IMPLEMENTATION AND COORDINATED PLANNING

Management Conference, BTNEP
Program Office, Points-of-Contact,
Governmental Affairs, Emergency
Response, and Communication of
Rules

The Program Implementation Action Plans are the most critical parts to the successful implementation of the CCMP; without them, the program would not exist.

The centerpiece of this set of plans is the continuation of the BTNEP MC. The BTNEP MC will be the entity through which the CCMP is implemented, monitored, coordinated, and evaluated. Through its diverse membership of all stakeholder groups, the BTNEP MC will be the main avenue for stakeholder involvement in the estuary's management efforts. Finally, through its organizational structure, management agreements, and decision-making policies, the BTNEP MC represents a meaningful commitment of its membership to ensure that the CCMP is implemented. Thus, the BTNEP MC truly epitomizes the BTNEP goal: maintain multi-level, long-term, comprehensive watershed planning.

From the beginning of the BTNEP planning process, BTNEP MC members realized that Program Implementation and Coordinated Planning would be a critical and integral part of the CCMP. This



CATEGORY 1

document reflects this idea in many ways. Clearly, the most important action in this regard is the continuation of the BTNEP MC as described above. By bringing all stakeholder groups together in a single management entity, a coordinated planning effort is ensured. Supporting this idea is the BTNEP MC's adoption of a decision-making and conflict-resolution methodology, expressed in the BTNEP goal, forge common ground solutions to estuarine problems, that is inclusive, objective, and reflective of the diverse interests which exist in the BTES and depend upon its resources.

The collective input of the BTNEP MC and the CCMP revision teams provide several plans to ensure coordinated, comprehensive, and effective management of the BTES. These plans work to establish a mechanism for coordination among government agencies and to create a strong framework for comprehensive planning within the BTES.

PI-1 Barataria-Terrebonne Management Conference

OBJECTIVES

- To provide oversight of CCMP implementation
- To provide direction to the Barataria-Terrebonne Program Office (BTPO)
- To ensure that all stakeholders have the opportunity for input into implementing the CCMP

- To facilitate coordinated management of the BTES

BACKGROUND/MAJOR ISSUES

The BTNEP MC, originally convened in 1990 to develop the CCMP, has been the catalyst for producing open and frank discussions about some of the most critical coastal management issues of the nation. Since its inception, the BTNEP MC has made a commitment to fairness and has fostered a spirit of trust and cooperation among its members and the communities it serves. A founding principal of the BTNEP MC has been a consensus-based form of decision-making which has gained the respect and commitment of the members and the public.

BTNEP successfully brought together a diverse group of stakeholders to draft and revise a CCMP for the BTES. Through this process, decisions have been made using the expertise and experience of interdisciplinary groups and multiple stakeholders. As the CCMP is implemented, it is critical that similar mechanisms continue to be employed in order to require that all interests are represented and that coordinated, integrated, common ground decision-making continues.

Estuarine resources are in demand by many different groups which results in multiple-user conflicts. It will always be a challenge to set and follow priorities for the BTES that protect not only the natural resources but also the rights of resource users and the lifestyles of the BTES.

At present, several large scale planning and restoration efforts are underway at the federal, state and local levels which will affect the BTES. The BTNEP MC will continue to follow and coordinate



BTNEP Management Conference. Image: Lane Lefort Photography

with these efforts to ensure that all ongoing activities support the goals of the CCMP.

DESCRIPTION

The BTNEP MC will continue to bring together a diverse group of stakeholders to ensure an ongoing affirmation and implementation of the shared vision as established in the CCMP. As such, the BTNEP MC will enable a coordinated, BTES-wide approach to funding, planning, and ongoing monitoring of BTES management to provide an important mechanism for

making sound decisions and appropriate revisions to the CCMP as the need arises. In addition, the BTNEP MC provides a forum for ongoing formal communication and dialogue among private and public interests. Finally, the BTNEP MC will make available the diverse expertise and resources of MC members and their constituencies in moving the CCMP implementation forward.

The BTNEPMC is not intended to replace or duplicate existing State government. It is not a new agency or authority, and it is not a regulatory body. It provides

an opportunity to maintain the ongoing dialogue related to the issues of mutual concern based on the proven structure of the BTNEP MC. The makeup of the BTNEP MC includes diverse representation of BTES interests. The BTNEP MC consists of between 40 to 50 members selected to represent the interests of the major stakeholders in the BTES. Some of the major stakeholders to be represented include industry, business and economic development; federal, state, and local governments; academia, environmental, and educational organizations; and the general public.

The BTNEP MC organizational structure could be refined as it deems necessary. Because of the large size of the BTNEP MC, subcommittees could be formed to address specific issues. In order to maintain a broad-based decision-making process as well as encourage widespread involvement, quarterly meetings of the full BTNEP MC will be held with more frequent meetings of various committees and subcommittees if necessary. All interested stakeholders, the general public, and media are welcomed and encouraged to attend these meetings.

To facilitate the administrative and fiscal responsibilities associated with implementing the CCMP, the BTPO will provide support services as requested by the BTNEP MC. For additional details about this office, please refer to P1-2 Barataria-Terrebonne Program Office.

The BTNEP MC adopted operational procedures in 2000. The operational procedures identify the role of the BTNEP MC, BTNEP MC membership, BTNEP MC Officers, Program Director, staff, BTNEP MC meetings, conflicts of interest disclosures, media relationships, and adoption and amendment of procedures.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

The BTNEP MC will be responsible for its own implementation. BTNEP MC members will select an executive committee that may include a chairman,

co-chair, secretary, and other necessary positions. With BTPO support and coordination, all BTNEP MC members will implement CCMP Action Plans.

The EPA will provide guidance to the BTNEP MC. An EPA representative will attend all full BTNEP MC meetings. The EPA will annually review data collected work products, and deliverables of the BTNEP MC as part of this Action Plan.

The BTPO will provide support to the BTNEP MC. As requested by the BTNEP MC, the BTPO will perform administrative functions related to the BTNEP MC.

TIMELINES AND MILESTONES

The BTNEP MC will host quarterly meetings for all members. Attendance records will be reviewed annually during the first calendar quarter and requests for alternate or replacement members will be made to organizations that have not attended at least two meetings in the previous calendar year. Executive board positions will be for a term of two years beginning on the first day of the calendar year. Elections for executive board positions will be held during the 3rd quarter of the calendar year.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Existing member organization budgets will cover participation in BTNEP MC activities including full committee meetings and subcommittee meetings. The BTPO staff will support the BTNEP MC as outlined in P1-2 Barataria-Terrebonne Program Office.

PERFORMANCE MEASURES

Performance measures include:

- four BTNEP MC annual meetings.
- quarterly BTNEP MC meeting.
- various reports to EPA about BTNEP MC and BTPO activities.



BTNEP Management Conference. Image: Lane Lefort Photography

Data Gathered

- BTNEP MC meeting agendas
- BTNEP MC meeting presentations
- EPA reports as required
- annual work plans and reports to EPA
- annual reports to State as directed

Monitoring

Parties Responsible: The BTPO will be responsible for all reporting parameters.

Timetable for Gathering Data: Data will be collected annually, quarterly, and/or as requested by EPA, BTNEP MC, and the State.

How Data is Shared: All materials are shared through the web either on the BTNEP.org site or through EPA or State of Louisiana.

Possible Data Gaps: The BTPO and/or the BTNEP MC will regularly evaluate data to determine any possible data gaps.

Additional Funding Needed: Yes, as the BTPO evolves, additional funding may be required.

PI-2 Barataria-Terrebonne Program Office

OBJECTIVE

- To provide administrative and logistical support to the BTNEP MC by maintaining a BTPO with an active full-time staff

BACKGROUND/MAJOR ISSUES

This action would continue the operation of the BTPO similar to the existing one. The BTPO would be tasked with a number of responsibilities all of

which would directly relate to implementing the CCMP. The first group of responsibilities would be the administrative duties necessary to conduct BTNEP MC meetings. Included would be developing detailed agendas, notifying participants, preparing meeting minutes, and following up on activities and duties assigned at the meetings.

Other major responsibilities are to assume the lead role in developing Memorandums of Agreement (MOA) with various government agencies and others to implement CCMP actions and to assist the various responsible agencies with respect to implementing specific Action Plans. The BTPO would be accountable to BTNEP MC for CCMP implementation matters and to the fiscal agency for BTPO administration and personnel concerns.

The current configuration of the BTPO has worked well. For the CCMP to be implemented, it is recognized that personnel must be assigned to accomplish the administrative and logistical work necessary to actually continue the implementation process and to support the ongoing BTNEP MC. The BTPO will be responsible for developing and executing numerous projects to gather scientific information, to educate the public about various issues, and to foster support from stakeholders. As BTPO responsibilities change over time, the size and configuration of the BTPO should be changed to meet those responsibilities.

DESCRIPTION

The BTPO will provide personnel dedicated to working specifically on implementing the CCMP. Without having this specifically dedicated staff, the likelihood of the BTNEP MC continuing to function as it currently does and having the momentum to implement the CCMP could be jeopardized. By having staff in a BTPO, all of the stakeholders and the agencies responsible for the CCMP would be assured that personnel would be available to assist with Action Plans to monitor progress with respect to implementing the CCMP.

The BTPO would continue to operate with existing

Louisiana State civil service positions under a fiscal agency and/or with detailed personnel from other agencies for as long as the BTNEP MC deems necessary. As staffing and funding needs change in the future, the BTPO configuration could be altered.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

The BTNEP MC is responsible for directing the work of the BTPO. A state agency or non-profit organization can act as the fiscal agency for BTPO administration and personnel concerns. This organization would be responsible for the necessary administrative support to continue the operations of the BTPO by providing staff positions and benefits. It would also assure the State matching funds for any federal grants which fiscal agent is LUMCON under the Louisiana Board of Regents (BoR). In the future, the BTPO could be housed under other agencies or organizations as it has been in the past.

TIMELINES AND MILESTONES

The BTPO will:

- coordinate four BTNEP MC annual meetings. Developing detailed agendas, notifying participants, preparing meeting minutes, and following up on activities and duties assigned at the meetings would be included.
- update the BTNEP MC on program activities at each BTNEP MC meeting.
- prepare an annual work plan to be approved by the BTNEP MC.
- implement specific Action Plans as assigned by the BTNEP MC. (This implementation may come from annual work plans and other partnering opportunities.)
- assume the lead role in developing MOAs with various government agencies and others to implement CCMP actions and to assist the various responsible agencies with respect to

implementing specific Action Plans.

- provide personnel salaries, benefits, and work space dedicated to working specifically on implementing the CCMP. The BTPO will work with the state agency that acts as the fiscal agent for administrative and personnel matters.
- maintain all equipment and state assets associated with the BTPO.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Costs will be associated with the level of effort that the BTNEP MC deems necessary to accomplish above described activities. Costs will include personnel

salary and fringe benefits, office space, equipment, operating services, supplies, and Action Plan project costs. These costs will vary based on implementation schedules.

The EPA provides annual funding each year to the NEP. The State is committed to providing a dollar for dollar match to the annual funding. The Barataria-Terrebonne Estuary Foundation (BTEF) may also be a source of funding for the BTPO. Outside grants may also be used a source of funding for the BTPO.

PERFORMANCE MEASURES

Performance measures include:

- four BTNEP MC annual meetings.



*BTNEP staff member works closely with DEQ BTNEP MC members on water quality improvements.
Image: Lane Lefort Photography*

- quarterly updates to the BTNEP MC on program activities at each BTNEP MC meeting.
- annual work plan to be approved by the BTNEP MC and EPA.
- various reports to EPA about BTPO activities.
- Annual Report to EPA with personnel salaries, benefits, and work space dedicated to working specifically on implementing the CCMP.
- report to State annually on all equipment and State assets associated with the BTPO.
- report to the State on Performance Indicators as required.

Data Gathered

- BTNEP MC meeting agendas
- BTNEP MC meeting presentations
- annual work plan outputs
- EPA reports as required
- annual work plans and reports to EPA
- annual reports to State as directed

Monitoring

Parties Responsible: The BTPO will be responsible for all reporting parameters.

Timetable for Gathering Data: Data will be gathered annually, quarterly, and/or as requested by EPA, BTNEP MC, and the State.

How Data is Shared: All materials are shared through the web either on the BTNEP.org site or through EPA or State of Louisiana.

Possible Data Gaps: The BTPO and/or the BTNEP MC will regularly evaluate data to determine if possible data gaps exist.

Additional Funding Needed: Yes, as the BTPO

evolves, additional funding may be required.

PI-3 Maintain Points-of-Contact for the State of Louisiana

OBJECTIVES

- To maintain Points-of-Contact for the State of Louisiana with respect to implementing the CCMP
- To maintain appropriate organizational relations with the host fiscal agency
- To continue to maintain professional associations with many State of Louisiana agencies that provide a mechanism for implementing the CCMP

BACKGROUND/MAJOR ISSUES

As CCMP implementation continues, it is important that the Louisiana Governor's Office of Coastal Activities be designated as a primary Point-of-Contact for the State of Louisiana. It would also seem appropriate that the BoR through LUMCON will continue in its role as the responsible agency for fiscal and administrative oversight of BTNEP. LUMCON provides fiscal administrative support for the BTPO support functions and would continue to receive any additional EPA grant funds.

Additionally, the BTPO on behalf of the BTNEP MC is encouraged to maintain and build relationships with other State of Louisiana agencies who are BTNEP MC members and who are instrumental in implementing the CCMP. Estuarine resources are in demand by many different groups which results in multiple-user conflicts. By maintaining and building professional associations, the BTPO and BTNEP MC may help residents better protect the BTE's natural resources, the rights of resource users, and the unique lifestyles of the BTES.



BTNEP staff member working with LDWF on Marine Debris Removal. Image: Lane Lefort Photography

DESCRIPTION

The Governor's Office of Coastal Activities will be designated as the Point-of-Contact for State of Louisiana wetlands policy-related issues and activities related to implementing the CCMP. This may include help in monitoring, seeking funding, and helping the public to understand restoration goals, objectives, and trade-offs.

The BoR through LUMCON will be designated and continue in its role as the responsible agency for fiscal and administrative oversight of BTNEP. This includes the oversight of the operation of the BTPO. BoR-LUMCON will be responsible for seeking funding on the state level through the legislative process for State financial support of BTNEP. LUMCON will also be the financial overseer and fiscal agent for all current and potential EPA awards. This includes the fiscal and administrative oversight of existing awards and potential awards provided by private, local, state,

and federal grant funds.

The BTPO will also build, maintain, and seek professional interactions and connections with other state agencies that have influence on the health of the BTES and implementing the CCMP.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

The BTPO and BTNEP MC will maintain and improve contacts with the State of Louisiana. The BTPO staff will be responsible for the day-to-day interactions, and BTNEP MC members will support maintaining relationships that help with implementing the CCMP.

If needed, the BTNEP MC members can select an executive committee that may include a chairman, co-chair, secretary, and other necessary positions to aid in implementing this Action Plan with support and coordination provided by the BTPO.



TIMELINES AND MILESTONES

The BTPO will continue to build on long standing relationships with state agencies. The BTPO staff will report to BTNEP MC at its quarterly meetings about activities as needed.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Existing BTNEP budgets will cover participation in activities including meetings. The BTNEP MC will support the BTPO staff.

PERFORMANCE MEASURES

Performance measures include:

- four BTNEP MC annual meetings.
- various reports to EPA about BTNEP MC and BTPO activities.

Data Gathered

- BTNEP MC meeting agendas
- BTNEP MC meeting presentations

- EPA reports as required
- annual work plans and reports to EPA
- annual reports to the State as directed
- BTNEP work products

Monitoring

Parties Responsible: The BTPO will be responsible for all reporting parameters.

Timetable for Gathering Data: Data will be collected annually, quarterly, and/or as requested by EPA, BTNEP MC, and the State.

How Data is Shared: All materials are shared through the web either on the BTNEP.org site or through EPA or State of Louisiana.

Possible Data Gaps: The BTPO and/or the BTNEP MC will regularly evaluate data to determine if possible data gaps exist.

Additional Funding Needed: Yes, as the BTPO evolves, additional funding may be required.

CP-1 Governmental Affairs and Education

OBJECTIVES

- To keep federal, state, and local government officials and elected and appointed officials informed as to the critical issues of the BTES
- To secure continued awareness of the need for implementing the CCMP
- To provide sufficient information to Louisiana's Congressional Delegation on the national significance of the BTES

BACKGROUND/MAJOR ISSUES

Continued implementation of the CCMP is supported by the enactment of legislation and appropriation of funding that benefit the estuarine system. This requires an ongoing collaboration among partners in public and private sectors as well as Non-governmental Organizations (NGO) and institutional partners. Concise, factual information must be provided to our elected and appointed leadership regarding the true value of the estuarine system as identified by the economic growth portion of the revised CCMP and the benefits it provides to the State and the nation. In turn, our leadership will be able to respond to the questions and concerns of their constituencies with timely and accurate information concerning the actions and activities reflected in the CCMP.

DESCRIPTION

Activities herein are designed to support the ongoing efforts to educate federal, state, and local leaders regarding the challenges facing the BTES, to foster a sense of stewardship for our natural resources, to encourage support for the policies and actions set forth by the CCMP, and to provide the educational and informational tools required to address the concerns of the diverse constituencies within the BTES. Specifically, this plan proposes:

1. an annual town-meeting style event with participants who include federal, state, and local elected and appointed officials and members of the BTNEP MC and BTPO staff as well as friends of the BTES.
2. ongoing meetings with government officials with regard to issues of immediate concern to the BTES.
3. educational events such as boat tours and project site visits designed to provide government officials a first-hand experience with the issues and challenges facing the BTES as well as possible solutions.

4. the establishment of a BTES Government Affairs Advisory Workgroup made up of BTNEP MC members and leadership of the BTEF who are able to make informational contacts with elected and appointed leadership.
5. collaboration with existing legislative caucuses as well as local, regional, and national organizations in order to expand the awareness of estuarine issues and value of implementing the CCMP.

Actions identified in this plan shall occur in locations throughout the BTES. In addition, meetings and educational events may be expected to occur at other designated locations as necessary to adequately engage and participate in state, regional, and national conferences and meetings addressing issues of concern to the BTES and BTNEP.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

All educational and informational materials developed, produced, and distributed through this Action Plan will be the responsibility of the BTPO. With support of the BTNEP MC, the BTPO will coordinate and implement meetings, briefings, project site visits, and other events that are educational and informational in nature. The BTEF with the support of other members of the BTNEP MC may lead other activities that may be required to secure adequate funding sources to implement the CCMP.

TIMELINES AND MILESTONES

Activities identified within this Action Plan are mostly ongoing. The town-meeting style event may be conducted on an annual basis. A BTES Governmental Affairs Advisory Workgroup will be established within two years.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Costs associated with this action may include but are not limited to staff time, travel, dues for membership



United States Capitol building. Image: <https://www.aoc.gov/capitol-buildings/about-us-capitol-building>

in associations and organizations with similar goals and interests, conference fees, the development, production, and distribution of educational and informational materials, and the implementation of an annual town-hall style event. Costs incurred may range from \$25,000 to \$75,000 per year.

Funding for developing, producing, and distributing educational and informational materials may be made available through the BTPO budget or the BTEF budget as well as members of the BTNEP MC in addition to direct and indirect support from business, civic, and community organizations.

PERFORMANCE MEASURE

Performance measure includes:

- list of meetings, briefings, and/or events as reported on BTNEP MC quarterly agendas

Data Gathered

- number of events, communications, and/or briefings
- number of attendees at events
- number of meetings held by the Governmental Affairs Workgroup

Monitoring

Parties Responsible: The BTPO will be responsible for all reporting parameters.

Timetable for Gathering Data: Data will be gathered annually and/or as requested by EPA, BTNEP MC, BTEF and/or the State.

How Data is Shared: report to EPA

Possible Data Gaps: None identified at this time.

Additional Funding Needed: If available, it may be useful.

CP-2 Emergency Response, Recovery, and Resiliency

OBJECTIVE

To coordinate diverse activities across other Action Plans in the event of disaster response, recovery, and resilience.

BACKGROUND/MAJOR ISSUES

As a result of various hurricanes, oil spills, major rain events, and other catastrophic events that have either occurred in the Barataria-Terrebonne National Estuary (BTNE) or adjacent to the system but had a significant effect on the area or its stakeholders, the BTNEP MC and the BTPO have found themselves engaged in one way or another in Emergency/Disaster Response, Recovery, and Community Resilience

throughout the existence of the BTPO. These events and efforts by the BTPO, although technically not a part of the previous CCMP, have been valuable for the communities in the BTES. BTNEP MC members as well as BTNEP staff and the BTEF board members played roles in every aspect of mitigating the effects those events had on the BTES, BTES people, and its stakeholders. A short list of example roles that BTNEP has served before, during, and after these extreme events follows.

- raised awareness of the landscape and how people interact within it
- provided a conduit for information sharing
- coordinated between agencies and stakeholders for volunteers
- served as BTES subject matter experts
- hosted various supply drives

DESCRIPTION

Generally, Action Plans of the CCMP serve as guides for BTNEP to work on throughout the year



Flags of the U.S.A. and Louisiana on the desk of a state legislator. Image: <https://twitter.com/lalegis>



Shrimp boat at dock. Image: Lane Lefort Photography

and the life of the CCMP with milestones, costs, and performance measures to meet. The intent of this Action Plan varies from the traditional Action Plans in that it will serve only as a guide to the BTPO in the event of an extreme event that may result from meteorological, geological, man-made, or other source. When these events occur within the BTES, local, state, and federal agencies activate to fulfill emergency operations roles which support the Federal Emergency Management System (EMIS). Some of these agencies' key personnel and functions are represented by BTNEP MC members; however, some are not. This Action Plan, when needed, will serve as a way to account for the value added by the BTNEP staffs' ability and flexibility to fill in the gaps

the BTNEP MC may not.

This Action Plan will take place throughout the BTNE and may take place in areas adjacent to the BTNE as such areas may impact the BTES.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

In coordination with the BTNEP MC and the BTEF, the BTPO will serve as the lead agency.

TIMELINES AND MILESTONES

The timelines and milestones will be dependent and enacted upon when an extreme event takes place.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Due to the intent of this Action Plan and the way that it will be used and carried out, cost and sources of funding will be determined at the time of occurrence. Frequently, the BTEF has acted as a fiduciary manager to facilitate a quick response and to address pressing needs.

PERFORMANCE MEASURE

Performance measure will include:

- a summary list of activities provided on quarterly

BTNEP MC agendas

Data Gathered

- summary of activities

Monitoring

Parties Responsible: BTPO

Timetable for Gathering Data: unknown

How Data is Shared: via websites

Possible Data Gaps: none identified

Additional Funding Needed: yes, as available



Oil skimmers at work. Image: Doug Helton, NOAA/NOS/ORR.

CP-3 Communication of Rules, Regulations, and Guidelines

OBJECTIVES

- To ensure that all stakeholders are involved in the state and federal (where applicable) legislative and regulatory process related to CCMP Action Plans
- To facilitate the education and communication of regulatory actions that will affect BTES stakeholders related to CCMP Action Plans
- To communicate stakeholders' needs to elected and appointed officials in response to the development of rules, regulations, and guidelines related to CCMP Action Plans

BACKGROUND/MAJOR ISSUES

Rules, regulations, and guidelines at all levels of government affect the stakeholders in the BTES. Although procedural guidelines may include public comment and public hearing requirements, the system is complicated and multi-leveled. At the state level, changes can occur through two major processes: the legislative process through which statutory changes are made in the law and the regulatory process through which agencies are mandated to write regulations to implement the statutes.

Stakeholders have the opportunity to get involved in the rulemaking process at several levels but oftentimes are not aware of changes until the process is completed and the rules or regulations have been created or altered. BTNEP MC can be a mechanism to inform and educate the public on such issues. Government officials coordinating changes to laws or rules also need information and education. BTNEP MC should bring issues to officials with the perspective of the BTES stakeholders' needs.

Public participation begins at commission meetings, task force meetings, and board meetings. These

entities are organized through legislation as expert panels or as stakeholders to give input on legislation and policy. A member of the BTNEP MC should attend meetings of interest. These meetings are required to meet the standards of the Louisiana Open Meeting Law (R.S. 42:11 through 28) and the State Boards and Commissions requirements (R.S. 49:1301 through 1306) that require information be made available to the public. Most meetings allow public comment and may allow additions to the agenda.

The State of Louisiana Administrative Procedures Act and the Federal Administrative Procedures Act as well as a number of other statutory and constitutional provisions, such as the National Environmental Policy Act (NEPA) and Article 9 of the Louisiana Constitution, regulate the process for amending or creating legislation and rules. Generally, these laws require that government regulations and actions under those regulations be based on some kind of record that demonstrates that the agency considered enough factors to support a finding and that it did not act arbitrarily and capriciously. To ensure an opportunity for the public to express its opinion, the two Administrative Procedures Acts ordinarily require that notice of draft regulations or proposed actions under those regulations, such as the consideration of permits, be published and that the public be given an opportunity to comment.

One of the basic tenets of BTNEP is that if those individuals and groups affected by the laws and regulations could have a voice in the creation and change in those laws and regulations, not just in the review process, a greater appreciation of the benefits of regulations and a higher incidence of voluntary compliance would be maintained.

Increasing stakeholder involvement in the regulatory process also encourages the adoption of regulations that are based on real needs; public empowerment fosters an ownership of regulations and increases the may result in new ideas for protecting the resources of the BTES.



BTNEP Management Conference meeting. Image: BTNEP

Making the officials aware of the community needs as a whole, not just one perspective, is important for fair and balanced decision making.

DESCRIPTION

This action will maintain the process the BTNEP MC uses to schedule public meetings, alert public officials, and facilitate communication during and after the creation of regulations or legislative acts. This action will continue to complement and reinforce the role of the BTNEP MC by establishing a process which significantly expands public dialogue and involvement in creating and enforcing the various rules, regulations, and guidelines which impact the BTES. This action will also provide needed communication from BTES stakeholders to public officials.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

The BTNEP MC will serve as the lead implementer as it will have a diverse representation from across the BTES and can establish a subcommittee on this

issue should the need arise. The BTNEP MC will also be able to bring in expertise and stakeholders as needed to guide and support this action.

Additionally, all relevant agencies, particularly those directly responsible for creating and enforcing regulations, and interest groups, particularly those representing the regulated community, will be involved in a supporting role.

TIMELINES AND MILESTONES

The BTNEP MC may:

- provide information to the public at BTNEP MC meetings about rules, regulations, and guidelines.
- designate a subcommittee to produce a report including a study of existing public involvement mechanisms, identification of groups involved in the process, and an analysis of the prior effects of key regulations and initial plan recommendations.
- hold special meetings to develop innovative mechanisms for public involvement.

- adopt the recommended practices to the extent practicable.
- work with the State Legislature to create formal recommendations for legislation, if necessary, reflecting the recommendations of the BTNEP MC (ongoing).
- continue review and revision of public involvement mechanisms aiming to further integrate them into BTES management.
- further educate agencies and stakeholders of the need for increased involvement and the available mechanisms.
- publish annual reports that update the progress of this action.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Costs will be associated with the level of effort that the BTNEP MC deems necessary to accomplish the above described activities. Costs might include contractor personnel salary and fringe benefits, office space, equipment, operating services, and supplies should BTNEP MC desire. The EPA provides annual funding each year to the NEP. The State is committed to providing a dollar for dollar match to the annual funding. The BTEF may also be a source of funding for the BTPO. Outside grants may be used a source of funding.

PERFORMANCE MEASURES

Performance measures include:

- information sharing at any one of the four annual BTNEP MC meetings.
- quarterly updates on activities to the stakeholders at related BTNEP MC meetings.
- various reports to EPA about BTPO activities.
- reports to the State on Performance Indicators as required related to sharing public information

about rules, regulations, and guidelines.

Data Gathered

- BTNEP MC meeting agendas
- BTNEP MC meeting presentation
- EPA reports as required
- annual reports to State as directed

Monitoring

Parties Responsible: The BTPO will be responsible for all reporting parameters.

Timetable for Gathering Data: Data will be gathered annually, quarterly, and/or as requested by EPA. All materials are shared through the web either on the BTNEP.org site or through EPA or State of Louisiana.

Possible Data Gaps: The BTPO and/or the BTNEP MC will regularly evaluate data to determine possible data gaps.

Additional Funding Needed: Additional funding needs are unknown at this time.

ELMER'S ISLAND WILDLIFE REFUGE REGULATIONS



Use of the refuge will be permitted from
**30 minutes before official sunrise
to 30 minutes after official sunset.**
This includes any land across routes to the refuge.

NO
•glass bottles
•glass drink
containers
•or other glass
products

NO PERSON
shall enter onto or be on the
GROUND OF THE REFUGE
during a
**RESTRICTED ACCESS
PERIOD**

**NO PERSON
SHALL** commercially fish, conduct any
guiding service, hunt, pursue, kill,
molest or intentionally disturb any
type of wildlife on the refuge,
EXCEPT for the legal recreational
harvest of living aquatic resources.

No person shall be in
**AREAS MARKED AS
RESTRICTED**
by signs posted by LDWF

NO MOTORIZED VEHICLES PERMITTED

**Non-consumptive users
NEED NO PERMITS**
of any kind for
beachcombing, picnicking, swimming, etc.



Anyone **16+ years** fishing
recreationally
will need a
fishing license

Designed by: Hannah Fulton & Phyllis Lear



Image: CWPPRA

ECOLOGICAL MANAGEMENT

Hydrologic Restoration, Management, Water Quality, and Flood Risk Reduction

The **Ecological Management** Action Plans directly address the Priority Problems identified for the estuary. As such, they are considered by many to be the most important elements of the CCMP. The plans are categorized as **Hydrologic Restoration and Management**, actions which address the issues of water and sediment flows, habitat loss, and marsh protection; **Water Quality**, actions which identify water quality problems and protect water resources; and **Living Resources**, actions which address problems associated with the plant and animal life of the estuary.

The APTs for these ecological management measures were assembled in order to provide the specific experience needed to develop executable strategies by the many partners who work in these areas. The teams included scientists from various universities and agencies, land owners, private citizens, and business owners who had expertise in restoration, water quality, and/or living resource management. This collective effort of the teams produced eighteen Action Plans to help improve the natural balance of the estuary. Because the problems are so large and interconnected, it should be noted that lead agency or agencies for many of these plans are often organizations such as the U.S. Army Corps of Engineers (USACE), CPRA, CWPPRA, Louisiana Department of Environmental Quality (LDEQ), LDWF, Louisiana Department of Natural Resources (LDNR), U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), National Oceanographic and Atmospheric Administration (NOAA), EPA, Louisiana Department of Agriculture and Forestry (LDAF), Louisiana Oil Spill Coordinators Office (LOSCO), Louisiana Department of Health (LDH), or local governments.

The Action Plans included under **Hydrologic Restoration and Management** address the three most critical Priority Problems identified for the BTES: *Hydrologic Modification, Sediment Reduction, and Habitat Loss*. These Action Plans are possibly the most significant in the CCMP. As coastal land loss continues to be an ongoing environmental issue, the actions in this section require broad support from a variety of stakeholders and partner organizations. The Action Plans include EM-1 Hydrologic



CATEGORY 2

Restoration and Management, EM-2 River Reintroductions, EM-3 Freshwater Reintroduction into Bayou Lafourche, EM-4 Beneficial Use of Dredged Material and Dedicated Dredging, EM-5 Preservation and Restoration of Barrier Islands, EM-6 Shoreline Stabilization, Induced Sediment Deposition, and Living Shorelines, and EM-7 Flood Risk Reduction and Coastal Resiliency.

The **Water Quality** Action Plans directly address three Priority Problems identified by BTNEP: *Eutrophication, Pathogens, and Toxic Substances*. EM-8 Pollutant Identification and Assessment, EM-9 Oil and Produced Water Spill Prevention and Early Detection, EM-10 Improvement of Water Quality through Reduction of Sewage Pollution, EM-11 Improvement of Water Quality through the Reduction of Agricultural Pollution, EM-12 Improvement of Water Quality through Stormwater Management, EM-13 Urban Green Spaces, EM-14 Assessment of Harmful Algal Blooms, EM-17 Improvement of Water Quality through Reduction of Inshore and Marine Debris, and EM-18 Protection of Drinking Water Sources address water quality improvements.

The **Living Resources** Action Plans address the Priority Problem of *Changes in Living Resources*. The actions proposed in this area not only serve to protect the living resources of the BTES, but also to address the need to protect the estuaries from the negative impacts caused by non-native exotic plant and animal species. The actions include EM-15 Protection and Enhancement of Native Biological Resources and EM-16 Reduction of Impacts from Invasive Species.

EM-1 Hydrologic Restoration and Management

OBJECTIVES

- To improve wetland habitats negatively impacted by local hydrologic modifications
- To improve hydrology through the effectual use of the freshwater, sediments, and/or nutrients that already reach the basins
- To stabilize water levels and salinity to provide conditions conducive to the establishment and growth of emergent and submergent marsh plants

BACKGROUND/MAJOR ISSUES

Louisiana's historically vast wetlands have been significantly reduced and damaged through hydrologic modifications in service of anthropogenic uses and activities. Although the channelization of the Mississippi River to reduce the effects of flooding and improve navigation in the beginning of the 20th century is the chief contributor to the degradation of Louisiana's wetlands, it is but only one of many contributing factors. Levees, railways, and roadways restrict passage of water within coastal Louisiana. Thousands of miles of channels have been dug through the coastal marshes in search of and for the extraction of petroleum and gas products. Channels were dug to increase shipping routes and to extract cypress trees. Typically, dredged sediments to create the canals were placed adjacent and along the canals often caused water impoundments. Wetlands were also leveed and drained for agricultural and urban use.

Wetlands can be lost directly through the action of



extraction or indirectly as a result of these actions. The digging of the canals is an example of the direct loss of wetlands. The placement of the dredged soil along the banks of the canal is also a direct loss of wetlands as the increased elevation of the spoil changes it to upland habitat. The crisscrossing of canals in the marshes can lead to impounded wetlands as the resulting spoil banks can form an impenetrable barrier to natural water sheet flow. Impounded areas often result in marsh collapse. Even uncontiguous spoilbanks can slow and reduce sheetflow of oxygenated waters, laden nutrients, and sediments necessary for healthy marsh. Paradoxically, as sheet flow has been reduced, saltwater intrusion has increased due to all the extra canals allowing quick ingress of gulf waters up into the fresher parts of

the estuary through tides and storm surge. Saltwater intrusion into fresh marshes and swamp can kill plant and animal species not adapted to saline water.

The wetlands of Barataria and Terrebonne are dependent on the free flow of water, sediment, and nutrients from the Mississippi and Atchafalya Rivers and their distributaries as well as the daily tides for their health and maintenance. Healthy wetlands provide vital habitat for our commercial and recreational fisheries as well as habitat for waterfowl and many threatened or endangered shorebirds.

Although Louisiana's wetlands provide vital services to the state and nation, the cost to Louisiana's marshes has been significant. When channels are dug, wetlands are directly removed. As the number of canals and



Hydrologic restoration can be used to repair damaged systems. Image: CWPPRA

channels crisscrossing the marshes increases, the amount of water movement also increases. Large navigation channels have been a conduit for storm surge and saltwater intrusion, while agricultural and other marsh impoundments have also stressed wetlands by altering natural hydrology. This Action Plan attempts to address these ongoing hydrologic changes to Louisiana's waterways and the associated marsh habitats. The intent of hydrologic restoration projects is to reduce impacts without disrupting the commerce that still thrives in Louisiana's coastal zone.

Hydrologic restoration can be used to repair damaged systems. The restoration techniques that are identified in hydrologic modification generally use planning strategies that have two major objectives: (1) to physically rebuild the wetlands that have been lost and/or (2) to reduce or reverse the rate of land loss by improving the ecological stability of the remaining wetlands.

Restoration projects should not happen haphazardly or with the will of just one or two user groups. Hydrologic restoration must be done with thoughtful consideration to ecological need, feasibility, impacts, and the project's support of publicly vetted federal and state restoration planning.

Hydrologic restoration can take many forms.

- Earthen and rock plugs may be used to prevent unnatural tidal flow through abandoned canals, and water-control structures help to regulate water and salinity levels.
- In some cases, large culverts are installed under roads, levees, or other obstructions to reduce wetland impoundments. Impounded wetlands can suffer from stressed vegetation, restricted access for marine organisms, and water poor in oxygen, sediment, and nutrients that feed the marsh. Without reintroduction of water, marshes will eventually succumb to these stressors.
- Through a combination of passively and actively

managed structures, saltwater intrusion can be abated and water levels managed to optimize wetland growth and vitality. Wetlands are dependent on natural hydrology, and industry is dependent on access to resources in the coastal zone.

It should be noted that alterations to marsh hydrology can impact the use of Louisiana's coastal marsh habitat by estuarine fishes and macro-crustaceans. Structures in channels may prevent their movement through the marsh system and prevent the completion of their life cycle. Manipulation of water levels within managed areas, especially drawdown, can prevent access to marsh surface habitat. While some of the the promotion of submerged aquatic vegetation, are beneficial to juvenile fishes and macro-crustaceans, access must be maintained for the organisms to benefit. Responsive management strategies can be adapted to allow the ingress and egress of certain species, but if marshes are hydrologically isolated for some part of the year, access by some species will be reduced.

DESCRIPTION

Hydrologic restoration is an adaptive management tool used to manage water flows to improve marsh or swamp habitat in a particular way. Projects of this nature are used to control the flow of water, sediments, and nutrients as well as regulate salinities in the estuary. These techniques are designed to reduce marsh loss, increase vegetative growth, improve water quality, repair drainage impairments or impoundments, help to maintain currently healthy wetlands, help to maintain or improve swamp habitats, and have a positive effect on fisheries and wildlife productivity.

Hydrologic restoration requires adaptive management techniques to monitor and evaluate water flow levels. These projects generally operate with the expectation of a continuous evolution that provides benefits to animals that inhabit the ecosystem. The primary goal of hydrologic restoration projects is improved



Man-made weirs and water control devices maintain water levels. Image: CWPPRA

habitat productivity. This is achieved by increased freshwater retention within fresh and brackish marsh areas, enhanced nutrient and sediment retention in marshes, and reduced tidal exchanges. Reductions in tidal exchange and turbidity may also benefit submerged aquatic vegetation. Increased productivity of existing marshes is essential because of the high rates of coastal land loss and habitat change being experienced within the BTB.

These types of projects will vary in size, scope, and cost. Pumps, fixed-crest weirs, variable crested weirs, flap gated culverts, siphons, conveyance channels, culverts, water control structures, cutting gaps in spoil banks, and adding plugs are examples of techniques used to improve habitat in surrounding marsh or swamp areas.

Marsh management based on hydrologic restoration

can be divided into two basic types: passive and active. The passive type makes use of non-adjustable structures such as fixed-crest weirs, slotted weirs, rock weirs, plugs, and levees. In passive marsh management projects, the goal is often to maintain a minimum water level inside the management area and to reduce the tidal exchange and velocity. In active management, water outfall management areas control water velocities to circulate water that bathes wetlands with oxygenated, nutrient-rich, freshwater.

The BTNEP MC notes that water control structures should be designed to address fisheries access issues; however, some unavoidable impacts may include reduced access issues in order to minimize impacts to recreational and commercial fishing access and reduction of ingress and egress of estuarine organisms.

Examples of large hydrologic projects in the estuary include:

Hydrologic Restoration and Vegetative Planting in Des Allemands Swamp (BA-34-2) is currently under construction. The lead federal agency working on the project is EPA.

Project Parish: Lafourche, St James

Project Description: The goal of this project is to reestablish historic hydrologic durations which will help maintain swamp elevation, improve swamp water quality, and increase productivity and regrowth of trees. Project features include spoil bank gapping, installing culverts, breaching of internal impediments, re-establishing natural channels, and site-specific vegetative plantings.

Estimated Cost: \$6.2 million

Land Benefit: 2395 acres

South Lake DeCade Freshwater Introduction (TE-39) is currently in Operations Maintenance and Monitoring (OM&M). The lead federal agency working on the project is NRCS.

Project Parish: Terrebonne

Project Description: This project included the construction of a water control structure in the southern bank of Lake DeCade. This will increase the amount of Atchafalaya River water and sediment introduced into the marshes south of the lake. In addition, shoreline protection was implemented adjacent to the proposed structure and a weir in Lapeyrouse Bayou was removed.

Estimated Cost: \$6.5 million

Land Benefit: 202 acres



Circular flap gates control water flow. Image: CWPPRA

Penchant Basin Natural Resources Plan, Increment 1 (TE-34) is currently in OM&M. The lead federal agency working on the project is NRCS.

Project Parish: Terrebonne

Project Description: The objectives of the project are to eliminate erosion and create approximately 35 acres of emergent marsh along the southern bank of Bayou Chene at its intersection with Bayou Penchant, convey Atchafalaya River water, sediment, and nutrients to lower Penchant Basin tidal marshes to offset subsidence and saltwater intrusion and maintain the integrity of a deteriorated reach of the north bank of Bayou Decade to minimize encroachment of open water marine influence.

Estimated Cost: \$18.9 million

Land Benefit: 675 acres

Central Terrebonne Freshwater Enhancement (TE-66) started as a CWPPRA project with NRCS as the federal sponsor. The project was transferred to the Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economies of the Gulf Coast States Act (RESTORE Act) funding stream and titled Bayou Dularge Ridge, Marsh Creation and Hydrologic Restoration.

The project will re-establish historic hydrologic and salinity conditions by reducing the artificial intrusion of Gulf marine waters via Grand Pass into the central Terrebonne marshes while also enhancing the influence of the Atchafalaya River waters on the area. The proposed planning project would include engineering and design of the Bayou Dularge Ridge. If implemented in the future, the project would re-establish hydrologic and salinity conditions, restore the ridge, and create and restore marsh to ensure the integrity of the ridge, its salinity gradient function, and the health of the marsh. Specific actions could include: data collection, oyster seed assessment, cultural resources, and easements and land rights.

Status: The Cultural Resources Assessment has been completed and all actions related to design have been

cleared. Design phase is scheduled to be completed at the end of 2019.

Estimated Cost: \$5.1 million.

Land Benefit: The project would result in 233 acres of hydrologic restoration, 282 acres of marsh creation, and 25 acres of ridge restoration for a total 540 acres of total direct net acres of benefit.

Note: Additional funds would be required to move this project to construction. Completion of the engineering and design is expected to take two to three years.

Houma Navigation Canal Lock Complex (TE-113) is currently in engineering and design. This CPRA project is designed to change freshwater distribution.

Project Parish: Terrebonne

Project Description: The Houma Navigation Canal Lock Complex (TE-113) is a part of the Morganza to the Gulf of Mexico Hurricane Protection Project. The structure will provide storm surge protection, increase freshwater distribution, and provide navigation along the Houma Navigation Canal (HNC). This project has multiple functions.

Estimated Cost: \$366 million

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

To date, federal, state, and local agencies have worked on a variety of hydrologic restoration projects related to marsh management and are now moving to use the technique for swamp recovery as well. The projects vary in size and scope, and it is expected that similar activities will happen in the near future. Additionally, local landholders have also used this technique to protect some of their private lands.

CWPPRA has consistently been the lead implementer of hydrologic management in the BTES. The projects listed above are large in size and require considerable funds and commitment.

Small scale projects may be implemented in entirety by local landowners in conjunction with parish government. The cooperation of local landowners and parish governments will continue to be essential to the successful implementation of any hydrologic restoration project.

TIMELINES AND MILESTONES

The 2017 Coastal Master Plan identifies two major hydrologic restoration projects for the area. The proposed projects are in the Grand Bayou area and the LaBranche Wetlands area. The proposed implementation periods are 11 to 30 years and 1 to 10 years from 2017, respectively.

Smaller projects may be constructed by local landowners and local governments as funds become available.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

The proposed projects' costs are \$8.7 million in the Grand Bayou area and \$80.9 million in the LaBranche Wetlands area. The exact sources of funding have not yet been identified.

PERFORMANCE MEASURES

Performance measures include:

- acres benefited from restoration activity
- acres created from the project

Data Gathered:

Data gathered may include but are not limited to:

- Accretion Data by way of Feldspar Plots/ Cryogenic Cores.
- Forested Swamp Vegetation.
- Herbaceous Marsh Vegetation.
- Hydrograph Information.

- Soil Properties.
- Surface Elevation over time.

These data points are related Coastwide Reference Monitoring System (CRMS) sites. CRMS data collection is recorded at https://www.lacoast.gov/crms2/crms_public_data/presentations/original/2006-11-004.pdf: Land to Water Ratio, Emergent Vegetation, Forested Vegetation, Vertical Accretion, Marsh Elevation Change, Porewater Salinity, Surface Water Salinity, Temp and Water Level, & Soil Characteristics.

Note: The CRMS project, under the direction and funding of CWPPRA, is one of the largest coastal habitat monitoring networks in the United States. The CRMS team effectively delivers data to a variety of audiences with roughly 60 scientists employed to go into the field to collect data from CRMS sites with additional analytical teams of scientists, computer programmers, and software engineers designing web delivery of large data sets. Monitoring data include: water level, salinity, sediment accretion, surface elevation change, composition and abundance of vegetation, ratio of land to water, and soil characteristics. The information is analyzed and summarized in maps, charts, tables, graphs, and indices and finally incorporated into interactive report cards available online. Today, about 390 CRMS sites, spread throughout coastal Louisiana, broaden the reach, increase the frequency, and expand the detail of wetland data.

Monitoring:

Parties Responsible: All responsible organizations maintain a list of ongoing and planned hydrologic restoration projects for marsh and swamp management. The State maintains a list of acres restored/protected. CWPPRA maintains acres created/restored for coastal restoration projects.

Timetable for Gathering Data: CRMS collects data annually. Project specific data may also be provided as available.



River reintroductions channel freshwater. Image: CWPPRA

How Data is Shared: via agency websites

Possible Data Gaps: none identified

Additional Funding Needed: yes, as available

EM-2 River Reintroductions

OBJECTIVE

- To use riverine resources of freshwater and sediment from the Mississippi and Atchafalaya Rivers in order to decrease salinities and preserve and/or create marshes

BACKGROUND/MAJOR ISSUES

After the devastating Mississippi River flood of 1927, Congress directed USACE to standardize and manage a system of flood protection levees along both banks of the river from Cairo, IL, to below New Orleans, LA. The Mississippi River and Tributaries Project (MR&T) also closed off distributaries and

effectively eliminated sediment input from overbank flow and crevasses that contributed historically to land gain in coastal Louisiana. Starved of sediment from the river, BTES lost approximately 865 square miles of wetlands between the years 1932 and 2010. This loss is partly due to natural processes such as deltaic subsidence, sea level rise, and erosion but has been exacerbated by anthropogenic activities such as canal dredging, subsurface fluid removal, and hydrologic modification. Freshwater and sediment diversions are expected to sustain and enhance existing wetlands and rebuild some of those that were lost.

With firm belief in the premise that actions must be taken to stabilize and rebuild the coast, BTNEP generally supports the introduction of freshwater and sediments to our deteriorating coastal wetlands. If diversions are designed and operated appropriately, the benefits to the ecosystem as a whole may outweigh the adverse impacts that would occur. River reintroductions are seen as a pathway to long term sustainability for existing marshes, newly created marshes, and coastal communities.

In addition to slowing land loss rates and providing sustainability, river reintroductions have the potential to build new deltaic land in their outfall area. Generally, diversions with larger discharge will have faster rates of delta growth, so there has been a recent tendency in planning to scale diversions upward. Davis Pond is currently the largest controlled freshwater diversion at 10,650 cfs. In contrast, the CPRA's 2017 Coastal Master Plan includes proposed controlled diversions of 2,000 cfs, 5,000 cfs, 20,000 cfs, 25,000 cfs, 30,000 cfs, 35,000 cfs, 50,000 cfs, and 75,000 cfs.

It must be acknowledged that besides the benefits that could be realized by diversions, numerous potentially important adverse impacts exist that must be considered throughout the planning and evaluation process. These impacts generally increase with scale as do user conflicts and sociopolitical opposition to implementation. The following is a brief discussion of some of these impacts.

- Induced Flood Risk

Flooding has been a problem in coastal Louisiana

throughout its history, but the problem is worsening with land loss and sea level rise. In recent years, computer modeling from various studies looking at predicted increases in water levels caused by diversion operations have shown wildly varying results. Some models indicate that the increase in flood risk to nearby communities should be minimal with a moderately-sized diversion. Other models show significant increases in water levels that would indeed increase flood risk in populated areas. Models have not yet examined the cumulative impacts of multiple proposed diversions operating simultaneously.

Another variable that should be considered is wind, a major driver of water levels in the estuary. In winter, storm fronts generally move north to south, and water levels in the basins are typically lower, providing an opportunity for seasonal diversion operations. This is particularly true in the Barataria Basin where backwater flooding from a high river has not been a significant concern. However, in the Terrebonne Basin,



The Davis Pond river reintroduction diverts freshwater. Image: CWPPRA

backwater flooding from a high Atchafalaya River has historically been a major concern. In Terrebonne, diversion operations timed to “optimize” sediment capture would conflict directly with flood fighting efforts there. Furthermore, southerly winds begin in spring and often last through fall, causing higher water levels and coastal flooding issues regardless of river stage. It may be difficult, from both a physical standpoint of high basin-side water levels as well as a sociopolitical standpoint of the perception of flood risk, to operate large-scale diversions during these months.

The threat of community flooding obviously increases with diversion discharge and proximity to the area of outfall. Additionally, some models suggest that outfall areas will be more prone to flooding in the early years of operations and will need time for channels to evolve in order to expand capacity. If projects are properly designed and appropriately scaled, it is unlikely that water elevations will increase significantly as a result of freshwater and sediment diversions. However, this critical issue of flood risk must be addressed throughout the process from the project’s conceptual phase through to its operation.

- Impacts to Commercial Fisheries

Implementing major diversions may involve some adverse impacts to living resources. Of particular concern are impacts to current oyster growing areas. The duration, seasonal timing, and degree of freshening will affect the breeding, growth, and harvesting of the eastern oyster in some areas. This serious concern must be addressed as diversions are constructed in areas where oyster leases will be impacted. In order to diminish the likelihood of litigation, renewed attention to public engagement is necessary. It is important to ensure that these oyster growers – and all other stakeholders – continue to be involved with and informed about the progress and timing of construction and operation of

projects. The preferred path forward is consensus on operational plans with assurances that those plans will be rigorously adhered to post project construction.

Modeling results have suggested that a 75,000 cfs controlled sediment diversion into mid-Barataria Bay would have significant impacts on oysters, finfish, and shellfish. Some of these projected impacts would be negative (e.g., lethally low salinities for oyster beds close to the project) and some positive. Many of the modeled resources show negative trends early in the 50-year project life but a positive trend later. Models of various seasonal operations regimes show potential to mitigate some of these impacts to resources. For example, diversions limited to springtime operations (taking into account potential flooding) would allow a more successful fall oyster spat set and would more closely mimic historical freshwater introductions in the basins.

Other potential positive outcomes could be an increase in freshwater-dependent resources like waterfowl, alligators, and freshwater fish like largemouth bass which will fare well close to the project.

- Impacts to Other Living Resources

One potential biotic impact from major diversions is to resident populations of marine mammals, specifically bottlenose dolphins. Freshening of an entire estuary is possible with major sediment diversions, which could affect dolphin health as they do not readily relocate. Causing harm to the health of the resident population of bottlenose dolphins could constitute a taking, requiring a waiver under the US Marine Mammal Protection Act (MMPA). Currently, the Mid-Barataria Sediment Diversion has received an exemption under the MMPA.

Another potential biotic impact is the introduction of invasive species or the facilitation of their spread. The majority of Louisiana’s most

troublesome invasive species are freshwater-dependent aquatic organisms. These species may expand their range as new diversions come online and create new freshwater habitat. These include the floating and submerged aquatic plants giant salvinia, water hyacinth, and hydrilla; mollusks such as apple snails, zebra mussels, and Asian clams; several species of Asian carp; and even the marsh-destroying nutria. Diversions could potentially be vectors for the introduction of new invaders to the estuary such as the northern snakehead, an Asian fish currently found in tributaries of the Mississippi River in Arkansas.

- Induced Shoaling

Another diversion impact is siltation of navigable waterways and/or barge floating areas generating a need for increased maintenance dredging in channels near diversion structures. Waterways affected could be federally maintained navigation channels, oil field access channels, and/or natural streams. Anticipated increases in the cost of maintenance dredging induced by diversion operations must be accounted for in the early stages of diversion planning so that accurate cost-benefit ratios can be considered. Additionally, in order to reduce the likelihood of litigation, full disclosure of anticipated effects to the navigation community is required. Consensus on the question of who is responsible for induced dredging costs must be reached ahead of implementation.

- Shipping

Water level in the Mississippi River is recognized as another critical issue that must be addressed. If multiple diversions are to be operated simultaneously or if the river experiences a period of very low stages, careful monitoring and adaptive management techniques must be used. The Port of Baton Rouge, the Port of New Orleans, and the Port of South Louisiana are three of the ten largest shipping ports in the Nation. These shipping and associated transportation

industries could be impacted unless careful planning assures that critical water volumes and navigation channels are maintained.

- Nutrients and Contaminants

Other issues to be addressed during the planning and subsequent monitoring of freshwater and sediment diversions include the impact of increased nutrient levels and the potential for increased eutrophication in coastal bays. Some debate exists as to the potential effects of increased nutrients on wetland plants and algae growth. More study is needed prior to implementing large-scale diversions to ensure that they can achieve the intended benefits without doing harm to wetlands and water quality. Additionally, introduction of other contaminants, including microplastics, must be monitored. Diversions should be designed to minimize unacceptable levels of eutrophication and contaminant introduction.

- Environmental Justice

Executive Order 12898 (1994) addresses environmental justice in minority and low-income populations. The order acknowledges the disproportionate adverse impacts that federal actions have historically had on certain communities. It also commits the federal government to promoting nondiscrimination in future federal actions that may impact environmental quality. Communities such as the Native Americans in Grand Bayou, Vietnamese-American fishermen, and low-income residents throughout the BTES could be negatively impacted by river reintroductions.

Diversions are dependent on relatively large rivers with stage heights that routinely exceed adjacent marsh elevation in order to provide gravity flow to wetlands. The Atchafalaya and Mississippi Rivers offer many potential locations to implement diversions. In addition, the Gulf Intracoastal Waterway (GIWW) provides opportunities which



Dredge working at the West Bay Sediment Diversion. Image: CWPPRA

greatly expand the potential locations, albeit with less suspended sediment and lower flow than the major rivers.

In general, upstream sites are preferred to downstream sites simply because more marsh exists for the outfall to flow through, and, therefore, more space for sediment to settle before it is lost to the open Gulf of Mexico. However, human population density also increases upstream, leading to increased potential for community flooding, user conflicts, and sociopolitical opposition.

On the Mississippi River, several locations have been extensively evaluated for suitability as sediment diversion sites. The Mid-Barataria Diversion, currently in the Engineering & Design phase, evolved from the earlier Myrtle Grove project concept and is located in the same area. Multiple studies over many years have focused on this location for its suitability.

DESCRIPTION

This action is to support the appropriate reintroduction of freshwater and sediment to the BTES as a mechanism to preserve and/or restore wetland habitat

and to combat saltwater intrusion. This action could take the form of siphons drawing river water out and over the levees into the wetlands or the construction of gated or ungated structures in the levees to allow river water to flow into the basins. Several river reintroductions into the BTES already exist, and several more are proposed in various planning documents including the 2017 Coastal Master Plan authored by CPRA.

The State of Louisiana has experience with large controlled diversions to manage the River for flooding as evidenced by the Morganza Spillway and the Bonnet Carré Spillway. Additionally, the Old River Control structure diverts approximately 30 percent of the Mississippi River to generate electric power, to manage flood waters, and to provide for public recreation.

Existing diversions include siphons such as those at Naomi or West Pointe à la Hache. Siphons are small-scale projects that use pipes running from the river, over the flood protection levee, and into the adjacent wetlands. Vacuum pumps remove the air from the pipes, and water is siphoned through by gravity at a rate increasing with river stage height over the

wetlands. These siphons have had positive impacts on wetland vegetation in the immediate outfall area, but their maximum discharge is a relatively low 2,000 cfs, so effects are geographically limited.

Other existing reintroductions include freshwater diversions such as the one at Davis Pond, constructed upstream of New Orleans and completed in 2002. Davis Pond is currently one of the largest controlled diversions ever constructed, capable of flowing at 10,650 cfs. It is referred to as a “freshwater” diversion because it was designed not to build or sustain land, but to stabilize salinity regimes and increase oyster production. It uses a 9,300-acre ponding area into which the vast majority of sediments fall out with the intent of combatting saltwater intrusion farther down-basin without covering oyster grounds with sediment. The Davis Pond diversion is very effective at pushing isohalines down basin and is rarely operated at or near maximum flow. It was built by USACE and is now operated by the State of Louisiana.

Another existing reintroduction is the uncontrolled diversion at West Bay near the mouth of the

Mississippi River. Building the diversion as a simple dredged channel without flow control structures saved tremendously on project cost, but this could only be accomplished under a special set of circumstances. The West Bay Sediment Diversion is sited downstream of any roads, communities, levees, or other significant infrastructure, and had consensus support for implementation. In this location, river stage rises only a few feet above sea level, and the outfall area is a shallow bay with a direct connection to the open waters of the Gulf of Mexico, so flooding is not a concern. It is unlikely that an uncontrolled diversion could safely work in any location farther up basin, and none are currently proposed.

The CPRA’s 2017 Coastal Master Plan evaluated dozens of project concepts for river reintroductions and ultimately proposed 11 new diversions, five of which would discharge into the BTES. Of these five proposed diversions, two would divert water from the Atchafalaya River into the Terrebonne Basin, two would divert water from the Mississippi River into the Barataria Basin, and one would increase the



Pipes are used to convey freshwater. Image: CWPPRA

flow of Bayou Lafourche (see Action Plan EM-3 Freshwater Reintroduction into Bayou Lafourche). Bayou Lafourche is fed by pumps drawing from the Mississippi River, but the other four proposed diversions would be large-scale, controlled “sediment” diversions. Sediment diversions aim to deliver significant amounts of sediment to the estuary, maximizing sediment capture from the river through placement near sediment sources, engineering of deep intake structures, and optimized operational strategies. Such projects will usually reach their full potential only if the diverted water, once it enters the receiving area, moves across the marsh surface. This “outfall management” optimizes the delivery of nutrients and suspended sediment to the marshes. This may be achieved through the use of water control structures such as weirs, culverts, plugs, and spoil bank management.

Outfall management and the techniques used to achieve this management must play a vital role in achieving the maximum gain from river diversion projects. The goal of outfall management is to slow water velocities and to circulate diverted flows to immerse wetlands as much as possible with oxygenated, sediment-rich, freshwater in the upper reaches of the project area and allow it to slowly flow through the estuary diluting ambient salinities. It is not an effort to impound water, but rather to incorporate retention and distribution measures for better water control and to retard the rapid unidirectional drainage typically enhanced by various types of man-made channels. However, outfall management techniques are not without controversy. For instance, one of the most important techniques used in outfall management is spoil bank gapping. Under certain conditions, gapping can improve hydrologic conditions, promote sediment deposition, reduce flooding, promote marsh productivity, and increase access to the marsh for estuarine organisms. In other conditions, gapping can provide avenues for tidal export of organic sediment and saltwater inflow, both of which can cause wetland loss. Gapping should never be deeper than the adjacent

marsh surface to maximize overbank flooding and minimize channelization. Outfall management plans must be developed on a project-by-project basis.

The philosophy guiding most of our controlled diversion operational management plans is to use engineered structures to mimic historic annual flooding patterns. The rationale for this is that since estuarine ecosystems and their component species are well adapted to annual freshwater inputs, as evidenced by the high productivity and diversity associated with the natural condition, a shift back towards those conditions could prove beneficial to restoring marsh. Along with dredging for marsh creation, sediment diversions are another action that can create marsh by providing coarse sediments for new marsh substrate. This action achieves the overall alliance objective of restoring fluvial inputs of sediment and water to preserve and create marshes. Major controlled sediment diversions such as those proposed in CPRA’s 2017 Coastal Master Plan have the potential to offset significant areas of wetland loss.

Diversions will improve the long-term sustainability of coastal wetlands and may have benefits to wetland vegetation and habitat for fish and wildlife resources. However, possible adverse impacts include increased flood risk to populated areas from diversion and backwater sources, impacts to fisheries and related socioeconomics, induced shoaling in the river’s anchoring areas or navigation channel, introduction of invasive species or facilitation of their spread, and negative impacts to some existing wetlands and soils. Weighing benefits against the adverse impacts of diversions is a critical yet complicated process depending heavily on the specifics of location, scale, operations, and time. Time, especially, is a critical component in a comprehensive assessment of the true cost-benefit of sediment diversions. Trajectory economics for assessing the flow of economic services, when compared to other means of coastal restoration, must be part of any coastal restoration plan.

As part of this action, BTNEP intends to closely follow the latest research and modeling of proposed diversions, understand and contextualize the current data from monitoring of existing diversions, and continue a comprehensive public education program to inform citizens about the probable beneficial and adverse impacts associated with river reintroductions. BTNEP is committed to using the best science, filtered through the lens of the stakeholder public, to support diversion operations regimes that are both beneficial and implementable.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

- CPRA, State of Louisiana

CPRA oversees operations of existing diversions and is currently in the implementation phase of the 2017 Coastal Master Plan. The plan includes 11 proposed river diversions statewide at a cost of \$5 billion. These diversions are in various stages of planning, engineering & design, and construction.

- USACE, New Orleans District

USACE constructed the two existing diversions

at Davis Pond and Caernarvon and has partnered with the State to plan and design other diversions. They also hold permit authority under CWA Section 404 regulating discharge of dredged or fill material into waters of the United States, USC Section 408 regulating alterations of USACE Civil Works Projects, and Section 10 of the Rivers and Harbors Act prohibiting obstruction or alteration of navigable waters.

- LDNR

LDNR has the authority to grant Coastal Use Permits (CUP), the purpose of which is to make certain that any activity affecting the Coastal Zone is performed in accordance with guidelines established in the Louisiana Coastal Resources Program (LCRP). The guidelines are designed so that activities in the Coastal Zone can be accomplished with the greatest benefit and the least amount of damage.

- CWPPRA Task Force

CWPPRA implemented the West Bay Diversion and has proposed several other diversion projects. The scale of diversions typically proposed by CWPPRA is much smaller than many of CPRA's



River reintroductions channel freshwater. Image: CWPPRA

largest proposals in the 2017 Coastal Master Plan, but, nonetheless, these smaller diversions can have benefits on a local scale.

- Other Federal Agencies

Federal resource agencies such as EPA, NOAA/NMFS, USFWS, and USDA/NRCS have responsibilities as commenting agencies for granting permits.

TIMELINES AND MILESTONES

CPRA will work with federal, state, and local partners to develop timelines. The 2017 Coastal Master Plan includes an implementation schedule for the 11 proposed diversions. Each project evolves through planning, engineering & design, and construction phases which can each take several years before moving to operations & maintenance.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Freshwater and sediment diversions are the most costly types of coastal restoration projects as they require extensive planning, design, and engineering; many years of construction and continued operations; adaptive management; and maintenance costs. Cost estimates for diversions into the BTES included in the 2017 Coastal Master Plan follows.

\$196,100,000	Bayou Lafourche 1,000 cfs
\$282,900,000	Atchafalaya River (to Penchant Basin) 30,000 cfs
\$397,900,000	Increase Atchafalaya Flow to Terrebonne (via GIWW) 20,000 cfs
\$882,400,000	Ama Diversion 50,000 cfs
\$998,800,000	Mid-Barataria Diversion 75,000 cfs

Sources of funding will include state-only funds, CWPPRA, Coastal Impact Assistance Program

(CIAP), Louisiana Coastal Area (LCA), cost-sharing programs with USACE and other federal agencies, the RESTORE Act, and other spill-related sources.

PERFORMANCE MEASURES

Performance measures include:

- acres of land created
- acres of land benefited
- decrease the rate of land loss measured in land/water ratios over time
- achieving intended salinity regimes and gradients based on ppt or isohalines USACE, New Orleans District

Data Gathered:

Data gathered may include: water levels; sediment accretion/erosion; vegetative response; habitat change; land/water ratios; operational details of the diversion itself; soil quality metrics such as bulk density and organic versus mineral content; socioeconomic effects including changes in commercial fisheries; effects on other living resources such as fish and wildlife; effects to migratory birds, marine mammals, and threatened and endangered species; impacts to navigation/boating access; and many aspects of water quality including temperature, salinity, dissolved oxygen, nutrients, suspended sediment, and contaminants.

Monitoring:

Parties Responsible: CPRA, CWPPRA, Louisiana State University (LSU) AgCenter, LA Sea Grant, and other state and federal resource agencies including EPA, NOAA/NMFS, USFWS, USDA/NRCS, USGS, LDWF, LDNR, LDEQ, LDH, etc.

Timetable for Gathering Data: Monitoring should include historical, real-time, and long-term data sets collected throughout the project life from planning through operations.

How Data is Shared: Data from the CRMS is shared via interactive website, and the recent development of the System Wide Assessment and Monitoring Program (SWAMP) promises to expand on data parameters covered by CRMS and to share the data in similar ways. Additional parameters should be shared on project-specific websites.

Possible Data Gaps: none identified

Additional Funding Needed: yes, as available

EM-3 Freshwater Reintroduction into Bayou Lafourche

OBJECTIVE

To support and encourage reintroduction of Mississippi River flow into Bayou Lafourche in order to bring freshwater and sediments to the BTB marshes to help address coastal land loss and to ensure adequate consumptive freshwater supplies by combating saltwater intrusion

BACKGROUND/MAJOR ISSUES

Bayou Lafourche, originally called La Fourche des Chetimaches (the fork of the Chitimacha), is an historic tributary of the Mississippi River that extends 106 miles from its origin in Donaldsonville to the Gulf of Mexico. The bayou is bounded on the west by Louisiana Highway 1 and on the east by Louisiana Highway 308 and is promoted as “the longest Main Street in the world.” It flows through Ascension, Assumption, and Lafourche parishes and serves as a major freshwater source for their residents. Original inhabitants of the area were various Indian tribes including the Chitimacha, Chawasha, and Washa. In the late 1700s, small European settlements were built, followed shortly by the first Acadians in 1764. In addition, a small group of Canary Islanders called “Isleños” imported by the Spanish government to

help settle the Louisiana territory settled in the area.

The French explorers Iberville and Bienville considered Bayou Lafourche the west fork of the Mississippi River, thus “Lafourche,” the fork. In the mid-1800s, Bayou Lafourche carried roughly 12 percent (over 40,000 cfs) of Mississippi River flow. To address local flooding concerns, in 1904 a closure was constructed at Bayou Lafourche, and it ceased to function as a distributary of the Mississippi River. This major hydrologic modification resulted in devastating impacts to the BTB. To provide freshwater flow, a pump station was built on the Mississippi River at Donaldsonville in 1955 to allow water from the Mississippi River to enter Bayou Lafourche. Currently, about a quarter of one percent (200 cfs) of the Mississippi River flow is allowed down the Bayou. This flow is closed if heavy rains have caused high water in the Bayou or if monitoring stations on the Mississippi River indicate a chemical spill has occurred upriver of Donaldsonville.

Closing Bayou Lafourche prevented freshwater from reaching the marshes in the southern BTB. Navigation to the Mississippi River from Bayou Lafourche was eliminated. However, the closing allowed for increased development of the natural and man-made levees, intensified agricultural activities, and also enhanced economic opportunity, especially with the petroleum industry boom increasing the job base. Seasonal flooding of Bayou Lafourche was controlled, and farming, residential, and business development could proceed predictably. Now, the BTB are experiencing the most severe coastal land loss rates in the world. Concerns about adequate long-term consumptive water supplies continue as do concerns about possible contamination from agricultural chemicals use. Increasing Mississippi River flows into Bayou Lafourche is a reliable way to satisfy consumptive freshwater supply demands now and into the future and is a major way to benefit coastal landscapes by supplying freshwater and sediments to areas that were historically connected to freshwater flows from the river.

Increasing diversion flows down Bayou Lafourche nourishes coastal marshes both on the east and west sides of the bayou near Lockport, combats saltwater intrusion from the Gulf of Mexico, and provides more reliable freshwater consumptive supplies for residents and industry. Reintroduction of Mississippi River flow to Bayou Lafourche is a sustainable restoration technique using the established natural process that nourished and created marshes prior to the closure of the bayou. The pump's current capacity is between 420 and 450 cfs. Freshwater, nutrients, and sediment should help revitalize marsh vegetation that is stressed by saltwater increases or by sediment deprivation.

DESCRIPTION

This Action Plan will aid in addressing the major priority problem for the BTES which is habitat loss and hydrologic modification, and, as an additional benefit, it will help ensure adequate freshwater drinking supplies for nearly 300,000 Louisiana residents. Currently, the uppermost 16 miles of the channel have been cleared and dredged, and construction has recently been completed to replace the Union Pacific Railroad Bridge in Donaldsonville and the pedestrian bridge near Assumption Parish High School in Napoleonville.

Additionally, the construction of a water control structure in Lockport is also complete which will prevent saltwater migration farther north into Bayou Lafourche. The water control structure at Lockport will function as a weir if necessary. The analysis and design of improving pumping capacity have been initiated for the pump station site in Donaldsonville with an estimated (2017) cost of \$41 to \$70 million based on pump capacity. This project is aimed at increasing the pumping capacity from the Mississippi River into Bayou Lafourche nearly threefold by either expanding the existing pump station or constructing a new pump station. Other current ongoing projects that have begun are the Thibodaux Weir Removal Preliminary Analysis, which looks at replacing the existing permanent weir with a gate or use of a temporarily deployed weir, and the permitting of channel dredging from Napoleonville to Thibodaux.

Since BTNEP's original CCMP was formed and accepted, alternatives to accomplish the desired outcomes were evaluated, and the plan currently being implemented was selected. Successful and timely execution of this plan is critically important to the residents of BTES because of the consumptive water supply benefits and the benefits afforded the receiving marshes on the lower end of Bayou



Dredging operations to improve water flow in Bayou Lafourche. Image: BTNEP

Lafourche. BTNEP will continue to support the Bayou Lafourche Fresh Water District (BLFWD) and CPRA throughout the execution phase and during long-term O&M program.

This action will occur entirely along Bayou Lafourche. Actions at the headwaters in Donaldsonville include dredging, renovating or redesign, and constructing the pump station drawing from the Mississippi River. Additional dredging will occur from Donaldsonville to Thibodaux to increase channel capacity, and the Thibodaux weir will be redesigned or removed. Outfall management actions are possible at various locations along the entire channel.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

Local: BLFWD

State: CPRA

Federal: USACE, EPA, USFWS, and NRCS

TIMELINES AND MILESTONES

The remaining components of the overall project, namely the new pump station at Donaldsonville, removal of the weir at Thibodaux, and channel dredging are expected to be complete by 2020.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

As defined above, lead agencies/entities are legislatively mandated to manage issues related to this Action Plan. Furthermore, each agency/entity develops annual budgets and programmatic budgets internally to address those legislatively mandated requirements. These budgets and discussion thereof are not presented here but are available from BLFWD and/or CPRA.

BTNEP as a co-lead implementer works with other lead agencies/entities on an annual basis to define data gaps and develop partnerships with these organizations to address those data gaps. Projects

are defined during this phase along with appropriate costs and budgets. These costs vary according to the size and scope of the individual projects. Funding sources vary, including possible EPA funding.

PERFORMANCE MEASURES

Performance measures include:

- the amount of freshwater flowing in Bayou Lafourche up to the project design maximum
- acres benefited
- number and duration of high chloride events in Bayou Lafourche

This increase in the flow of freshwater in the bayou will meet the appropriate demand for drinking water for 300,000 people and for industries who rely on the water.

The performance measures are directly related to an appropriate increase capacity of the bayou to accept and move water in order to improve water quantity, improve water quality, improve drainage, and improve recreational uses.

Methods:

Steyer and Stewart (1992) list variables which may be measured to monitor freshwater and sediment diversions implemented under CWPPRA. It is recommended that this model be followed, regardless of the particular funding source for any component of the overall project. Measurable parameters identified by Steyer and Stewart (1992) have been prioritized by Steyer et al. (1995) into Essential Variables or Additional Variables or Substitutions. For this Action Plan, only the Essential Variables are recommended for immediate and on-going monitoring. Those include Habitat Mapping, Salinity, Water Level, and Vegetation.

Data Gathered:

BLFWD and CPRA currently post information on the project on their respective websites. Monthly

meeting minutes from BLFWD discuss:

- operational activities.
- proposed millages.
- cost estimates for upcoming work.

Monitoring:

Parties Responsible: BLFWD and CPRA

Timetable for Gathering Data: As requested by BLFWD and CPRA; currently monthly reports are made.

How Data is Shared: All materials are shared through the web on the BLFWD website or CPRA.

Possible Data Gaps: BLFWD meets regularly to

evaluate data to determine any possible data gaps.

Additional Funding Needed: Yes, at current estimates, the project will require between \$70 to \$100 million.

EM-4 Beneficial Use of Dredged Material and Dedicated Dredging

OBJECTIVE

To make use of material when dredging activities or dedicated dredging occurs within or adjacent to the BTES in order to create, maintain, and/or restore marsh, coastal ridges, and islands.

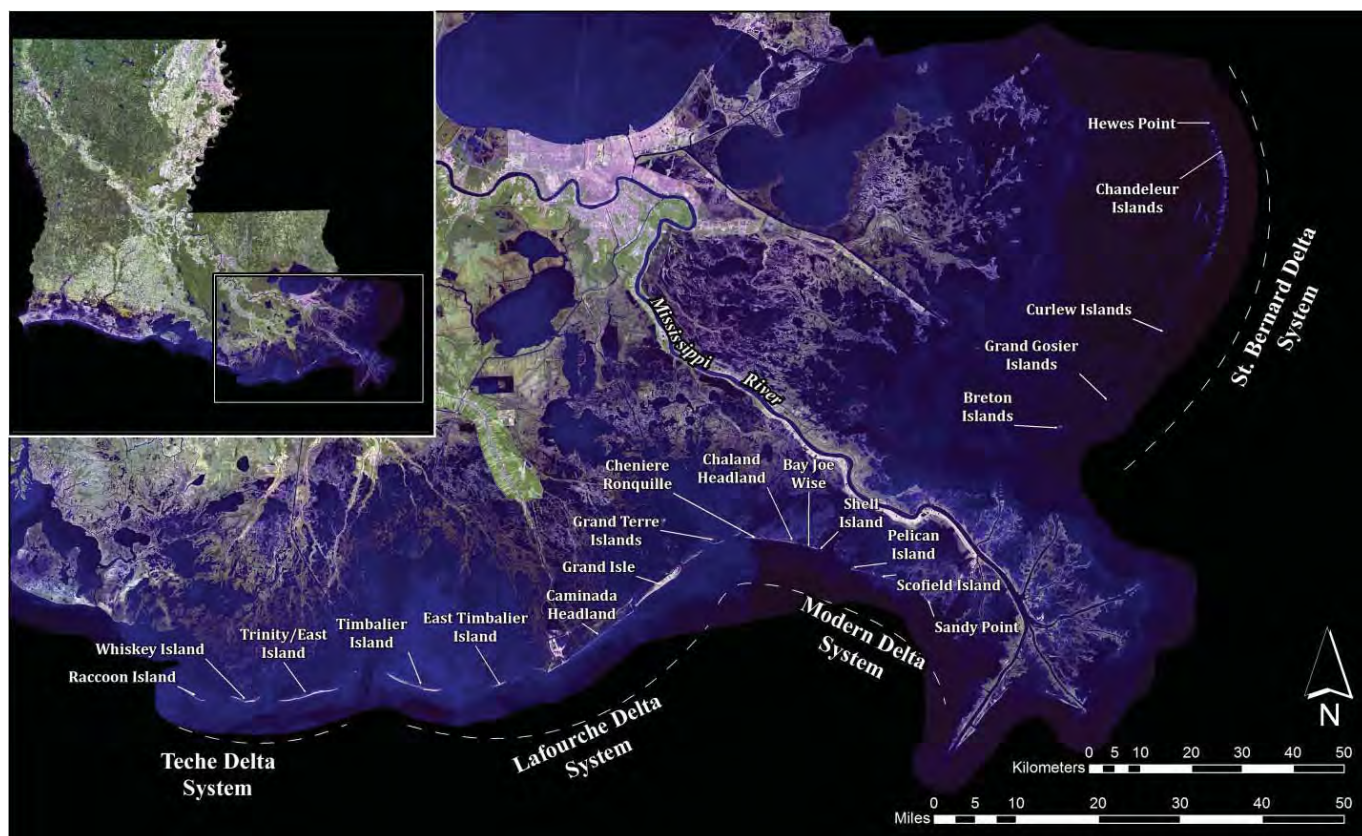


Figure EM-4.1. Dredge materials from both maintenance and dredging, and dedicated dredging operations are used beneficially along Louisiana's coast.



Sediment is pumped into areas for shoreline stabilization. Image: CWPPRA

BACKGROUND/MAJOR ISSUES

Dredged materials can be used for various purposes that are beneficial to society and to the environment. Numerous uses for dredged materials may be considered beneficial based on the user's perspective. Conservation uses could consist of the creation of habitat and the restoration of degraded habitat. Development uses could consist of new land for ports, infrastructure, or parks. National Environmental Policy Act (NEPA) requires consideration of project alternatives that are environmentally sound, so beneficial use should be considered for operations requiring dredged material disposal.

Two source categories for dredged material should be defined:

- Dredged material removed from new or existing navigation channels, ports, or harbors and from constructing or maintaining oil and gas pipeline and production canals may be used as a resource in a productive way.

- Dedicated dredging is the deliberate removal of material from one site to restore or enhance another site.

Historical beneficial use of maintenance dredged material within the BTES has been varied. Initial use was to establish new land for ports, airports, homes, and industries. More recently, however, use has shifted to conservation with wetland and barrier island restoration projects and the construction of upland areas, bird nesting islands, wetlands and woodland restoration projects, and aquatic and marine habitat.

Dredged materials from both maintenance dredging and dedicated dredging operations are used beneficially in Louisiana. Plans exist for using maintenance dredged materials in projects such as marsh creation, nesting habitat creation, canal filling, and barrier island restoration. Plans also exist for using dedicated dredging to accomplish barrier island breach sealing, shoreline protection, beach and dune nourishment, nesting habitat creation, and

marsh creation projects.

Implementing these actions is hampered by high costs and conflicting uses of water bottoms (i.e., the presence of oyster leases). Because of cost implications, these actions can only be accomplished economically in areas free of oyster leases, near waterways where maintenance dredging is undertaken, or where dedicated dredging is possible. However, it may be possible to use innovative technologies to transport dredged material through newly constructed pipelines for this purpose over greater distance than is currently practiced.

Permits from LCRP for coastal uses and the Department of the Army Section 404 and Section 10 permit system are required to construct or maintain oil and gas pipeline and production canals. These permits may be conditioned to require that the dredged material be used beneficially whenever possible. Due to the smaller volumes removed for these dredging operations compared to federal navigation channels, it may be more feasible from an economic and engineering standpoint to use dredged material from oil and gas canals beneficially.

DESCRIPTION

This action will take advantage of existing sediments which must be periodically removed from existing navigation channels or oil field canals. These materials will be used to restore degraded habitat and to create new habitat. Dredged material from maintenance dredging operations is periodically removed from ports, harbors, navigation channels, and oil field canals. Using dredged material beneficially is an alternative to ocean disposal of dredged material, upland disposal, or other non-beneficial disposal options. In addition, dedicated dredging represents another potential source of material for beneficial use.

Dredging oil and gas field canals occurs frequently in the BTES. The material excavated from oil and gas pipeline and production canals may be readily usable in beneficial ways. In addition, compost or sewage

sludge may also be used under certain circumstances if deemed harmless and appropriate.

Although a number of factors – including logistics, grain size, and presence of contaminants – will limit materials to nourish, restore, and create coastal habitat will be encouraged. Potentially, up to 20 million yd³ could be used annually in Louisiana to enhance coastal wetlands through marsh creation, wetland nourishment, barrier island restoration, ridge restoration, bird islands, and other techniques.

Dredged material should be used to restore and create marsh at all possible locations with available technology whenever it is cost effective to do so. Because of economic and engineering realities, this action is recommended where it is economically feasible to do.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

USACE, New Orleans District

Through Fiscal Year 2015, the Corps has constructed over 61 square miles of land in Louisiana through beneficial use of dredged material obtained via the Federal maintenance dredging program. Of these 61 square miles, 26 of them are located within the BTNEP footprint. That means that about 43 percent of all the maintenance-dredged material obtained has been placed within the BTES.

For example, the Corps created approximately 815 acres of wetlands in 2013 through the beneficial placement of approximately 56 percent of Southwest Pass dredged material.

Currently, approximately 42 percent of suitable/available dredged material under the O&M program is used beneficially. Due to either the physical characteristics or the location of the dredged material, not all of the material dredged by the Corps is available for beneficial placement in the coastal ecosystem. With more funding, about 14 to 18 million yd³ could potentially be used beneficially (most of

this material would come from the Mississippi River Deep Draft Crossings).

The 2007 Water Resources Development Act (WRDA) directed the Corps to integrate its work with coastal restoration efforts.

CWPPRA Task Force

CWPPRA uses dedicated dredges to create new marsh in both BTB. Dredges are used to pump materials from the Mississippi River into the Barataria Basin, and it is possible to get material from the Atchafalaya River as well.

CPRA, State of Louisiana

The 2017 Coastal Master Plan includes marsh creation projects that are created through the beneficial use of dredged material.

Office of Coastal Management (OCM), State of Louisiana

Through the State LCRP since 2009, the State requires private applicants who want to dredge more than 25,000 yd³ of sediment to place the material in coastal restoration projects or pay a fee to support restoration. Table EM-4.2 lists the yd³ used and acres created within the BTES since 2009 by OCM through its LCRP and beneficial use policy.

TIMELINES AND MILESTONES

The Beneficial Use of Dredged Material (BUDMAT) Program has identified the following BTES areas of opportunity over the next 20 years: Barataria Bay, Port Fourchon, Berwick Harbor, Atchafalaya River, Mississippi River, and the HNC.

The State of Louisiana CPRA will be implementing its 2017 Coastal Master Plan over the next 50 years which will create marsh projects via the beneficial use of dredged material.

The State's OCM continuously uses adaptive management by re-evaluating the policies and procedures of the LCRP and how to manage coastal

Table EM-4.2

Cubic yards and acres created

Cubic Yards	Acres Created	Year
129,134.00	77.29	2009
769,952.00	119.99	2010
839,569.24	173.73	2011
1,029,910.00	652.33	2012
1,787,526.30	230.35	2013
2,897,314.43	252.33	2014
219,428.17	125.79	2015
29,607.00	171.37	2016
7,702,441.14	1,803.18	Total

uses among all users. Specific to this Action Plan, the OCM will review the effectiveness of its beneficial use policy and adjust it appropriately as needed over the next 20 years.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

The USACE's BUDMAT Program's objective is to cost effectively increase the beneficial use of material dredged from federally maintained waterways at a total cost of \$100 million over a ten-year period. The WRDA of 2007 - Section 7006(d) within the Louisiana Coastal Area Program authorizes the BUDMAT Program.

CWPPRA currently spends on average between \$2.5 and \$18 million on marsh creation projects that beneficially use dredged material annually. Projects are identified and funded based on a competitive wetlands value assessment. Funding for aforementioned projects will be available as the projects move through the public process.

The State of Louisiana has plans for large scale marsh creation projects laid out in the 2017 Coastal

Master Plan. It is envisioned that some portion of the \$5 billion Gulf Coast Ecosystem Restoration Task Force funds will go toward this technique.

Additionally, the Natural Resource Damage Assessment and Restoration Program (NRDA) process may also provide funding under the EPA's CWA to repair damages caused by the Deepwater Horizon oil spill. Louisiana will receive approximately \$500 million to implement projects for the coast under the 2017 Coastal Master Plan. It is anticipated that a portion of these funds may be used in the BTES for this type of restoration.

PERFORMANCE MEASURES

Performance measures include:

- acres/linear feet/miles of land created and/or millions of yd³ delivered
- acres benefited

Data Gathered:

- All organizations maintain a list of acres created.
- Some organizations maintain a list of the millions of yd³ used.

Monitoring:

- USACE completes BUDMAT reports.
- CWPPRA keeps track of acres created and maintained.
- The State of Louisiana keeps track of acres created or maintained.
- CPRA's Coastal Reference Monitoring Stations collect water quality and vegetation data on most restoration sites.

Parties Responsible: USACE, CWPPRA, State of Louisiana, and CPRA



Port Fourchon created a man-made ridge using dredge material. Image: Port Fourchon

Timetable for Gathering Data: annual report

How Data is Shared: via agency websites

Possible Data Gaps: none identified

Additional Funding Needed: yes, as available

EM-5 Preservation and Restoration of Barrier Islands

OBJECTIVE

To preserve and restore barrier islands in order to protect environmental and economic resources

BACKGROUND/MAJOR ISSUES

Louisiana's barrier shoreline is one of the fastest eroding shorelines in the world. The barrier islands of the BTES are eroding rapidly, and since the 1880s, barrier islands of the BTES have lost approximately 1.6 billion m³ in sediment from the shoreface and have retreated landward up to three kilometers. The cross-sectional area of the tidal inlets has more than tripled during this time.

Storm-induced currents are a major driver of these changes (Miner et al., 2009). This erosion and shoreline retreat has been a contributing factor to the land loss within the BTES. These islands need to be elevated and widened to provide habitat for living resources and to prevent breaching and overwash. These problems can be addressed by importing sediments.

The restoration of Louisiana's barrier islands and barrier island systems has been a priority for a number of restoration programs over the past several decades, and more than 30 barrier island projects have been constructed to date. These projects consist of a combination of restoration techniques including beach nourishment, back barrier marsh creation,

shoreline protection, vegetative plantings, and sand fencing.

Since the barrier islands serve as a vital nesting area for wading birds and sea birds and a resting area for migratory birds, unnecessary disruptions by humans should be avoided whenever possible. Shore parallel canals which have been dredged or are immediately adjacent to the barrier islands lead to the breakup of the island. These canals should be filled to the height of the barrier island when the need for the canal has ceased. Navigation canal protection jetties should have a regular program of sediment by-passing or should be shortened or removed so that the natural flow of sediments to adjacent flanking barrier islands is not disrupted.

An offshore sediment analysis is currently being conducted. Expansion of availability of sediment from Ship Shoal is a possibility, but the Shoal's importance as a hypoxia refuge for snapper, crabs, and possibly other species might complicate this issue.

DESCRIPTION

This action will preserve and restore barrier islands by pumping sand to elevate dunes, narrow tidal inlets, and provide greater island width. This action will also provide for building back-island salt marshes and filling abandoned oil and gas canals. The two main technologies to be used are beach nourishment – the addition of sediment (sand) to a beach to replace that which has been lost to erosion – and island restoration by material addition – the use of imported sediment to repair island damage or reduce future degradation by heightening and widening an island. In addition, some of the tools described in EM-6 Shoreline Stabilization, Induced Sediment Deposition, and Living Shorelines will be used on the barrier islands as appropriate.

CPRA is currently developing a barrier island Breach Management Plan to address both breach prevention and response to breaches when they occur. This plan will help to minimize the acceleration of island



Sand fencing captures wind-blown sediment. Image: CWPPRA

disintegration that commonly occurs after a breach. Prompt repair of storm-induced damages will extend the life expectancy and integrity of Louisiana's barrier shorelines.

Dredged material should be used to nourish beaches on the BTES shoreline at all possible locations with available technology whenever it is cost effective to do so. In addition, breach repair should be performed promptly whenever storms create breaches in barrier shorelines.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

CPRA, State of Louisiana

The State of Louisiana currently has a 2017 Coastal Master Plan. The plan includes a barrier island/headland restoration program at a cost of \$1.5 billion. CPRA is currently developing a program which intends to restore BTES islands on an as needed basis rather than naming specific islands.

USACE, New Orleans District

The USACE dredges navigation channels in the BTES, and where bar channels and the lower reaches of the channels are dredged in the vicinity of barrier

islands, the dredged material is often used for beach nourishment or marsh creation on the bay side on the bay side of barrier islands such as Grand Terre. Currently, approximately 42 percent of the suitable/available material dredged under the O&M program is used beneficially. Due to either the physical characteristics or the location of the dredged material, not all of the material dredged by the USACE is available for beneficial placement in the coastal ecosystem. However, if funding were made available, much of this material could potentially be used for barrier island or headland restoration. The 2007 WRDA directed the USACE to integrate its work with coastal restoration efforts.

CWPPRA Task Force

CWPPRA has constructed numerous barrier island restoration projects from Raccoon Island to Pelican Island including breakwaters, shoreline protection, marsh creation, and vegetation planting.

TIMELINES AND MILESTONES

Over the next 50 years, the State of Louisiana CPRA will be implementing its 2017 Coastal Master Plan, which includes implementing several barrier island restoration projects on an as needed basis.



Barrier shoreline restoration projects require large funding streams. Image: CWPPRA

Over the next 20 years, the USACE's BUDMAT Program's will be working to use the dredged material from channel maintenance for marsh creation and beach nourishment where feasible.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

The State of Louisiana has plans for large scale barrier island restoration projects laid out in the 2017 Coastal Master Plan. It is envisioned that some portion of the \$5 billion Gulf Coast Ecosystem Restoration Task Force funds will go toward this technique. CPRA has set aside \$1.5 billion for their barrier island program.

Additionally, the NRDA process might also provide funding under the EPA's CWA to repair damages caused by the Deepwater Horizon oil spill. Louisiana will receive approximately \$500 million to implement projects for the coast under the 2017 Coastal Master Plan. It is anticipated that a portion of these funds may be used in the BTES for this type of restoration.

The USACE's BUDMAT Program's objective is to cost effectively increase the beneficial use of material dredged from federally maintained waterways at a total cost of \$100 million over a ten-year period. Some of this material would be used on barrier shorelines in the BTES. The WRDA of 2007 - Section 7006(d) within the Louisiana Coastal Area Program

authorized implementing the BUDMAT Program.

CWPPRA currently spends a large portion of its annual budget on barrier island projects. Projects are identified and funded based on a competitive wetlands value assessment and public input. Funding for aforementioned projects will be available as the projects move through the public process.

PERFORMANCE MEASURES

Performance measures include:

- acres of land created and/or millions of yd³ delivered
- acres benefited

Data Gathered:

- the compilation of videography and photography of the 2005 hurricane impacts
- the construction of a unified historic shoreline change database for the Louisiana coastal zone
- the development of a historical bathymetric database with up-to-date 2006 bathymetric analysis that provides a current seafloor change for the shoreline extending from Sandy Point to Raccoon Island and the northern Chandeleur Islands

- Light Detection and Ranging (LiDAR)
- surveys for the sandy shorelines of the coastal zone.

Monitoring:

The Barrier Island Comprehensive Monitoring (BICM) plan has been developed as a framework for a coastwide monitoring effort. This effort includes documenting the historically dynamic morphology of the Louisiana nearshore, shoreline, and backshore zones. This aspect of the program is designed to complement other more area-specific monitoring programs that are currently underway through the support of agencies such as the Louisiana DNR and USACE.

BICM will provide long-term morphological datasets on all of Louisiana's barrier islands and shorelines rather than just those islands and areas that are slated for coastal engineering projects or have had construction previously completed. BICM also specifically provides a larger proportion of unified, long-term datasets that will be available to monitor constructed projects, plan and design future barrier island projects, develop operation and maintenance activities, and assess the range of impacts created by past and future tropical storms.

USACE maintains completed reports on all BUDMAT activities.

CWPPRA maintains public reporting to keep track of barrier island restoration projects completed as well as uses the CRMS for gathering water quality and vegetative cover data.

The State of Louisiana through CPRA keeps track of acres created or maintained.

Parties Responsible: State of Louisiana, USACE, CWPPRA

Timetable for Gathering Data: annual reports

How Data is Shared: via agency websites

Possible Data Gaps: none identified

Additional Funding Needed: yes, as available

EM-6 Shoreline Stabilization, Induced Sediment Deposition, and Living Shorelines

OBJECTIVES

- To facilitate maintaining and restoring existing marshes and swamps by reducing shoreline erosion along bays, lakes, canals, and bayous
- To trap or induce sediment deposits in order to maintain and restore existing marshes and swamps as well as build new marshes
- To construct and maintain living shorelines for shore erosion control wherever possible and feasible in order to create and enhance growth and sustain habitat that is naturally resistant to erosion

BACKGROUND/MAJOR ISSUES

Shoreline erosion occurs wherever land meets water, and people have been trying to combat it since ancient times. This Action Plan supports the overall alliance objective of maintaining and restoring existing marshes and swamps by protecting the slightly elevated shoreline rim therefore protecting marshes behind the shore from wave attack and saltwater.

Sediment trapping and inducing structures are most effective at improving deposition and preventing resuspension in lower wave energy environments where they baffle small wind-generated waves and where suspended sediment concentration is high. They are less useful in areas of high wave activity such as along canal banks, navigation channels (e.g., the GIWW), or the Gulf of Mexico shoreline where greater likelihood of adverse impacts exists such as



Shoreline stabilization projects involve construction equipment. Image: CPRA

undermining by storm wave action. While traditional structures provide hard substrates that may become colonized by reef building organisms and enhance fishing habitat, living shoreline technologies are specifically designed to promote sustainable habitat that naturally resists erosion and undermining. A possible issue at stake with induced sedimentation is the ownership of created land when projects are constructed using federal or state funds.

DESCRIPTION

Shoreline stabilization refers to measures that reduce or halt shoreline erosion. Shoreline stabilization is recommended wherever shoreline erosion is a problem. Preferred technologies and building materials for shoreline stabilization projects will vary by site due to location-specific conditions (e.g., elevations, soil strength, and exposure to wind and

waves). The distance and orientation of structures relative to the shoreline can also influence their success.

Sediment inducers and sediment trappers refer to stabilization measures that also aim to build land through deposits of suspended sediment from the water column. Living shorelines stabilize shorelines (and perhaps also act as sediment inducers or trappers) using structures made from natural and man-made materials (e.g., wetland plants, submerged aquatic vegetation, oyster reefs, sand, and stone) that are designed to reduce erosion while retaining or enhancing ecological processes. Table EM-6.1 provides stabilization technologies.

This plan supports limited construction of projects of local concern that are favored by local government and landowners even though it might not affect large areas of the BTB. This action is recommended

especially in areas where blowouts exist – where erosion has occurred to the point where marshes abut canals and other water bodies as well as in areas where extensive marsh erosion may occur. Sediment inducing and trapping techniques are encouraged whenever practical based on the project locality, cost, and availability of suspended sediment. Wherever feasible, living shorelines are also recommended as they act to promote establishment and growth of habitat and organisms important to the coastal ecosystem and should also resist erosion naturally and sustainably.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

CPRA and USACE

CPRA and USACE construct various shoreline stabilization projects to protect land and maintain navigation.

CWPPRA

CWPPRA has constructed various shoreline stabilization devices over its existence.

Other Likely Implementers

LDNR; LDEQ; LDWF; LDAF; Louisiana Department of Culture, Recreation, and Tourism (LDCRT); BLFWD; Bayou, Soil, and Water Conservation Districts; and other quasi state agencies, citizen action groups, parish governments, and landowners.

TIMELINES AND MILESTONES

Laying out a conceptual timeline for implementing this Action Plan is difficult. Locations where shoreline erosion is a problem have been well identified in the BTES, but other critical areas may arise, for example, if threatening a pipeline or other structure. The lack of a reliable source of funding and the general high cost of shore protection precludes setting up a timeline for implementation.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Determining costs for implementing projects in this Action Plan is also difficult. Shoreline stabilization projects can vary greatly in their scope and are often included as components of larger projects in combination with other types of ecological restoration such as marsh creation using dredged material, hydrologic restoration, or barrier island restoration (considered separately). A possible range of costs for individual projects is suggested from examples of completed projects below.

Terrebonne Bay Shore Protection Demonstration (CWPPRA, TE-45), Cost: \$2.74 M

Purpose: demonstration of the cost and effectiveness of three shoreline protection methods (gabion mats, concrete onshore armor units, and foreshore triangular units) for their ability to abate erosion and develop and sustain oyster reef

Lake Salvador Shore Protection Demonstration (CWPPRA, BA-15), Cost: \$2.8 M

Purpose: test four shoreline protection methods for effectiveness in reducing erosion and construct 9,000 ft of rock shoreline stabilization to protect the shoreline and adjacent marsh from wave-induced erosion

GIWW Bank Restoration of Critical Areas in Terrebonne (CWPPRA, TE-43), Cost: \$13 M

Purpose: restore and armor critical lengths of deteriorated channel banks along the GIWW with construction of over 40,000 linear ft of foreshore rock dike protection

West Lake Boudreaux Shoreline Protection and Marsh Creation (CWPPRA, TE-46), Cost: \$17.9 M

Purpose: reduce erosion of the west Lake Boudreaux shoreline and protect emergent marsh with over 10,000 linear ft of rock dike; Note: The cost also includes a significant marsh creation component.

Table EM-6.1 Shoreline Stabilization Technologies

Technology	Description and Comments
Bulkheads	Hard structures built at the shoreline, designed to protect land behind from erosion or to stabilize a vertical earthen embankment; may be constructed from timber, steel, plastic or concrete sheet pile, or cast-in-place concrete
Seawalls	Hard structures built at or behind the shoreline, usually designed to protect the land behind from erosion due to wave attack; may be constructed from timber, steel, plastic or concrete sheet piles, stones, or cast-in-place concrete
Breakwaters+	Barriers (typically made of stone) constructed parallel to and off a shoreline; designed to lower wave energy that reaches the shore and slow sediment movement
Segmented Rock Breakwaters+	Rectangular rock structures placed parallel to a shoreline at varying intervals in open water to diffract incoming waves causing them to lose energy and deposit sediment leeward of the structure; can potentially be used in sediment starved systems
Groins+	Barriers constructed perpendicular to the beach to trap sediment in the littoral drift on the upstream side or to prevent longshore erosion of the downstream side; not recommended due to the potential for downdrift sediment starvation
Timber Pylons+	Treated timber pilings driven deep into soft sediments with cross members attached such that the structure appears as a wide "V" shaped fence pointing away from land; designed to baffle wave energy and promote suspended sediment deposition on the landward side
Revetments+	Hardened coverings constructed on the slopes of shore faces to protect from erosion due to wave attack and current movement; usually constructed of stone, precast concrete armor units, or cast-in-place concrete; usually have a filter system so material is not washed from behind by water

Table EM-6.1 Shoreline Stabilization Technologies (cont'd)

Technology	Description and Comments
Geotextile Tubes* +	Consist of a fine mesh pillow-shaped fabric tube that can be placed then filled with dredged material; function much like rock gabions in that they are self-contained and effective in soft sediments; easily positioned in a variety of arrangements depending upon wave climate and desired results
Foreshore Dikes* +	Low rock dikes placed adjacent to a channel bank to promote sediment deposition when waves break over them; useful along the banks of major navigation channels such as the HNC and the GIWW
Foreshore Reefs* +	Conditions favorable to oyster reef establishment and growth of biological organisms such as oysters; reefs reduce wave energy and promote deposition of suspended sediment
Rock Gabions* +	Diffraction and baffle wave energy to protect the shoreline and promote deposition of suspended sediment; effective in soft unconsolidated sediments
Brush Fencing* +	Consist of treated timber cribbing filled with discarded brush material; (e.g., Christmas trees) useful in low energy environments with adequate suspended sediment to slow current velocities and promote suspended sediment deposition
Terracing* +	Sediment piled to an elevation at which marsh vegetation can colonize using a small dredge or plow; generally built in parallel linear or grid patterns surrounding shallow open water in order to baffle wave energy, create conditions favorable for establishment of submerged aquatic vegetation and marsh expansion, and protect adjacent marsh from wind driven wave erosion
Vegetative Planting* +	Usually established from sprigs or seeds; vegetation stabilizes sediments and accumulates imported sediments
Material Replacement* +	Filling an eroded shoreline, usually with dredged material, to a historical or other desired configuration.

+ A plus sign indicates that structures can act as sediment inducers as well as shoreline stabilizers.

* An asterisk indicates that the technology could represent or include a living shoreline depending on the methods and materials used.

Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (CWPPRA BA-37),
Cost: \$29.4 M

Purpose: prevent erosion along Little Lake shoreline with construction of over 25,000 ft of foreshore rock dike protection; Note: The project also includes a significant marsh creation component.

Estimated costs for shoreline protection in the 2017 Coastal Master Plan is \$800 billion or more. For example, \$184.5 M is estimated for 140,000 ft of rock breakwaters along the GIWW from Bayou LaFourche to Bayou Perot, and \$563.2 M is estimated for 426,000 ft from Bourg to Amelia.

PERFORMANCE MEASURES

Performance measures include:

- linear feet or linear miles of shoreline stabilized or created,
- acres created,
- acres benefited or protected

Data Gathered:

Implementing organizations should maintain design plans with project areas, expected benefits, results of geotechnical analyses, and construction documents with as-built elevations and volumes of material. Monitoring and maintenance reports should also contain data on the project effects.

Monitoring:

Implementing organizations should conduct inspections to monitor the project and its effects. For example, CWPPRA projects are typically monitored for five years. Relevant parameters to be monitored may include elevation, shoreline change, hydrology, and oysters.

Parties Responsible: implementing agency (CPRA, CWPPRA, etc.)

Timetable for Gathering Data: annual reports

How Data is Shared: via agency websites

Possible Data Gaps: none identified

Additional Funding Needed: yes, as available

EM-7 Flood Risk Reduction and Coastal Resiliency

OBJECTIVES

- To provide flood risk reduction measures for property, population centers, ecosystems, etc.
- To anticipate, prepare for, and adapt to changing conditions and withstand and recover from disruptions

BACKGROUND/MAJOR ISSUES

Historically in the vicinity of the BTES, levees and control structures have been used to reduce flooding. There are several levels of flood protection provided by the levees and control structures, which are frequently determined by legislation. Typically, the objective is to provide a 100-year level of protection to all coastal areas, but due to funding constraints and economic feasibility, such endeavors may not always be pursued. The Morganza to the Gulf of Mexico Hurricane Protection Project and the CWPPRA Program have constructed numerous restoration and protection projects and highlight work that is taking place in the BTES boundary (Pages 289-290).

The Morganza to the Gulf of Mexico Hurricane Protection Project, which was authorized in the 2007 WRDA and is contained within the BTES footprint, will provide a 100-year level of protection, if constructed, and will include approximately 98 miles of earthen levee, 22 floodgates on navigable waterways, 23 environmental water control structures and a lock complex consisting of a lock

in the HNC along with an adjoining floodgate and a dam closure. Of the 98 miles of earthen levee, the Terrebonne Levee and Conservation District (TLCD) has the responsibility of maintaining and operating approximately 75 miles, including 11 floodgates, and 90 flap or sluice gates at 24 locations. This project reduces storm surge risk to people and property as well as the remaining fragile marsh from tropical storm and hurricane storm surge in the vicinity of Houma, Louisiana. A map of the authorized features of the project is presented in Figure EM-1.

Wetland loss, subsidence, and sea level rise are some of the major causes increasing coastal vulnerability to storm impacts. While measures are put in place to protect coastal communities from storm surge and subsequent flooding, Louisiana is losing wetlands, its natural storm buffer, at a rate equal to that of a football field an hour as calculated by USGS. In fact, some of the most rapid land loss rates are occurring in the BTB. Programs such as the CWPPRA Program are supporting coastal resiliency by identifying these coastal areas in need and executing land building projects, hydrologic modification projects, shoreline protection projects, and other types of restoration in those areas. Similarly, any wetland loss experienced in construction of a Hurricane Storm Damage and Risk Reduction System (HSDRRS) project or other flood risk reduction projects must be mitigated through construction of additional wetlands. Without land building across coastal Louisiana, flood protection measures are less effective at reducing the risk of flooding during a flood event.

Plans exist to construct and expand the flood protection and resiliency measures already in place. Several projects are still in construction, others still in design, and there are plans for more flood risk reduction projects provided at the federal, state, and local levels. These plans would benefit the BTES in its entirety including its populations, communities, ecosystems, and its diverse marine and aquatic habitat.

Contingent upon economic feasibility, flood risk

reduction and coastal resiliency efforts should be implemented in all areas where a need exists, and any unavoidable wetlands losses can be addressed.

DESCRIPTION

This Action Plan will recommend measures that if put in place will reduce flood risk and maintain and support coastal resiliency within the BTES when and where feasible. Flood risk management seeks to reduce flood risks by *managing the floodwaters* to reduce the probability of flooding and by managing floodplains and coastal areas to reduce the consequences of flooding. Flood risk management requires integrating and synchronizing programs at various levels of government designed to reduce flood risk. Damage to infrastructure, homes, businesses, and ecosystems due to storm surge risk and rainfall events can be reduced with structural and non-structural flood protection projects.

Earthen levees, concrete walls, flood gates, or pumps are structural components of a flood risk reduction project, with earthen levees typically being the principal component. Approximately 170 miles of planned and existing levees within the BTES boundaries provide hurricane risk reduction to the populations and ecosystems in the BTB. These levee projects include the St. Mary Backwater Flooding project, Morganza to the Gulf of Mexico Hurricane Protection Project, Valentine to Larose, Larose to Golden Meadow, Cut-off/Point Aux Chene Levee, Kraemer Bayou Boeuf Levee Lift, St. Charles West Bank Hurricane Protection Levee, East Harvey Canal Interim Flood Protection, West Bank and Vicinity, Rosethorne Tidal Protection, Jean Lafitte Tidal Protection, Lafitte Area Levee Repair, and the New Orleans to Venice project. The HSDRRS, which was authorized in 2005 following Hurricanes Katrina and Rita, provides risk reduction against a 100-year level of storm surge through construction of levees, floodwalls, locks, and pumping stations. Currently, two HSDRRS projects (the West Bank and Vicinity and the New Orleans to Venice Hurricane Risk Protection projects) within the BTES are being

constructed and will provide flood risk reduction to the BTB.

If implemented, non-structural flood protection, consisting of elevating and flood proofing homes and businesses, is an indicator of resilience. The 2012 Coastal Master Plan developed 116 conceptual non-structural projects for areas inhabited along coastal Louisiana. The number of non-structural projects across coastal Louisiana is expected to increase the plan recommends 26,569 structures for mitigation at a cost of \$6.06 billion. The program is expected to grow in the coming years if funding can be identified. In addition, communities can also enact procedural and programmatic changes such as enactment of building codes and ordinances to help reduce flood risk and support coastal resiliency within the BTES boundary.

Some of the issues experienced in implementing flood risk reduction measures and coastal resiliency efforts include induced development and the potential for some levee alignments to increase flood population at risk.

There is a potential to reduce flood risk and increase coastal resiliency in Louisiana by maintaining current knowledge of our existing and proposed levee systems, our flood control structures and their operations, and taking advantage of a wide range of resiliency measures, structural and non-structural. The definition of resiliency as used in this document is based on Executive Order, 13653 of November 1, 2013 (Preparing the U.S. for the Impacts of Climate Change), in which the President defined resilience as “the ability to anticipate, prepare for and adapt to changing conditions and withstand and recover from disruptions.”

Resilience represents a comprehensive, systems-based, life-cycle approach to both acute hazards and changes over time, and the concept of resilience is used to convey a broad-based, collaborative approach to finding creative solutions to such challenges. USACE has divided resilience into four

key principles: prepare, absorb, recover, and adapt. USACE supports this definition of resilience and believes the four principles convey the elements of the President’s definition as a step-wise framework for action.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

USACE, New Orleans District

To date, USACE has completed the engineering and design on two HSDRRS projects located within the BTES boundary (the West Bank and Vicinity and the New Orleans to Venice Hurricane Risk Protection projects), which together of 129 miles of earthen levees. These levees provide reduction of risks from flooding to the surrounding area in the BTES.

CPRA, State of Louisiana

The 2017 Coastal Master Plan recommends 124 projects that build or maintain more than 800 square miles of land and reduce expected damage by \$8.3 billion annually by year 50 or by more than \$150 billion over the next 50 years. It includes 79 restoration projects, 13 structural risk reduction projects, and 32 nonstructural risk reduction projects that will be implemented throughout coastal Louisiana. Restoration projects build or maintain land and support productive habitat for commercially and recreationally important activities coastwide. Structural risk reduction projects reduce flood risk by acting as physical barriers against storm surge. Nonstructural risk reduction projects elevate and floodproof buildings and help property owners prepare for flooding or move out of areas of high flood risk. Specifically, nonstructural mitigation measures may include non-residential structure floodproofing, residential structure elevation, or voluntary residential structure acquisition. The nonstructural risk reduction projects include a total of 26,000 structures recommended for mitigation at a cost of \$6 billion. The program includes 1,400 floodproofings, 22,000 elevations, and 2,400 voluntary acquisitions.



Local residents raise their homes to prevent flood damage. Image: Lane Lefort Photography

TLCD

TLCD is currently responsible for 70 miles of levees, 11 navigable floodgates, and 9 locations with either flap or sluice gates. In addition, TLCD is working on the Morganza to the Gulf Hurricane Risk Reduction System. When completed, the Morganza to the Gulf system will extend from Gibson, Louisiana to Lockport, Louisiana in Lafourche Parish. This levee alignment protects most of the five bayou communities (Pointe-aux-Chenes; Montegut; Chauvin, Robinson Canal, and Cocodrie; Dulac; Dularge and Theroit) located in the southern portion of Terrebonne Parish.

As of August 2016, TLCD currently operates two pump stations, one of which serves a flood protection purpose (Bayou LaCache marsh management pump station located on the north bank of Bush Canal between Bayou Terrebonne and Bayou Petit Caillou).

TIMELINES AND MILESTONES

Over the next several years, USACE will continue with construction of the West Bank and Vicinity and the New Orleans to Venice Hurricane Risk Protection

projects.

CPRA will be implementing its 2017 Coastal Master Plan and continue constructing flood risk reduction projects in the BTES as funding allows. The State of Louisiana plans on expanding its non-structural flood risk reduction program in the future if funding allows.

Currently, TLCD is performing the engineering and design for two drainage projects in the Petit Caillou and the Chachoula areas that will pump water out of the levee system to protect the area from flooding. TLCD is seeking funding from the state to complete the two drainage projects.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

USACE's objective is to cost effectively reduce flood risk. Currently, the estimated cost of the West Bank and Vicinity and the New Orleans to Venice Hurricane Risk Reduction projects is roughly \$5.5 billion combined. Implementation of these projects is funded through the HSDRRS program.

The Morganza to the Gulf of Mexico Hurricane Protection Project was reauthorized for construction in WRDA 2014 at a cost of \$10.3 billion. No Federal funds have been provided at this time.

The State of Louisiana will implement flood risk reduction projects as provided for in the 2017 Coastal Master Plan and will continue to implement as well as cost share on federal projects that reduce flood risk.

TLCD is performing the engineering and design for two drainage projects and plans to apply for state money to complete those projects. In addition, the TLCD won voter approval for two local sales tax initiatives for the Morganza to the Gulf system; 50 miles of the 98 mile levee system has been constructed using only local and state funding.

One example of successful funding opportunities is the Louisiana Department of Housing and Urban Development (HUD) who, in response to National Disaster Resilience Competition (NDRC), received \$92,629,249 in NDRC funding to support its Louisiana Strategic Adaptations for Future Environments Program (LA SAFE). LA SAFE seeks

to protect coastal wetlands in and around southeast Louisiana, retrofit communities to withstand increased flooding risk, and reshape high-ground areas to maximize their use and safety. The NDRC funds will also enable a tribal community on the Isle de Jean Charles, which has experienced a 98 percent loss of land since 1955, to relocate to a resilient and historically-contextual community. The Isle de Jean Charles, home to the Band of Biloxi-Chitimacha-Choctaw tribe located in Terrebonne Parish is being recognized as one of the first communities in the United States to be moved in response to sea level rise and coastal land loss, making them a model for future response to improving resilience.

With a focus on coastal resiliency, CWPPRA annually provides about \$15 million in funding for the engineering and design and around \$60 million for the construction, operation, maintenance, and monitoring of coastal restoration projects. These types of projects help improve resiliency by reinforcing the natural storm buffer of coastal Louisiana. Funding for CWPPRA comes from the Sports Fish Restoration and Boating Safety Trust Fund, which is supported



South Lafourche floodgate conversion. Image: South Lafourche Levee District

by various fuel taxes and taxes collected on a variety of sport fishing related goods. Program funds are made available to projects as they move through the selection process.

PERFORMANCE MEASURES

Performance measures include:

- communities, infrastructure, population centers, and assets protected
- change in flood damage costs based on insurance claims

Data Gathered:

- All responsible organizations maintain a list of ongoing and planned flood risk reduction projects and corresponding fact sheets.
- The State and USACE maintain a list of acres restored/protected for HSDRRS mitigation projects.
- TLCD maintains an up-to-date emergency contingency plan for operations of structural flood protection components during storms or flood events.
- CWPPRA maintains acres created/restored for coastal restoration projects.

Monitoring:

All organizations monitor levee systems and other flood protection structures regularly.

Parties Responsible: USACE, State of Louisiana, and TLCD

Timetable for Gathering Data: annual Levee Inspection Reports

How Data is Shared: via agency websites

Possible Data Gaps: none identified

If Additional Funding is Needed: yes, as available.

EM-8 Pollutant Identification and Assessment

OBJECTIVES

- To facilitate access to accurate and timely water quality data for the BTES by the public, researchers, and governmental agencies
- To facilitate access to Geographic Information System (GIS) data and mapping for hydrology, land use, permitted facilities discharging to BTES water bodies, and other related topological parameters that will promote better identification of current or potential water quality impacts

BACKGROUND/MAJOR ISSUES

Based on the draft *2016 Water Quality Integrated Report (IR)*, currently, LDEQ monitors and assesses 94 separate basin subsegments (water quality assessment units) in the BTES. Assessments occur every even numbered year as required by the CWA. Most assessments are based on a percentage of ambient data results that meet water quality standards. The typical period of for each IR is the four years prior to report development; however, due to the four-year rotating monitoring cycle, most subsegments only have one year of data (October – September) available for each IR assessment. Suspected causes of impairment for each subsegment are reported in the IR. A limited number of suspected causes of impairment are based not on ambient data but on other available information such as fish consumption advisories and non-native aquatic plants. Table EM-8.1 summarizes the different suspected causes of impairment found in the BTB.

In order to address the reported impairments, accurate and up-to-date water quality data and topological information is important to target actions that are most likely to result in water quality improvements and protection. A number of local, state, federal, BTNEP, and academic institutions are

currently engaged in a variety of water quality and GIS data acquisition. By identifying these sources, BTNEP and its partner agencies can promote better coordination between researchers and water quality protection agencies to avoid costly resampling or reanalysis of data that have already been collected.

While not identified as such in Table EM-8.1, eutrophication is a known priority problem in the Gulf of Mexico and within the bayous, lakes, and estuaries of the BTES. Through the development of a comprehensive GIS, linking land uses to nutrient concentrations, identification of point source and any other source loadings within the basins and estimating movement of water from interbasin discharge (e.g., the Mississippi River) could be accomplished. Similarly, knowledge of the density of fecal coliform bacteria and concentrations of toxic contaminants will assist managers in addressing and evaluating identified problems related to public health and aquatic toxicity. Without such a system, managers will be faced with the task of redeveloping such estimates for each individually proposed project or any management changes within the BTB. Additionally, speculation concerning the eutrophication and contaminant impacts by project opponents may be difficult or impossible to successfully dispute if a systematic quantitative approach for loading projection is not put in place prior to specific project evaluations. Long delays in project implementation may result in the absence of such an approach.

In addition to the potential contaminants described above, a significant legacy of contamination is likely to exist from the past practice of discharging produced water directly into BTES water bodies. Effective in 1995, State regulation banned the practice of discharging produced water into coastal waterbodies (LAC 33:IX.708.C.2.b). However, prior to this time, the practice was widespread and resulted in heavily contaminated sediments in the vicinity of the discharges. Boesch and Rabalais (1989) looked at outer continental shelf discharges and concluded that the total volume of produced water entering estuarine and coastal waters in the Gulf of Mexico

Table EM-8.1

Suspected cause of impairment in the BTB based on the Draft 2016 Water Quality Integrated Report and the number of impaired segments for each suspected cause.

Suspected Causes of Impairment	Number of Impaired Subsegments
Non-Native Aquatic Plants	27
Fecal Coliform	25
Oxygen, Dissolved	20
Nitrate/Nitrite (Nitrite + Nitrate as N)	11
Phosphorus (Total)	11
Turbidity	8
Total Dissolved Solids	7
Residual Surface and Sub-surface Oil/Tar Balls/Tar Mats	6
Sulfates	6
Chloride	4
Enterococcus	2
Mercury in Fish Tissue	2
pH, High	2

was estimated to be approximately 435,000 barrels per day and mainly located in the BTES region. St. Pê (1990) reported that an estimated 530,000 barrels per day were released into the BTES based on 1987 estimates. This volume was generated from over 300 individual discharges from oil and gas production facilities. Limited information is available at this time to identify all of these former discharge points; therefore, it may not be possible or feasible to locate and remediate these areas.

Identification and assessment of potential pollutants in the BTES is critical to understanding where water quality concerns may exist. This understanding will permit a more targeted effort to maintain and restore water quality in the BTES. In particular, excess

nutrients from regional agriculture poses a potential risk to area water bodies. As such, efforts should be made to coordinate with the Louisiana Nutrient Management Strategy to identify and mitigate excess nutrient sources. Other targeted parameters include oxygen demanding substances, fecal coliforms, and toxic pollutants such as organic compounds and metals. Existing sources of data and information include but are not limited to those found in Table EM-8.2.

DESCRIPTION

Whenever possible, direct links to the various data sources are provided in Table EM-8.2. If direct data links are not available, then links to agency or university or NGO websites are provided to facilitate contacting these entities to determine the scope and availability of their data. All identified data sources are based on monitoring and/or research in the BTES.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

Lead agencies or entities are those listed in Table EM-8.2. Links to these entities are also provided where available.

TIMELINES AND MILESTONES

All timelines and milestones for this management plan are based on the requirements of the agencies or entities identified above. Timelines and milestones for filling in data gaps will be based on requirements of the agencies or entities with a potential for gathering additional data under existing or yet-to-be developed monitoring programs.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Agencies and entities collecting data and working to solve problems project varying costs.

Agencies and entities identified above have existing limited sources of funding for their programs. Any

additional monitoring to fill in data gaps will have to be funded from yet to be identified grants or other program resources.

PERFORMANCE MEASURE

Performance measure is the number of impaired subsegments. In order to ensure the integrity and accuracy of the data made available through this management plan, all data, assessments, and information should be collected or developed with the best possible Quality Assurance/Quality Control (QA/QC) measures. QA/QC requirements are frequently a requirement of the funding source for most sampling programs.

Data to be shared via:

- website links on BTNEP website to agency data
- website links to GIS apps
- data types listed in Table EM-8.2

Data Gathered:

Data may be gathered by the organizations identified in Table EM-8.2 but are not limited to those found in Table EM-8.2. To the extent permitted by the data gathering agency or entity, all data will be made available to the public, researchers, and governmental agencies through websites or direct contact with the data gathering organization. Table EM-8.3 provides possible data parameters.

Monitoring:

Monitoring programs are based on data gathering requirements of the agencies and entities listed in Table EM-8.2.

Parties Responsible: Responsible parties are those listed in Table EM-8.2.

Timetable for Gathering Data: Timelines for gathering data are based on data gathering requirements of the agencies and entities listed in Table EM-8.2.

Table EM-8.2. Website links to agencies and entities either collecting or with the potential for collection of water quality and other data or information in the BTES.

State Agencies	Data Type	Description of Available Website Information	Website Link
LDEQ	Ambient Water Quality Monitoring Program	Water sample and meter readings from Statewide ambient monitoring sites typically sampled monthly for 12 months.	http://www.deq.louisiana.gov/portal/tabid/2739/Default.aspx
	Water Quality Integrated Reports	Water quality assessment reports mandated by the Clean Water Act produced in April of even numbered years.	http://www.deq.louisiana.gov/portal/DIVISIONS/WaterPermits/WaterQualityAssessment/WaterQualityInventorySection305
	NPS Program's WIPS and NPS Management Plans	Special project water quality data collected in support of Nonpoint Source WIPs or other pollution reduction efforts.	http://nonpoint.deq.louisiana.gov/
	Aquifer Evaluation and Protection	Groundwater data collected to assess and protect drinking water aquifers.	http://www.deq.louisiana.gov/portal/tabid/108/Default.aspx
	Source Water Assessment Program	Surface or groundwater data collected as part of drinking water source protection efforts.	http://www.deq.louisiana.gov/portal/Default.aspx?tabid=1744
	Mercury in fish, vegetation, sediment, water	Mercury and related data from fish tissue and other matrices used to assess the need for fish consumption advisories related to mercury.	http://www.deq.louisiana.gov/portal/tabid/2733/Default.aspx (fish) http://www.deq.louisiana.gov/portal/tabid/2734/Default.aspx (vegetation) http://www.deq.louisiana.gov/portal/tabid/2735/Default.aspx (sediment) http://www.deq.louisiana.gov/portal/tabid/2732/Default.aspx (water)

State Agencies	Data Type	Description of Available Website Information	Website Link
LDEQ (cont'd)	Enforcement actions	Effort by the LDEQ Inspections and Enforcement Divisions to identify and correct illicit discharges to water or other media.	http://www.deq.louisiana.gov/portal/DIVISIONS/Enforcement.aspx
	Permitted facilities and other data or information in GIS	Primarily locational information for facilities permitted by LDEQ for water discharges.	http://map.ldeq.org/Default.aspx
	Nutrient Management Strategy	Contains information and reports on multi-agency coordination of nutrient management strategies.	http://www.deq.louisiana.gov/portal/DIVISIONS/WaterPermits/WaterQualityStandardsAssessment/NutrientManagementStrategy.as
	Fish kill investigations or other incidents may be available through LDEQ's EDMS	Reports by LDEQ's Inspections Division on fish kill or other incident investigations that may or may not be water related.	http://www.deq.louisiana.gov/portal/ONLINESERVICES/ElectronicDocumentManagementSystem.aspx
CPRA	SWAMP	Coast-wide and basin-wide monitoring plans for Louisiana's SWAMP, Version III	http://coastal.la.gov/ http://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=11464 asp?Root=0&sid=11464 ElectronicDocumentManagementSystem.aspx
	CRMS (CPRA and USGS)	Monitoring of the effectiveness of individual projects as well as monitoring the cumulative effects of all projects in restoring, creating, enhancing, and protecting the coastal landscape.	https://lacoast.gov/crms2/Home.aspx

State Agencies	Data Type	Description of Available Website Information	Website Link
LDH	BEACH monitoring program for Enterococcus	Tests water at 24 beach sites along the Louisiana coast to determine whether the water quality meets EPA criteria. Water samples are collected weekly during Louisiana's beach season between the months of May and October.	http://www.dhh.louisiana.gov/index.cfm/page/288 (Data available upon request) https://watersgeo.epa.gov/beacon2/ (EPA data repository for BEACH monitoring information)
	Molluscan shellfish program	The Molluscan Shellfish Program is the regulatory agency for the oyster harvesting waters along Louisiana Gulf Coast. The harvesting areas are set forth by the Louisiana Sanitary Code and the National Shellfish Sanitation Program.	http://www.ldh.louisiana.gov/index.cfm/page/629 (Data available upon request)
	Harmful algal bloom monthly monitoring for <i>Karenia brevis</i> as part of molluscan shellfish program	Part of Molluscan shellfish program.	http://www.ldh.louisiana.gov/index.cfm/page/629 (Data available upon request)
LDNR	LDNR Home Page	State natural resource agency.	http://dnr.louisiana.gov/
	Office of Coastal Management	The Office of Coastal Management is responsible for the maintenance and protection of the State's coastal wetlands. The main function of the Office of Coastal Management is the regulation of uses in the Louisiana coastal zone, especially those which have a direct and significant impact on coastal waters.	http://dnr.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=85&ngid=5

State Agencies	Data Type	Description of Available Website Information	Website Link
LDNR (cont'd)	Office of Conservation	The Office of Conservation is charged with conserving and regulating oil, gas, and lignite resources of the State.	http://dnr.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=46&ngid=4
	SONRIS	Multifaceted data repository for natural resource data and information.	http://sonris.com/
LOSCO	Identification of oil spill sites	LOSCO's primary function is to ensure effective coordination and representation of the State's interests in all matters related to spill response and prevention.	http://www.losco.state.la.us/
LDWF	LDWF home page	State wildlife and fisheries resource agency	http://www.wlf.louisiana.gov/
	Marine Fisheries Management Plans	PDF reports for a variety of marine fisheries management plans	http://www.wlf.louisiana.gov/fishing/fishery-management-plans-marine
	Inland Fisheries Management Plans	PDF reports for a variety of inland fisheries management plans	http://www.wlf.louisiana.gov/fishing/waterbody-management-plans-inland
	Creel Surveys	LA Creel gives managers more confidence in their data and a better foundation for management of our fisheries.	http://www.wlf.louisiana.gov/about-la-creel
	Fish kill investigations		
	Aquatic Vegetation Control Plans	PDF reports for a variety of aquatic invasive species control plans.	http://www.wlf.louisiana.gov/fishing/aquatic-vegetation-control-plans

State Agencies	Data Type	Description of Available Website Information	Website Link
LDAF	LDAF home page	State agriculture and forestry resource agency.	http://www.ldaf.state.la.us/
	Soil and Water Conservation Districts	The Office of Soil & Water Conservation provides financial assistance, administrative support, centralized direction and coordination to SWCDs which provide conservation planning services to landowners within their individual districts.	http://www.ldaf.state.la.us/conservation/soil-water-conservation-districts/
	Conservation Programs	Provides links to a variety of State conservation programs.	http://www.ldaf.state.la.us/conservation/conservation-programs/
	Information and Education	Provides links to a variety of State water, soil, wetland, farming, and forestry education programs.	http://www.ldaf.state.la.us/conservation/conservation-information-education/
	Pesticide and Environmental Programs	LDAF is the State's lead agency in regulation of pesticide use and application. LDAF's Pesticide and Environmental Programs Division is responsible for all aspects of pesticide use to minimize unnecessary impacts by pests to agriculture and society in general while protecting human health, the environment, and endangered and threatened species as mandated by the federal law.	http://www.ldaf.state.la.us/ldaf-programs/pesticide-environmental-programs/
BTNEP	BTNEP home page	A partnership of government, business, scientists, conservation organizations, agricultural interests, and individuals for the preservation, protection, and restoration of the BTES in southeast Louisiana.	www.btnep.org
	Invasive species studies	Promotes awareness of invasive species in the BTES in order to promote reductions in the spread of these species.	http://invasive.btnep.org/InvasiveHome.aspx
	BTNEP Projects	BTNEP develops projects that help better understand the ecological, social, and geologic processes that all play a role in the restoration of the BTES.	http://www.btnep.org/BTNEP/projects/ProjectList.aspx

Federal Agencies	Data Type	Description of Available Website Information	Website Link
USEPA	STORET and WQX	EPA's primary water quality data storage and retrieval tool. Compiles data from multiple agencies and private research groups.	https://www.epa.gov/waterdata/storage-and-retrieval-and-water-quality-exchange
	WATERS	WATERS unites water quality information previously available only from several unconnected databases.	https://www.epa.gov/waterdata/waters-watershed-assessment-tracking-environmental-results-system
	ATTAINS	ATTAINS is an online system for accessing information about the conditions in the Nation's surface waters.	https://www.epa.gov/waterdata/assessment-and-total-maximum-daily-load-tracking-and-implementation-system-attains
	NEP	The NEP is a collaborative, effective, efficient, and adaptable coastal ecosystem-based network.	https://www.epa.gov/nep
NOAA	Home Page	NOAA enriches life through science. NOAA's reach goes from the surface of the sun to the depths of the ocean floor keeping citizens informed of the changing environment.	http://www.noaa.gov/
	Oceans and Coasts	NOAA's National Ocean Service is positioning America's coastal communities for the future	http://www.noaa.gov/oceans-coasts
	Fisheries	NOAA Fisheries provides science-based conservation and management for sustainable fisheries and aquaculture, marine mammals, endangered species, and their habitats.	http://www.noaa.gov/fisheries
	HAB monitoring	HAB monitoring and research information	http://oceanservice.noaa.gov/hazards/hab/
	NOAA Environmental Response Management Application	An online mapping tool that integrates key information to support environmental and severe weather responses in the Gulf of Mexico.	http://response.restoration.noaa.gov/maps-and-spatial-data/environmental-response-management-application-erma/gulf-mexico-erma.html
USDA	NRCS	Provides farmers and ranchers with financial and technical assistance to voluntarily put conservation on the ground.	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/dma/

Federal Agencies	Data Type	Description of Available Website Information	Website Link
USDA (cont'd)	Research and Science	Fosters continued economic growth, adapting to the effects of climate change and addressing food security in the United States.	http://www.usda.gov/wps/portal/usda/usdahome?navid=research-science
	Conservation	USDA recognizes that conservation by farmers, ranchers, and forest owners means thriving and sustainable agriculture.	http://www.usda.gov/wps/portal/usda/usdahome?navid=conservation
	Natural Resources Assessment	The USDA NRCS documents the effects of conservation practices and systems at various geographic levels so better decisions can be made initially and risk is managed more effectively.	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/
	ARS	USDA Agricultural Research Service, a premier scientific organization, coordinates research that solves problems affecting Americans daily.	https://www.ars.usda.gov/
USGS	Streamflow data	Historical instantaneous stream flow data portal.	http://waterdata.usgs.gov/la/nwis/uv/?referred_module=qw
	NWIS	Streamflow and water chemistry data portal.	http://maps.waterdata.usgs.gov/mapper/index.html
	International Charter "Space and Major Disasters"	The International Charter "Space and Major Disasters" (Charter) serves as an important source of satellite imagery for response to major natural and man-made disasters worldwide.	http://hdds.usgs.gov/international-charter
	EROS	Satellite imagery portal.	http://eros.usgs.gov/
Other	Data Type	Description of Available Website Information	Website Link
LUMCON	BayouSide Classroom	Student and teacher educational opportunities.	http://www.lumcon.edu/education/K-12/StudentDatabase/
	Teacher Education & Resources	Student and teacher educational opportunities.	http://www.lumcon.edu/education/Teacher.asp
LPBF	HydroCoast	Maps of Pontchartrain & Barataria Basins showing salinity, habitat, weather, water quality, and biological information.	http://saveourlake.org/coastal-hydromap.php
TNC	Grand Isle, Louisiana	Information on TNC's Grand Isle conservation areas.	http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/louisiana/placesweprotect/grand-isle.xml

Table EM-8.3

Possible data parameters collected by organizations monitoring in the BTES. Other organizations may collect additional parameters.

Dissolved Oxygen	pH	Chlorides
Sulfate	Total Dissolved Solids	Nitrate/Nitrite Nitrogen
Total Phosphorus	Conductivity	Water Temperature
Metals	Total Kjeldahl Nitrogen	Ammonia
Total Organic Carbon	Salinity	Hardness
Alkalinity	Stream Discharge (Cubic Feet per Second)	Fecal Coliform
Enterococcus	Total Suspended Solids	Total Dissolved Solids
Turbidity		

How Data is Shared: Data is to be shared either by accessing agencies' websites or entities in Table EM-8.2 or by contacting those organizations directly to determine data availability and means of access.

Possible Data Gaps: Sediment contaminant data is likely to be unavailable or dated due to lack of routine sediment monitoring. It may be possible to identify sediment data associated with the LOSCO/NRDA programs. Historical, greater than 20 years old, data may be available from LDEQ's produced water data study conducted in early 1990s. However, this data may be of limited value due to its age, and it is most likely available only as hardcopy.

Harmful Algal Blooms (HAB) continue to be a potential risk in the BTES and across Louisiana. LDH's Molluscan Shellfish Program samples for *Karenia brevis* on a monthly basis in order to help ensure oyster harvesting areas are safe for harvest. Additional sampling or the creation of a quick response team from among interested agencies

would be helpful in protecting the public from the risks of HABs. Several groups, including the Gulf of Mexico Program (GOMP), Gulf of Mexico Alliance (GOMA), and the Gulf of Mexico Research Initiative (GOMRI) may be potential sources for additional HABs monitoring.

It is difficult to calculate loads from much of the field data being collected because flow measurements are not being collected as part of routine LDEQ ambient monitoring or other sampling programs.

Additional Funding Needed: Additional funding is always helpful to agencies and entities engaged in environmental data collection efforts; however, these organizations are responsible for obtaining their own funding sources largely through existing federal, state, or private grants.

REFERENCES

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St. Pè, K.M. (Ed.). (1990). *An Assessment of Produced Water Impacts to Low-Energy, Brackish Water Systems in Southeast Louisiana*. Baton Rouge, LA: Louisiana Department of Environmental Quality Water Pollution control Division.

EM-9 Oil and Produced Water Spill Prevention and Early Detection

OBJECTIVES

- To reduce the number, volume, and impact of petroleum and related fluid spills in the BTES

- To place an emphasis on the prevention and early detection of petroleum and oilfield produced water spills in the BTES

BACKGROUND/MAJOR ISSUES

Petroleum is a complex mixture of hydrocarbons which can be toxic to the plants and animals impacted from a release or spill. Oilfield produced water, in addition to being highly saline, also contains petroleum hydrocarbons and, in oil-bearing formations common to those found in the BTES, is usually associated with high concentrations of radionuclides such as radium 226. These radionuclides often occur naturally in subsurface formations but at far greater concentrations than levels found in unimpacted surface waters.

The BTES is especially at risk to releases of oilfield and injection lines located within its borders. The petroleum industry, along with its supporting infrastructure, constitutes an enormous presence within the BTES compared to other estuaries in the Nation. Much of this infrastructure is located within the sensitive coastal wetlands of the southern BTES, that spill impacts may be increasing in magnitude exist.

Many spills are classified as accidental or due to failures. Many of these incidents are either totally avoidable or could be significantly reduced in impact simply through a more effective enforcement of existing federal and state spill prevention regulations. Clearly, it is preferable to prioritize prevention over response when considering spills of produced water and petroleum products. Additionally, by altering future flowline placement practices in marshlands where possible, early detection of spills could be enhanced.

As an example of one possible beneficial change in current practices, flowlines could be placed along canal spoil banks whenever possible rather than across vegetated wetlands. Then, in the event of a flowline failure, spilled fluids would be noticed more quickly. Corrective actions could then be initiated

more expeditiously, reducing the magnitude of the spill and resulting impacts.

Some of the more damaging and monetarily expensive spills of petroleum are those which occur from flowlines and transfer lines running through internal wetland areas. A leak can go unnoticed for weeks or longer before enough oil has been released to flow through thick wetland vegetation into an adjacent water body where the telltale sheen might be observed.

Perhaps the most ecologically damaging types of oilfield related spills are those which involve releases of produced water from buried injection lines. Since there is often no petroleum-related sheen associated with spills of these highly saline fluids, they can go unnoticed initially, only becoming evident much later when overlying vegetation shows signs of stress or dies.

Either of these types of spills usually results in lengthy and labor-intensive response efforts by agency and industry personnel. The remediation efforts required by the responsible parties in these cases are usually very expensive.

Unfortunately, petroleum and produced water spills are frequent occurrences in the BTES. Exact numbers of petroleum and produced water releases are difficult to obtain since no single agency maintains spill data for the area within the program boundaries. However, the National Response Center (NRC) database provides an avenue to better quantify the number of petroleum related releases within the BTES but not the volume released since many release reports do not contain a reported volume.

DESCRIPTION

The intent of this Action Plan is to encourage developing and implementing a strategy to reduce the number, volume, and impacts of petroleum and related fluid spills into the BTES. This is not a plan which is intended to address oil spill response. Rather, it is a plan to emphasize prevention and early



Image of Deepwater Horizon oil spill in the Gulf of Mexico. Image: NOAA

detection of petroleum and produced water spills because several federal and state agencies along with numerous private groups already have extensive spill response programs. This Action Plan seeks to build upon existing programs which emphasize the premise that preventing spills of petroleum and related oil production fluids would be less environmentally damaging and less costly to industry than reacting to them once they occur.

Implementing this Action Plan supports most of the programmatic goals established by the BTNEP MC in November of 1992. Spills of petroleum and related fluids are sources of toxins in the BTES. Prevention of these incidents will maintain the health of diverse biological communities.

Certain components of petroleum products, particularly the lighter, more volatile fractions, are toxic to wetland plants. Additionally, many spills of oil are also associated with releases of produced

water which can result in the loss of impacted vegetation. As the plant community is lost, the loosely consolidated sediments may be quickly eroded and can revert to less productive open water systems. The successful implementation of this Action Plan could effectively lessen impacts to those areas where spills are occurring.

An accessible, comprehensive database will ensure that the general public as well as agency and industry personnel are better informed of the magnitude and impacts of oilfield related spills. This awareness is a critical first step in developing a truly effective spill prevention program for the BTES. Also, this database is essential in forming a system to monitor the success of the overall program.

Generally, the location of spills and related fluids are not well defined. In contrast, the source of the release, in many cases, may be well defined. For example, oil wells, storage tanks, flares, and process/pressure

vessels may be well defined using Global Positioning System (GPS) units. However, once the product is on the water, the discharge may be distributed in a heterogeneous manner over a wide geographic area. For larger volume petroleum releases, spill trajectories and/or direct observations may be used to determine spill impact locations. Note: The source may originate within the BTES or from an offshore facility as in the case of the Deepwater Horizon oil spill.

The goals of this Action Plan can be accomplished under existing programs administrated by federal and state agencies. On the federal level, the U.S. Coast Guard (USCG) and the U.S. Environmental Protection Agency (USEPA) have responsibilities for responding to spills of petroleum and other oilfield products. Facilities having spills are required by federal law to report those incidents to the NRC (see Section E.c. United States Coast Guard).

From the NRC release reports, spills located within the BTES area and below the GIWW are jurisdictionally assigned to the USCG. Those spills which occur above the GIWW are jurisdictionally assigned to the USEPA. The current policy of the USCG limits their response to spills of oil in sufficient quantities which will cause the formation of an oil sheen. These include sheens created from the discharge of produced water.

The USEPA responds to spills of oil but their responsibilities also require them to be involved in any violation of the 1972 CWA which includes spills of oil field produced water. Both the USCG and the USEPA maintain databases through the NRC which are being used in this Action Plan. Currently, the NRC contains historical release reports dating back to 1990. Many of the release reports do not have a precise latitude/longitude coordinate to pinpoint the release source location. In many cases, only a reference to a physical landmark, surface feature, river mile marker or offshore mineral lease block is provided as a location reference. Once the release reports are spatially enabled (geocoded latitude/longitude) within the boundary of the BTES, the

Table EM-9.1

Summary of NRC Oil Related Release Reports from 1991 through 2015.

Five-Year Interval	Number of Release Reports
1991-1995	4,717
1996-2000	4,270
2001-2005	3,332
2006-2010	3,343
2011-2015	3,193
25 Year Total	18,855

historical reports may be used to determine the number of releases reported, the frequency over time intervals, and other statistics. The 1990-2015 NRC database within Louisiana's territorial limit contains approximately 43,197 oil related release reports, and of those reports, the BTES area contains approximately 19,958 oil related release reports. The Chemical Hazards Response Information System (CHRIS) codes used to identify oil related spills include: GOC, ODS, OFR, OFV, OHY, OIL, OLB, OMT, OOD, OON, ORD, OSX, OSY, OTB, OTD, OTF, OTH, OTW, OUN and NCT. Figure EM-9.1 spatially represents the locations of NRC release reports.

Table EM-9.1 summarizes the number of oil related release reports by five-year intervals beginning with year 1991. On the state level, several agencies have responsibilities which are pertinent to this action. All spills of petroleum as well as those of produced water are legislatively required to be reported to LDEQ.

LDEQ has specific regulations (similar to USEPA's) dealing with spill prevention and containment

safeguards, such as yearly flowline pressure testing and impervious decking requirements. However, the resources required to maintain an effective spill prevention program are not available.

In 1991, the Louisiana legislature passed the Louisiana Oil Spill Prevention and Response Act (Act No. 7) which was intended to complement the Oil Pollution Act of 1990, a federal law commonly known as OPA'90. The Louisiana Oil Spill Prevention and Response Act (LOSPRA) created LOSCO within the Department of Public Safety and Corrects (DPS). LOSPRA also created the LOSCO Interagency Council to assist the Coordinator in the development of a statewide oil spill prevention and contingency plan. The Act also specifically authorizes the Interagency Council to assist "... the coordinator in preparing and approving an annual work plan, identifying state agency needs which must be met in order to comply with the state oil spill contingency plan." It is important to note that LOSPRA does not include authority over produced water spill prevention.

The Office of Conservation, under the Louisiana Department of Natural Resources (LDNR OC) is also a key state agency with oil spill prevention responsibilities. The LDNR OC has specific regulations dealing with containment structures, operational safeguards during the drilling process, and oilfield waste disposal.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

As discussed above, several state and federal agencies share varying degrees of responsibilities primarily pertaining to the prevention of petroleum spills.

LDEQ

The LDEQ is the state lead response agency with regulatory authority pertaining to spill prevention which includes petroleum as well as produced waters. LDEQ, therefore, would be a logical choice for lead implementer of this Action Plan on the state

level. Support implementers should include USEPA, USCG, LOSCO, and LDNR OC.

USEPA

As a co-lead implementer, USEPA uses Spill Prevention, Control and Countermeasures (SPCC) and Facility Response Plan (FRP) rules to assist facilities in preventing unauthorized discharges of oil or hazardous materials into inland waters or adjoining shorelines. Increased emphasis on inspections to verify SPCC plans and FRPs could assist in preventing or significantly reducing unauthorized discharges.

USCG

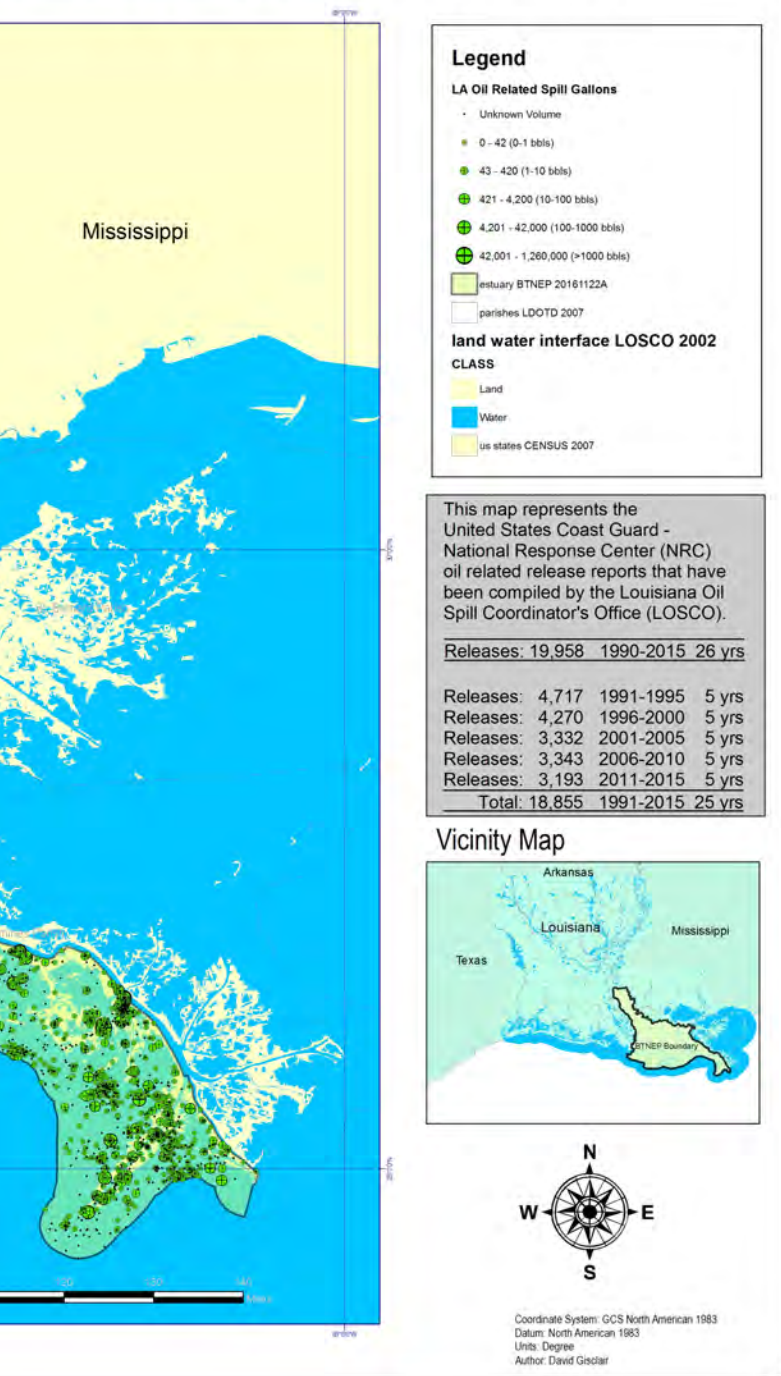
The USCG is the federal lead response agency for unauthorized discharges of oil into coastal waters and deep water ports. The USCG houses the NRC. The NRC is tasked with recording all oil, chemical, radiological, biological and etiological discharges into the environment from reports received by the national hotline at 1-800-424-8802 or from web reports (<http://nrc.uscg.mil>). The NRC release reports are stored in a national database and are provided to the public via yearly spreadsheets. Unfortunately, produced water releases, typically associated with oil production activities, go unreported in the NRC database unless the release creates a sheen.

LOSCO/DPS

The LOSCO in the DPS is tasked with and has developed a statewide oil spill prevention and response plan, taking into account rules developed under the federal Oil Pollution Act of 1990 (OPA'90). LOSCO is authorized to administer and direct all state discharge response and cleanup operations resulting from an unauthorized discharge of oil or threatened unauthorized discharge of oil in coastal waters, the land, or any other waters of Louisiana. As a co-lead implementer in spill response, LOSCO provides assistance with spatial information developed for contingency planning under the Environmental Baseline Inventory (EBI) mandate.

This map displays the distribution of green dots and crosses across the Terrebonne Parish area. The map includes parish boundaries and names such as West Feliciana Parish, East Feliciana Parish, St. Helena Parish, Washington Parish, St. Tammany Parish, St. John the Baptist Parish, St. Martin Parish, St. Mary Parish, and St. Charles Parish. A scale bar at the bottom indicates distances from 0 to 100 miles.

NEP 2016 Estuary Boundary



LDNR OC

The OC is charged with conserving and regulating oil, gas, and lignite resources of the state. This statutory responsibility is to regulate the exploration and production of oil, gas, and other hydrocarbons and lignite; to control and allocate energy supplies and distribution; and to protect public safety and the environment from oilfield waste, including regulation of underground injection and disposal practices. The OC is tasked with public safety and protection of the environment. The Engineering Regulatory Division is responsible for inspecting oil and gas wells and the associated facilities to ensure compliance with regulatory requirements. Increased inspections may assist in the prevention and reduction of unauthorized discharges.

TIMELINES AND MILESTONES

- Form a work group to examine and evaluate the currently-used spill database maintained by the LDEQ, Surveillance Section and the NRC (LDEQ, LOSCO, LDNR, USEPA, USCG) database.
- Design a database which would: 1) maintain accumulated spill data such as source of spill, volumes lost, habitats affected, magnitude of impact, reason for spill, costs associated with clean-up, etc. (Database Work Group) and 2) cross-reference spill unique record identifiers from each reporting source (USCG/NRC, USEPA, DPS, LDEQ, LDNR, and LDWF).
- Construct a database form using an appropriate, widely-used database program and install it on the LDEQ ORACLE system (Database Work Group).
- Maintain database by relying on the LDEQ field offices responsible for responding to these spills to enter data from regional offices via computer links to the LDEQ Oracle system (LDEQ).
- Develop and implement educational programs

which would serve to inform industry, federal, state, and local entities of the seriousness of the spill issue (BTNEP MC, USEPA, USCG, and LDEQ).

- Form a work group to address the LOSCO Interagency Council to inform them of agency needs which must be met in order to comply with the state oil spill contingency plan (BTNEP MC, USEPA, USCG, and LDEQ).
- Encourage effective and fair enforcement of spill prevention regulations throughout the BTES (BTNEP MC, USEPA, USCG, LDEQ, LDNR, and LOSCO).
- Maintain the spill database and use accumulated data to measure the success of this Action Plan (LDEQ).
- Continue educational efforts and incorporate figures on the costs associated with clean-up of spills into educational programs in order to demonstrate the sensibility of effective preventative maintenance programs (even without considering the usually-unquantifiable ecological costs).
- Effectively and fairly enforce spill prevention regulations (USEPA, USCG, LDEQ, and LDNR).
- Encourage federal and state agencies with oil and produced water spill prevention responsibilities to increase inspections of applicable facilities within the BTES (BTNEP MC, USEPA, USCG, LDEQ, and LDNR).
- Use the spill database to identify areas in which success is apparent and those in which further efforts are needed (LDEQ).
- Adjust or redirect the spill prevention program efforts into those areas in which the spill database figures indicate continuing problems (USEPA, USCG, LDEQ, and LDNR).
- Dedicate state resources specifically to oil and

oilfield produced water spill prevention.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Costs will be associated with the level of effort that the BTNEP MC deems necessary or appropriate to accomplish the above described activities. Acceptance of this plan by the agencies or entities listed as lead or support implementer does not commit that agency or entity to implement the plan. At a later date, parties identified as potential plan implementers will work with the BTPO, the BTNEP MC, and other plan implementers to formalize all commitments concerning implementation.

Estimate one person-month per year for monitoring all the aspects of the Action Plan and the cooperative efforts of each agency, including salary, fringe, incidental costs, and indirect costs of approximately \$8,000 for each year with no inflation. Costs of statistical analyses are estimated at four person-months (\$32,000 every five years). A statistical consultant should also be used at the beginning to help design the statistical analysis to be employed at five-year intervals to determine the suitability of existing data and what baseline data are needed (\$16,000 in the beginning). Modifications in monitoring plan (see below) should result in modifications of cost.

PERFORMANCE MEASURE

Performance Measure is:

- number, volume, and impact of petroleum and related fluid spills in the BTES

Monitoring for this Action Plan includes assessing the timely implementation of the components of the Action Plan and the eventual success of implementation (i.e., oil spill prevention increased and petroleum-source contaminants decreased). The first component is not conducive to monitoring in the traditional sense of data collection and analysis (e.g., water quality monitoring), but a tracking system. Monitoring implementation is designed to determine

whether such a spill database was developed, whether it was used in interpretation of information to the public, and whether a better informed public (including agencies and industry) resulted. Eventual project success can be monitored with an analysis of data that shows a reduction of petroleum-related spills (see Table EM-9.1. Summary of NRC Oil Related Release Reports from 1991 through 2015), and a reduction in petroleum-source contaminants in the water, sediments, and biota of BTES. The success of various Action Plans that target reduced sewage pollution, reduced oil related spills, and stormwater management may all be manifested in similar improvements in water quality.

If all Action Plans are working in parallel and water quality improves, it will be difficult to determine the cause and effect. Since the scale of implementation will vary among Action Plans, the level of success in improved water quality will also vary. The probability is high that implementation of any single management scenario may have varying effects in different environments. It is also possible that no single indicator may indicate program success, but success will be seen in a combination of indicators. The end result of multiple actions to improve water quality, however, will be noticeable in indicators of basin-wide ecosystem-level health. Specific

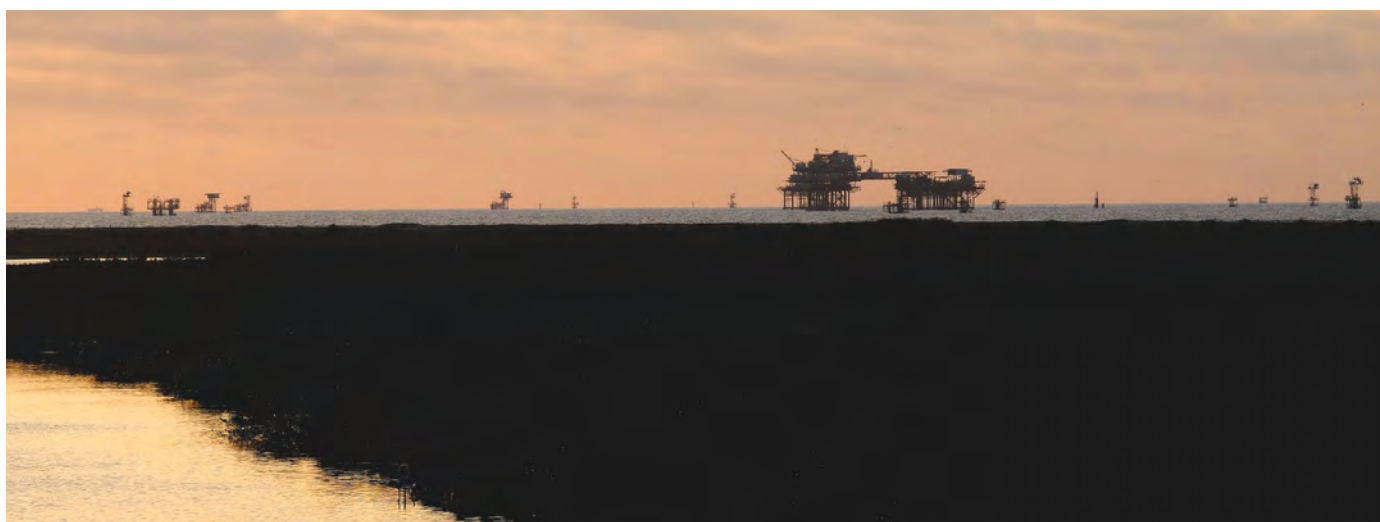
examples of project success are proposed below. They can be expanded or modified. They should be reviewed periodically and amended as appropriate.

Data Gathered:

- EM-9 establishes an accessible, comprehensive computerized spill database of petroleum and related fluids spills in the BTES.
- Interpretive information from the database will be provided to agency and industry personnel and the public to keep them informed of the magnitude and impacts of oilfield related spills. The usefulness of the database and transfer of information will be evident in increased awareness of the impacts of such spills and eventually increased prevention of such spills in BTES.
- Recorded number and volume of spills should be reduced along with petroleum-related contaminants in the BTES.

Monitoring:

Because of the heightened attention on environmental impacts due to the BP oil spill of 2010, the following monitoring strategies are intended to serve as a



Oil platforms off the Gulf Coast of Louisiana. Image: Lane Lefort Photography

statement of the most comprehensive and effective mechanisms to assess the effectiveness of projects implemented under the Action Plans. The monitoring strategies outlined here do not override or replace project monitoring that would be done by an agency related to specific agency-sponsored projects.

A monitor selected by the BTNEP MC will prepare reports to be submitted to the BTNEP MC. Although individuals involved in implementing the Action Plan may prefer a team member to monitor the project, usually a third party offers the best option as the responsible individual for the monitoring. Independent reviewers should be free of vested interests, historic commitments, unrestrained by mission statements, and free from personnel or budgetary actions. The implementer and cooperating agencies will provide the project monitor with data products listed above for subsequent assessment of accuracy and incorporation into reports. The monitor should interact directly with each cooperating agency to determine their level of commitment and activities for the various reports. Success of the monitoring strategy depends on the commitment of participating agencies and individuals to make monitoring an integral part of the CCMP and to provide the Action Plan monitor with the data required to develop reports to the BTNEP MC. An additional outside monitor (i.e., statistician) should be contracted by the BTNEP MC in years one, five, and ten. The results of the statistical analysis should be provided to the overall monitor of the Action Plan for presentation to the BTNEP MC.

The monitor will prepare quarterly reports. Reports will be submitted not less than 15 days prior to a regularly scheduled meeting of the BTNEP MC. The party responsible for the monitoring should be available to discuss the report at the meeting if requested to do so by the BTNEP MC. Monitoring reports will also be provided to the agencies or institutions participating in implementation. Interim reports can be prepared by the monitor at any time to draw the BTNEP MC's attention to significant problems, delays, etc. Statistical analysis of

petroleum and related spills data will be conducted at the end of years five and ten.

Guidance for Monitoring Reports

Quarterly reports to the BTNEP MC shall provide suitable components such as:

- check-off of project landmarks according to the project time line.
- assessment of cooperating agency contributions.
- description of educational programs.
- compilation of recipients of educational programs and their comments.
- assessment of petroleum spill database (accessibility and usefulness).
- statistical analyses.

Technical details may be included in the report in a presentation suitable for the Scientific Technical Committee and/or the BTNEP MC. A summary of the report shall be less than one page and be suitable for presentation to and understanding by the general public.

In addition to the evaluation of the technical accomplishments of the project, the monitor shall:

- identify problems observed during the reporting period and their potential causes.
- predict the short- and long-term consequences of the problems.
- recommend actions to address the problems as well as a potential implementer(s).
- identify a time frame for accomplishment of the recommendations.

Data collected as part of statistical analyses shall be submitted in DIMS compatible format.

BTNEP MC shall receive the quarterly reports. BTNEP MC shall discuss the monitoring document and take actions it feels appropriate with regard to the

implementation of the Action Plan.

BTNEP MC may at the end of any annual cycle change the periodicity or components of the monitoring reports if it feels the frequency or components of reports are inappropriate to keep abreast of the project. Changes in the independent reviewer can be made after any annual cycle but only with the knowledge and participation of the implementer and cooperating agencies, the independent reviewer, and the BTNEP MC.

Parties Responsible: Existing databases are housed in LDEQ (both petroleum and oilfield produced water spills) and the NRC, oil spill data from the USCG and USEPA. The Oil Spill Prevention and Response Act created an Interagency Council which is to assist LOSCO in the development of a statewide oil spill prevention and contingency plan (finished in 1995). The LDNR OC is one of several state agencies with responsibilities for oil spill prevention. The responsibilities and authorities of the above-named agencies are outlined in the Action Plan.

LDEQ is the suggested lead implementer with assistance from each of the above-named agencies. LOSCO has the authority under the Oil Spill Prevention and Response Act to: 1) use funds from the Oil Spill Contingency Fund for oil spill prevention and response purposes and 2) delegate responsibility to implement an oil spill prevention program. LOSCO is identified as the source of funding; the designated implementer would logically be LDEQ.

The development of this database overlaps with the objectives of EM-8 (Nutrient, Bacteria, and Toxic Contaminant Load Evaluation) and EM-13 (Contaminated Sediment Database).

Timetable for Gathering Data: A timeline developed jointly by the funding agency and the implementer will provide the basis for the monitor to assess plan implementation. Because of the multiple components, interactions of components, and involvement of many agencies, a more detailed timeline should be developed to track the progress of

the plan development. Examples of time landmarks follow.

- A lead agency is selected as implementer; a project work group is identified and responsibilities outlined, and a detailed timeline for the project is established.
- Source of funding is identified and secured.
- Appropriate, current databases for spills are identified and assessed.
- A database is developed to compile appropriate data from the various sources that meets the information needs of the Action Plan and a preventative oil spill program and is installed on the LDEQ computer system.
- A database is maintained by relying on LDEQ field offices and by LDEQ obtaining data from NRC.
- Educational programs to inform industry, federal, state and local entities of the seriousness of petroleum and related fluid spill issues are developed and implemented.
- A work group of LDEQ, USEPA, USCG, and BTNEP MC is formed and informs the LOSCO Interagency Council of agency needs which must be met to comply with the state oil spill contingency plan.
- A work group of LDEQ, USEPA, USCG, LOSCO and BTNEP MC develops plan for encouraging effective and fair enforcement of spill prevention regulations and implements plan.
- A plan is developed and implemented for encouraging relevant agencies to increase inspections of applicable facilities within BTES.
- Additional personnel are assigned to inspect oil production facilities.
- A database is updated by relying on LDEQ field offices and by LDEQ obtaining data from NRC.

- Inspections for potential sources of petroleum spills are conducted by relevant agencies.
- A work group of LDEQ, USEPA, USCG, LOSCO and BTNEP MC continues encouraging effective and fair enforcement of spill prevention regulations and implements plan.
- Educational programs to inform industry, federal, state and local entities of the seriousness of petroleum and related fluid spill issues are modified to include costs associated with cleanup vs. costs of prevention.
- Educational programs are disseminated to agency and industry personnel and the public.
- A work group of LDEQ, USEPA, USCG, LOSCO and BTNEP MC works to adjust and/or redirect spill prevention program into areas with continuing problems.
- State funds and resources are dedicated specifically to petroleum related spill prevention.
- A better informed public and agency personnel is created.
- Increased petroleum and related spills prevention exists.

Project Success Metrics:

- reduction in the number and volume of spills reported and responded to
- reduction in contaminants from petroleum and related spills in BTES

Measurable Parameters:

The activities of various agencies outlined above in implementing the plan will be monitored for indicators as follows.

- existence of spill database
- functional spill database (i.e., Data can be accessed, used, and analyzed and is entered into

database in acceptable formats, etc.)

- increased personnel assigned to oil production facility inspections
- increased personnel assigned to and participating in educational program development and dissemination
- increased public, agency, and industry awareness of petroleum and related spill problems, causes, and preventative measures
- problem areas for spills addressed and efforts redirected

Project Success:

Any reductions in petroleum and related spills will be assessed by a statistical analysis of:

- spill number and volume.
- petroleum spills and related fluids contaminants in water, sediments, and biota of BTES.
- classification of non-compliance of water subsegments for 305(b) reports due to petroleum-related contamination.

Data Collection Methods:

Plan Implementation - The monitor will contact the various agencies involved in the implementation to gather data (examples below) that will be incorporated into a monitoring project.

- check-off system according to timeline of project developed between funding agency and implementer as landmark dates are encountered and project objectives are met
- list and descriptions of educational programs developed
- list of recipients of educational programs, including dates, types of programs, and comments made by recipients of educational programs as to usefulness of the program

- project monitor accesses spill database and uses the data in examples of data analysis listed above

Project Success - The monitor will access appropriate databases and conduct statistical analyses. Examples:

- petroleum and related spills database
- relevant agency personnel records
- water, sediment, and biota contaminant data [e.g., LDEQ, USEPA Environmental Monitoring & Assessment Program (EMAP), NOAA Status and Trends]
- 305(b) Water Quality Inventory reports designation of water subsegments

Sample design and statistical methods:

Relevant sample designs or statistical analyses do not exist to evaluate implementing the plan.

Project Success - Suitable baseline data may be available in LDEQ, NRC, the proposed spill database, USEPA EMAP, and NOAA Status and Trends. Trends may not be identifiable after five years; however, the analysis should be conducted.

At a minimum, a determination of the usefulness of the database will be made. Identification of any long-term trends needs to be within the context of the variability of the system. Several statistical methods applicable to analysis of trends may be suitable. Data may be normalized and standard linear regression models can be used to detect trends once sufficient data points have been obtained (e.g., 15 years is considered the minimum for similar trend analyses conducted by Rabalais et al. 1995). If data cannot be normalized, nonparametric trend analysis techniques should be employed (e.g., modified Mann-Kendall tau tests and seasonal Kendall slope estimator tests; see Hirsch et al. 1982). Seasonal Kendall tau test is a nonparametric trend test that is appropriate for detecting monotonic trends in “time series” data, i.e., data routinely collected over time (or space). Differences can also be assessed geographically by an analysis of variance on transformed data for site differences. Where sites differ significantly, post-hoc comparisons are run to determine which sites differ from others. Power analysis will estimate the probability of detecting trends of a certain magnitude given a certain number of observations (see Appendix D in Regional Monitoring Program for The Galveston



Boom is deployed to protect fragile marshland during an oil spill. Image: NOAA

Bay Plan, Lane 1994). N.B. Identification of trends or correlations does not provide cause and effect relationships.

How Data is Shared: Data will be shared with appropriate digital media and outreach venues.

Possible Data Gaps: As discussed previously USCG data gaps exist for produced water spills. Difficulty in detecting produced water spills during produced water disposal injection operations makes it nearly impossible to capture these events. The produced water spills have no telltale signs like oil spill sheens unless the produced water contains sufficient residual oil to create a sheen.

Additional Funding Needed: Yes. Initial funding of \$80,000 is needed to initiate the project. Additional funding will be needed to maintain the database and associated outreach.

EM-10 Improvement of Water Quality through Reduction of Sewage Pollution

OBJECTIVE

To reduce fecal coliform counts, pathogens, nutrients, and organic matter in the BTES waterbodies attributable to discharges of human waste from inadequate or poorly-maintained sewage treatment plants, rural homesites, unsewered communities, commercial and recreational vessels, and waterfront camps

BACKGROUND/MAJOR ISSUES

Throughout the BTES, improper disposal and inadequate treatment of sewage results in poor water quality in many of the BTB's bayous, lakes, and bays. The primary parameter for monitoring sewage pollution is fecal coliform count as it indicates the

possible presence of pathogens which can cause human illnesses. Fecal coliform bacteria, including the most common species *E. coli*, are a group of bacteria that live in digestive tracts of all warm blooded animals. When counts exceed a threshold level in oyster grounds, harvesting of the oyster is halted to prevent the spread of disease through consumption of contaminated seafood. Such closures are occurring frequently within the BTES.

Other pollutants associated with sewage include nutrients and organic matter. Excessive nutrient loads stimulate algal growth and can lead to increased algal production. This, in turn, leads to oxygen depletion as the algae die, and the decaying organic matter draws upon the dissolved oxygen in the water during decomposition. This process can cause severe depletion of dissolved oxygen in the sluggish bayous of the BTES which may cause fish kills. This process is called eutrophication. Over-production of algae in the bayous, canals, and lakes can also result in impaired fisheries.

The 1994 *National Water Quality Report to Congress* shows that fecal coliform is at least a suspected or potential problem in 33 of 55 assessed waterbodies in the Terrebonne Basin and 18 of 27 assessed in the Barataria Basin. Analysis of LDEQ's ambient water quality monitoring data revealed that 8 of 18 sampling sites in BTES are not meeting the fecal coliform criterion for primary contact recreation. Additionally, 9 of the 18 sampling sites are not meeting the dissolved oxygen criterion.

The LDEQ 2016 IR shows fecal coliform impairment in 2 of 28 Barataria subsegments and 11 of 58 Terrebonne subsegments. Dissolved oxygen impairment was shown in 2 of 28 Barataria subsegments and 2 of 58 Terrebonne subsegments.

DESCRIPTION

The action will build on existing educational activities, incentive programs, regulation development, inspection and enforcement mechanisms, and capital improvement programs that work in unison to

produce a regional reduction in both accidental and intentional releases of sewage into the waters within and bounding the BTES.

The primary source of sewage pollution in the BTES is runoff or discharge from inadequate or poorly maintained sewage treatment plants, rural homesites, unsewered communities, commercial and recreational vessels, and waterfront camps.

The BTES is largely rural with many unsewered communities. Rural residents use septic tanks, cesspools, mechanical sewage plants, or camp systems for treatment of their wastewater. Some of the camp and mechanical sewage plant owners discharge directly to waterways. Many septic tanks are placed in soils that are not suitable, and even properly installed systems are not adequately maintained. Improper placement and poor maintenance of septic systems lead to runoff of untreated sewage.

Discharges from vessels, both commercial and recreational, also contribute to the fecal coliform pollution problem as does runoff from pastureland and dense animal populations such as nutria, overwintering waterfowl, and feral hogs.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

LDH

All parishes in the BTES, except Plaquemines, have adopted ordinances to include the State Sanitary Code with LDH sanitarians inspecting, issuing permits, and conducting enforcement on residential, commercial, and vessel sewage systems. The following areas maintain a database of residential type plants:

- Region 1: Jefferson and Orleans
- Region 2: Point Coupee, West Baton Rouge, and Ascension
- Region 4: Iberia and St Martin

Region 3: Assumption, Lafourche, St. Charles, St. James, St. John, St. Mary, Terrebonne, and Jefferson (Grand Isle only) maintain databases of size and types of sewage plants, both community and residential-type; Plaquemines Parish is parish-operated and does not maintain a database of community or residential-type sewage plants.

LDH has regulations requiring perpetual maintenance on community and residential plants. Beach monitoring is conducted at 24 sites along the coast to determine whether the water quality meets LDEQ criteria for enterococci. The Molluscan Shellfish program collects samples at designated stations to determine whether the water quality meets National Shellfish Sanitation Program (NSSP) criteria for fecal coliform and *Karenia brevis* (red tide). LDH participates in educational workshops for property owners, oyster fishermen, and wastewater treatment system installers. The Beach Monitoring general public to provide information on sampling protocols and locations along with health concerns due to the potential exposure of enterococci bacteria. The following agencies are involved in assessing pathogenic bacteria levels along coastal beaches.

LDEQ

- annual inspections of 50 percent of permitted Major Dischargers (greater than 100,000gpd) and 20 percent of permitted Significant Minor Dischargers (greater than 50,000gpd)
- investigates citizen complaints and spill release incidents
- Watershed Based Inspection Projects target impaired watersheds
- Enforcement Program for dischargers that are not in compliance with regulations
- Ambient Water Quality Program
- educational outreach programs
- stream and swimming advisories postings

LDWF

- cosigns shellfish harvesting closures with LDH and enforces closures
- Scenic Rivers Program: involved in regulation of camp systems on designated streams/rivers
- Scenic Streams Program: regulates point source discharges which have the potential to impact these streams, including sanitary discharges from houseboats and camps

LDNR

- CUP: applicants with residential, commercial, or industrial activity must ensure that sewage systems meet requirements of State Sanitary Code
- Clean Marina/Vessels Program: encourages sewage pump out and dump stations at marinas in the BTES

USCG

- verifies compliance with 33 Code of Federal Regulations (CFR), Part 159, Marine Sanitation Devices, on all CG inspected vessels (domestic and/or foreign)

Local Governments

- MS4 Permit Program: deals with comingling of stormwater runoff and sewage, combined sewage overflow system, and overloading sewage treatment systems. Municipalities must seek and eliminate illicit discharges.
- All parishes in BTES, except Plaquemines, have adopted the State Sanitary Code; however, parishes may also have more stringent regulations than the code.

South Central Planning & Development Commission (SCPDC)

- SCPDC and LDH are currently working on adding LDH permit applications to SCPDC's "My Permit" online program. The program

will potentially be statewide and include other agencies.

TIMELINES AND MILESTONES

LDH and LDEQ will continue with annual and need-based inspections, enforcement, and monitoring along with public education to improve water quality. BTNEP and the BTNEP MC will continue to support these ongoing state and federal programs and activities that protect and promote human health and the environment. BTNEP will also continue to look for opportunities to implement projects that support these activities.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

LDEQ

- administers the Clean Water State Revolving Fund (CWSRF) Program which provides financial assistance in the form of low interest loans to finance eligible projects, bringing them into compliance with the requirements of the CWA
- CWA Section 106
- CWA Section 319
- permit fees and enforcement

LDH

- State General Fund/retail permit fee collection
- EPA: beach monitoring program
- fees for installation of each residential-type sewage plant
- fees for sewage installer certification

Capital Resource Conservation and Development Council, Inc (CRC&D)

- administers the Home Waste System Initiative for low income households in the following BTES parishes: Pointe Coupee, West Baton Rouge,



Fish floating in water near Point a la Hache. Image: LDWF

Iberville, Assumption, St James, and Ascension

USDA Rural Development

- administers Single Family Housing Repair Loans & Grants in Louisiana which provides loans to very low-income homeowners to repair, improve, or modernize their homes or grants to elderly very low-income homeowners to remove health and safety hazards
- has a Community Facility Direct grant/loan program for local governments for public infrastructure including sewerage. The program is directed towards rural areas and is based on the size and income of the community

Louisiana Community Development Block Grant Program

- helps communities provide a suitable living environment and expand economic opportunities for their residents, particularly in low to moderate income areas. The Block Grants are awarded to the State annually by the U.S. Department of Housing and Urban Development, and the State's program awards and administers

the funds to units of local government for improvements to public facilities, economic development, demonstrated needs projects, and Louisiana Small Town Environmental Program (LaSTEP) projects, which funds materials for local community projects while citizens provide a portion of the labor

SCPDC

- assists communities in applications for and administration of grants and partners with BTNEP to apply for grants to offer education, infrastructure, etc.

USEPA

- handles grants for wastewater treatment

United States Economic Development Agency (Department of Commerce)

- offers grants to communities to extend sewer collection lines or increase treatment capacities when a new industry locates or when it becomes necessary to retain existing jobs

PERFORMANCE MEASURE

Performance measure is:

- number of impaired subsegments related to pathogens, nutrients, and organic matter in the BTES waterbodies

Data Gathered:

- LDH maintains sewage system databases, beach monitoring, and molluscan shellfish data
- LDEQ collects water samples associated with the Ambient Water Quality Network Program, conducts ecoregion surveys, Total Maximum Daily Load (TMDL) Monitoring, Special Watershed Project monitoring, incident investigations, and compliance sampling projects

Monitoring:

Parties Responsible: LDH, LDEQ

Timetable for Gathering Data:

- LDH: Sewage system databases are updated daily. Beach monitoring is collected weekly from April 1st through October 31st. Molluscan Shellfish sampling is collected weekly year round.
- LDEQ: Monitors all active Ambient Water Quality Network sites monthly within a four-year rotation while other monitoring occurs as required. The department periodically conducts Ecoregion surveys, TMDL monitoring, special watershed project monitoring, incident investigations, and compliance sampling projects on an as-needed basis.

How Data is Shared:

- LDH: Beach monitoring information is on the EPA website. Molluscan Shellfish Program data must be currently obtained from staff in LDH Headquarters. Aerobic treatment plant and community sewage system databases are maintained at state and regional levels and are

not currently available online.

- LDEQ: All monitoring data are available on the LDEQ public website.

Possible Data Gaps: Wherever monitoring is not taking place, data gaps exist.

Additional Funding Needed: yes

EM-11 Reduction of Agricultural Pollution

OBJECTIVE

To maintain water quality standards that adequately protect estuarine resources from agricultural nonpoint source pollutants

BACKGROUND/MAJOR ISSUES

Bayous and lakes throughout the BTES are impaired because of excess nitrogen, phosphorus, pathogens, and sediment from urban areas, industries, farms and ranches, and other sources. Throughout the BTES, partners will work with producers and landowners to implement voluntary conservation practices that improve water quality while maintaining agricultural productivity.

In the BTES, agriculture is a major land use. Sugarcane production totals over 203,000 acres, soybeans over 80,000 acres, and pastureland over 135,000 acres (obtained from the 2015 USDA Cropland Statistics data base). Water quality data from LDEQ's IR indicate that nonpoint agricultural sources in the Barataria Basin contribute to the degradation of 10 waterbody subsegments either not meeting or only partially meeting their designated use while in the Terrebonne Basin, 16 subsegments are not fully or only partially meeting their designated use.

This action will involve implementing conservation practices and Best Management Practices (BMP)

in sufficient quantity in a concentrated area so that agriculture no longer contributes to the impairment of water bodies within the BTES. To achieve these goals, the conservation partnership will work with landowners and individual agricultural producers to implement conservation practices such as nutrient management, integrated pest management, land shaping, prescribed grazing, cover crops, conservation cropping systems, and filtering wetlands.

Implementing these BMPs will work to decrease contaminants including nutrients (nitrogen and phosphorus), sediments, animal waste (fecal coliform), pesticides, herbicides, fungicides, insecticides, etc. from agricultural runoff that lead to eutrophication, decreased production, and plant or animal mortality within the BTES.

Implementing this plan will require coordination with local and state agencies, conservation districts, nongovernmental organizations, and others. Partners

will play a crucial role in encouraging and supporting producer participation. Conservation investments in the BTES is good for all residents because well-managed farms limit pollution from runoff, produce food and fiber, sustain rural economies, and provide food security to the nation. Communities benefit by having clean waterways, safer drinking water, and healthy habitat for fish and wildlife.

DESCRIPTION

This action will follow already developed BMPs as recommended in the LDEQ statewide nonpoint program. These BMPs meet, enhance, or exceed state and federal guidelines and are consistent with continued agricultural production in the area. Employing these management practices will ensure that the BTES waters shall have a good ecological balance of nutrients and be free of harmful concentrations of toxic contaminants. These BMPs were developed from user group and coalition input and are based on the direct involvement of such



BTNEP and LDEQ sampling water. Image: Lane Lefort Photography

groups. The location of implementing conservation activities will center on active agricultural lands within the impaired subsegments of the BTES.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

LDEQ

LDEQ is in charge of water quality monitoring and obtains program funds from the EPA CWA 319 program to restore impaired watersheds within the State of Louisiana.

LDAF

LDAF funds the Office of Soil and Water Conservation projects from the EPA CWA 319 program and works with NRCS to implement conservation practices to restore watersheds impaired by agricultural uses.

USDA-NRCS

NRCS has been the lead conservation agency in charge of implementing conservation practices on agricultural land and providing technical and financial assistance to private landowners and producers. The Environmental Quality Incentives Program (EQIP) funds this assistance and, in some cases, is leveraged by funds from local and state partners.

Targeted watershed initiatives provide a means to accelerate voluntary, private lands conservation investments to improve water quality with dedicated financial and technical assistance and to focus water quality monitoring and assessment funds where they are most needed. Water quality-related conservation practices enhance agricultural profitability through reduced input and enhanced soil health that results in higher soil organic matter, increased infiltration and water-holding capacity, and nutrient cycling.



Water sampling. Image: Lane Lefort Photography

TIMELINES AND MILESTONES

Over the next twenty years, LDEQ will continue ambient water quality monitoring in subsegments as well as increase sampling in special initiative watersheds within the BTES. Concentrated efforts will occur in subsegments identified by LDEQ and NRCS to achieve the objective. The LDAF and NRCS will continue implementing BMPs on private agricultural land through various programs including the EPA CWA 319 program, EQIP, Mississippi River Basin Healthy Watersheds Initiative (MRBI), GOMRI, National Water Quality Initiative (NWQI), Regional Conservation Partnership Program (RCPP), etc. Data from the most recent IR is used to determine where BMPs are needed the most in a particular watershed. The agencies work together to restore impaired watersheds. All agencies contribute to outreach activities.

In order to develop and implement solutions to the problems in the BTES, the proposed plans consist of forming common ground solutions and establishing a database program. Specific plans follow.

- Implementing comprehensive education and awareness programs that enhance public involvement is needed in the initial stages of the plan and will include workshops, seminars, etc. This will increase involvement plus the adherence to regulations and, in the case of agriculture, will include the awareness of and following of BMPs.
- Promoting regional pride and long-term stewardship of the BTB is also needed. Promoting the pride and stewardship goes hand in hand with the aforementioned education and coalition of government agencies and user groups. In the area of agriculture, involvement of individual farmers and their families can help promote the quality of the BTES.
- Developing strategies using input from the user groups and established coalitions to ensure that the water quality standards as set forth above

will be met and maintained. In the case of agriculture, the appropriate user groups will be directly involved.

- Creating an accessible, comprehensive database including GIS data with interpreted information for the public will be accomplished. Such a database should include all pollution source types, including information on quantification and distribution of agricultural pollutants in the ecological system and hydrologic system. Included is the formulation of indicators of estuarine ecosystem health and balance use of estuarine resources. The definition of limiting characteristics and indicators of ecosystem well-being must take into account all sources of pollution including agriculture. The overall view of the BTES will insure a better balanced use of the resources.

The focus of the following plans is to provide the basis for review of the effectiveness of the planned actions. Periodic monitoring and review of the program effectiveness will be conducted, including a review of the overall program as well as individual areas, plans, and/or methods.

- Initiating a three year monitoring phase based on the structure of the BMPs will provide monitoring data. Changes in the BMPs and/or addition of other such measures may be required in order to meet the goal of improving water quality as determined from analysis of monitoring data.
- Monitoring the amount and distribution of agricultural pollution is needed. Monitoring will be conducted in association with the monitoring of other sources and types of pollutants addressed in the CCMP Action Plans. Monitoring must include measurements of agricultural pollutants including nutrients, pesticides (including herbicides, fungicides, insecticides, etc.), sediment loads, salts, and animal wastes.

The final plan is to develop solutions to the agricultural pollution and sources of the pollution in the BTES. In

order to maintain and/or restore the BTB's biological communities, the sources of agricultural pollution must be reduced to acceptable levels in order to realistically support diverse biological communities. This includes the development and maintenance of multi-level, long term planning. Such planning must be conducted using all groups, coalitions, and political jurisdictions. Specific plans include:

- establishing close working relationships with the agricultural user groups to establish a means of determining valuation of the ecological resources.
- forming coalitions with other involved state and parish agencies to ensure a complete basis for setting resource priorities in the BTES. The appropriate agencies include LDNR, LDEQ, LDAF, Louisiana Cooperative Extension Service (LCES), USACE, USFWS, NMFS, NRCS, and local coastal management programs.
- meeting water quality standards that adequately protect estuarine resources. The water quality programs established under the CCMP should meet all state/federal guidelines. To accomplish this, the agricultural sources should be reduced to levels that ensure a good ecological balance of the BTES. Such levels are dependent on the assessments of distribution and quantities of pollutants as determined during initial studies.
- promoting environmentally responsible economic activities that sustain current agricultural activities and protect estuarine resources to reduce agricultural pollutants. The sustained use of agricultural methods that help maintain the viability of the BTES should be one of the main points of emphasis in promoting environmentally responsible activities.
- preserving the wetlands and barrier islands as a related focal point. The sediments, salts, and herbicides associated with agricultural source pollutants can directly impact wetland vegetation leading to erosion and loss of the affected wetlands. Reduction in the amounts of

these substances in the BTES waters will help in preservation of the associated wetlands.

- creating a plan compatible with natural processes. Flooding can pose problems if fields are flooded, and the resulting waters discharge sediment and/or pesticides into the watershed area. This discharge should be taken into account in the planning of future and present agricultural activities in the area.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

The LDEQ conducts an ambient water quality monitoring program from state funds and also obtains federal funds from the EPA CWA 319 program to monitor special projects in impaired watersheds. The LDAF Office of Soil and Water Conservation implements conservation practices on agricultural land with special federal project funds from the EPA CWA 319 program in the amount of \$1.9 million a year. The NRCS also implements conservation practices via field offices through technical assistance around the state.

PERFORMANCE MEASURE

Performance measure is:

- number of impaired subsegments related to agricultural runoff.

Data Gathered:

- acres of conservation practices, types of conservation practices, water quality data, and watershed impairments

Monitoring:

Data from LDEQ water quality monitoring are collected via grab samples which are tested by an accredited laboratory for specific parameters. LDAF and NRCS report implemented practices.

Parties Responsible: LDEQ, LDAF



Fecal coliform bacteria can come from farm animals. Image: BTNEP

Timetable for Gathering Data: LDEQ and LDAF complete annual and semi-annual reports. LDEQ updates the integrated report of impaired watersheds every two years.

How Data is Shared: agency websites, group meetings, teleconferences, field days, training workshops

Possible Data Gaps: critical acres within impaired watersheds needing treatment

Additional Funding Needed: yes

EM-12 Improvement of Water Quality through Stormwater Management

OBJECTIVES

- To reduce the negative impacts on water quality that current stormwater disposal practices may produce
- To reduce loadings of nutrients, fecal coliform bacteria and pathogens, and other pollutants in waterways



Sugar mill in full operation. Image: Lane Lefort Photography

- To enhance wetland vegetation with inputs of nutrients, sediments, and freshwater from stormwater runoff

BACKGROUND/MAJOR ISSUES

Stormwater pumps exist throughout the BTES. A Center for Louisiana Inland Water Studies (CLIWS) report for BTNEP states that 256 identified pumps exist within the BTB. Stormwater pumps account for 215 of these, and 41 are classified as agricultural pumps. The majority of stormwater pumps drain residential, commercial, or industrial areas. The agricultural pumps drain crop agriculture, pasture land, and cattle operations. The large area of the BTES provides an opportunity to actively manage all or part of stormwater runoff that would not be provided by gravity-based drainage systems alone.

Much of the developed and impounded wetlands (fast lands) for residential, commercial, and agricultural use in the BTES complex are under pump to remove stormwater. The stormwater pumps move water off the fast lands into receiving waterbodies which move water rapidly into shellfish producing areas. As a result, inadequate detention time exists to reduce

coliform bacteria levels before oyster beds are impacted. The intent of the pumping is to alleviate flooding in developed lands. Per the CLIWS report, most of the water bodies receiving the pumped waters could not be classified by type. However, of the few receiving waterbodies that could be classified (48 total), 44 percent were canals flowing through some type of wetland, 25 percent were canals through other areas, and 31 percent were wetlands. The pumped water including all of the pollutants and nutrients that may be present enters these waterbodies directly.

The stormwater pumping system that exists in the BTES complex directly or indirectly impacts all residents of the BTB. The direct impact of the existing system is the removal of stormwater from developed or agricultural areas to receiving waters that should be able to shunt the storm flows away to reduce the incidence and duration of flooding. Indirect impacts of the existing system are the potential and actual impairment of water quality in the receiving water bodies and the impact this impairment has on drinking water supply, fisheries, and recreation. The Stormwater Action Plan will impact all residents of the BTES complex by reducing negative impacts

through reducing loadings of nutrients, fecal coliform bacteria and pathogens, and other pollutants in waterways and enhancing wetland vegetation with inputs of nutrients and freshwater.

BTNEP has implemented two projects that could be used to decrease stormwater being delivered to receiving waterbodies and fisheries growing areas. In 2016, BTNEP implemented Stormwater Infiltration Basin and Pétaque Terrain in Peltier Park in Thibodaux, LA. The project constructed a stormwater infiltration basin that also has a surface for playing the game of pétaque. This project was designed as an alternative way to decrease stormwater discharge to streams, increase groundwater recharge, provide a double use of greenspace, provide recreational benefits to the community, and provide local economic benefits. It is estimated that the feature can hold approximately 8,600 gallons of stormwater.

In 2010, BTNEP, in partnership with Terrebonne Parish Consolidated Government (TPCG) and LSU, completed a two-phase study entitled “Wetland Response to Stormwater Discharge at the Pointe au Chien Pumping Station, Pointe aux Chenes Wildlife Management Area, Terrebonne Parish, LA,” which collected pre-pumping data and post-pumping data for loading of nutrients, fecal coliform bacteria and sediments, and wetland response at the Pointe au Chien Pumping Station. The study found that a significant decrease existed with distance of nutrients, fecal coliform bacteria, and sediments with distance from the pumping station outfall and a significant increase in wetland areal coverage near the outfall of the pumping station.

This Action Plan complements several BTNEP programmatic goals. It uses existing infrastructure, with some modifications, to adjust, offset, or be compatible with natural processes. This Action Plan helps to provide a common ground solution to several estuarine problems including water quality and helps to revitalize wetland areas.

This plan will provide several benefits to the BTES complex residents. Improved coordination and sharing of information and ideas among local, state, and federal agencies and the public should result. Flexible stormwater disposal can help strengthen local governments’ ability to identify and reduce local problems like flooding, water quality, and wetland and resource health through their own initiatives. More long-term benefits will be improved water quality for drinking, agriculture, fisheries, and recreation. Enhanced wetland areas should result in being able to provide the functions of water storage, water quality improvement, and ecological values that wetlands impart.

DESCRIPTION

This plan will establish alternatives to current stormwater pump outfall management. Specifically, this plan will:

- encourage, develop, and implement a series of stormwater treatment and wetland enhancement projects in representative areas throughout the BTES.
- sponsor additional information collection that would assist in local stormwater management planning.
- encourage local governments to adopt ordinances that improve stormwater disposal practices.
- ensure that to the extent possible, stormwater management improvements make use of equipment that is already in place.

Stormwater disposal alternatives will be planned where they can help reduce flooding, where existing pumps and appropriate alternative disposal sites coexist, and where fecal coliform impacts on oyster beds or other negatives are unlikely. Most importantly, alternative stormwater management will be implemented only where the water quality of the stormwater is acceptable for the wetland to assimilate its pollutant load over an adequate residence time.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

Stormwater Redirection Projects

Co-lead implementers will be BTNEP and local parish governments. Either the BTNEP or local parish governments would be able to apply for large grants. Local parish governments would be responsible for construction and maintenance.

- **New Pumping Stations:** For new pumping stations, no drainage canal for collecting pumped stormwater would be dug. The stormwater outfall would go directly into receiving wetlands.
- **Existing Pumping Stations:** An earthen dam would be constructed across the existing outfall canal to force stormwater to sheet flow over adjacent wetlands. The outfall pipe would be relocated so that stormwater would flow directly into wetlands adjacent to the original outfall canal.

Stormwater Infiltration Basin Projects

Co-lead implementers will be BTNEP, local city governments, and local parish governments. Either BTNEP or local governments would be able to apply for large grants. Local governments would be responsible for construction and maintenance.

Urban Green Space

See EM-13 Action Plan on Urban Green Spaces.

Urban Stream Restoration Projects

Co-lead implementers will be BTNEP, local city governments, and local parish governments. Either BTNEP or local governments would be able to apply for large grants. Local governments would be responsible for construction and maintenance.

TIMELINES AND MILESTONES

These efforts will be ongoing throughout the program life based on funding opportunities. Each project will

have different achievements and milestones. Project milestones will be reported to the BTNEP MC, EPA, invested partners, and the community through various media sources.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

The total range of funding necessary annually for EM-12 is variable depending on the size and scope of the project(s) which will include but will not be limited to:

- salaries.
- operating services.
- supplies.
- equipment.

Sources of funding include local, state, federal, individual, industrial, institutional, NGO, and private organizations.

PERFORMANCE MEASURE

Performance measure is:

- quantitative improvements in water quality from project-specific data

Possible Data Gathered:

Stormwater Redirection Projects – sediment elevation, water quality data, and vegetative cover; Infiltration Basin - total volume water retained; Urban Stream Restoration - pre- and post-data: water quality data, number of animal species, number of plant species

Parties Responsible: BTNEP and local parish and city governments

Timetable for Data Gathering: pre- and post-project

How Data is Shared: BTNEP MC meetings and online through current online technologies where

appropriate

Possible Data Gaps: how various vegetative communities respond and adapt

Additional Funding needed: yes

EM-13 Urban Green Spaces

OBJECTIVES

- To encourage the creation and growth of wildlife habitats in urban areas
- To provide additional recreational space for visitors and residents of the Estuary to improve quality of life
- To augment economic development
- To improve urban flood control
- To reduce urban flooding from runoff

- To augment the natural processes that will help to improve air and water quality in the Estuary

BACKGROUND/MAJOR ISSUES

Many areas of south Louisiana are sparsely populated, lush, and green. The bayous in the BTES are among some of the most beautiful and naturally scenic along the Gulf Coast. In addition to their importance as navigation systems for the area, the bayous and waterways of south Louisiana contribute to the culture, ecology, and economy of the region. However, with modernization and growing populations, much of these natural areas are under stress or are being lost, and the diversity of wildlife enjoyed in the region is being threatened. This, in turn, impacts the complex and delicate ecosystem affecting air and, particularly, water quality and also hampers the tourism industry in this part of the state.

Urban green spaces can serve multiple uses, including enhancing the natural beauty and overall attractiveness of urban areas, improving air and water quality, encouraging tourism and growth of local economies by enhancing the quality of life, as well



Stormwater pumping stations can be used to revitalize wetlands. Image: BTNEP

as aiding in flood control. Urban green space design that is incorporated into a drainage system not only adds to the enjoyment of a natural setting but also helps to clean and polish runoff before it is ultimately discharged into a receiving stream thus improving the quality of the water in the stream. Such facilities also serve as runoff storage which reduces urban flooding while nourishing habitat within the urban setting.

The runoff storage abilities of urban green spaces can also characterize small water gardens and other pervious spaces throughout the urban environment and can have application in places such as surface parking lots. Not only do water gardens better handle runoff from these facilities but they also remove pollutants from the water that would otherwise be carried directly to receiving streams and add an attractive visual green space that breaks up the stark, unattractive appearance of most surface parking lots.

Properly designed urban green spaces contribute considerably to the overall sustainability and resiliency of the community by not only reducing flooding but also by improving water quality as well. As they clean and polish runoff, they help to improve the water quality of the receiving streams which, more often than not, are Louisiana's scenic bayous. In doing so, they enhance the ability of these bayous to contribute to the preservation of various wildlife species as well as our enjoyment through recreational pursuits of residents and visitors alike that may include fishing, boating, and swimming. In this sense, urban green spaces also contribute directly to the economic health of our communities.

Developing urban green spaces that also function to store and clean urban runoff requires a high level of coordination among local government planning, engineering/drainage, recreation agencies, and private entities such as landscape design firms. Such coordination is needed because a properly functioning urban green space must consider how plant materials (trees, flowers, bushes, etc.), recreational facilities (nature trails, parks, etc.), and drainage must work together to produce the desired result. The green

space must retain enough water to promote growth of wetland species yet allow for the storage of runoff during storm events so that water can be carefully "treated" within the green space before being released into the receiving stream. Urban green spaces thus become an attractive and multi-functional alternative to stark, unattractive, concrete-lined drainage ditches.

While the concept of urban green spaces is often included in the development of a community's comprehensive plan, such facilities can be developed independently. The multi-functional aspect of urban green spaces, recreation, quality of life, economic growth, flood protection, water quality improvement, and wildlife habitat enhancement, may allow capital funding to be pursued from multiple sources. These outdoor areas allow residents to highlight their culture, the beauty of their natural resources, and the contribution of the land and waterways to the livelihood and lifestyles of their area. Such aspects of the community can also be very attractive to visitors in addition to providing easy access to attractive water features in small and large communities. Careful design and coordination will allow urban green spaces to also provide needed feeding and resting places for migrating birds and other wildlife.

DESCRIPTION

This action will encourage communities within the BTES to plan and develop urban green spaces that feature native plantings, nature trails, parks, and water features incorporated into drainage systems and bayous that provide wildlife habitats, recreational opportunities, runoff storage and cleaning, and bank stabilization where appropriate.

Urban green spaces can be incorporated into virtually any urban drainage facility or waterway with careful planning, design, and engineering. Specific features can be incorporated into underutilized urban green spaces that have a drainage element. This concept can also be integrated into the design of surface parking lots.

LEAD AGENCY RESPONSIBLE FOR

IMPLEMENTATION

While individual municipalities and communities within the BTES should take primary responsibility for the development of such urban spaces, BTNEP should endeavor to encourage and lend its expertise to the design of such facilities.

TIMELINES AND MILESTONES

Over the next three to five years, suitable locations for urban green spaces within communities in the BTES should be identified and designed. A few of these should be funded and constructed. The first milestone, therefore, will be identifying suitable locations for such facilities. This should be accomplished within the first five years. Afterwards, funds will need to be dedicated for design and engineering with construction funding sources to be identified soon after.

After construction funding has been identified and secured, some of these facilities should be able to be completed. Given funding cycles, this may take an additional 10 to 15 years. At the end of 15 years, several urban green space facilities should be constructed, as described herein, in communities in the BTES.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Depending on the level of complexity involved, location, and size of the urban green space, costs could range from thousands of dollars to hundreds of thousands of dollars and possibly higher. Incorporating such pervious design features into an urban surface parking lot adds only a relatively small amount into the overall cost of the parking lot. Retrofitting in both cases would tend to be more expensive.

Funding sources for such facilities may include local capital budgets, state capital outlays, grants from such agencies such as the EPA, etc., and the RESTORE Act if the community is in a coastal

parish eligible to receive such funds. Such projects could be eligible under one or more RESTORE Act funding categories. However, the use of RESTORE Act funds requires incorporating the project into the parish's Multiyear Implementation Plan which is submitted to the U.S. Treasury Department for pre-approval and a prescribed public comment period before final Treasury approval. If the particular parish has already submitted and received approval for its Multiyear Implementation Plan, it will need to be amended in order to be approved by the Treasury using the same process.

PERFORMANCE MEASURE

Performance measures include:

- acre or square footage of project footprint
- number of native plant species

Data Gathered:

Measurement of the success and/or performance of urban green space of the type envisioned here can be based on the number of visitors to the new facility, visitor surveys designed to collect data on use and acceptability in the community, and likes and dislikes, etc. In addition, after the facility has been constructed and in operation for at least 8 to 12 months, water quality samples downstream of the drainage course and in the receiving stream could be taken and compared to baseline data collected before the facility was constructed. Surveys of facility visitors would be primarily of a qualitative nature since the facility is designed to enhance quality of life, but water quality surveys would be more quantitative.

Monitoring:

Parties Responsible: Individual communities with guidance and assistance from BTNEP should take responsibility for the qualitative aspects of monitoring. For the quantitative aspects of monitoring, coordinating agencies such as LDEQ



Volunteers help create an urban garden. Image: BTNEP

and EPA with BTNEP should take responsibility.

Timetable for Gathering Data: Some of the quantitative data may already exist in the records of the state/federal agencies mentioned above. The collection of new water quality data does not need to begin until after the project(s) have been constructed and in operation for at least one year. The qualitative data gathering effort should begin after the project has been constructed and in operation for about six months. The individual communities with assistance from BTNEP should hold public meetings to discuss the benefits of each project prior to construction during the planning process.

How Data is Shared: Quantitative and qualitative data collected for this effort should be shared with other communities thinking about constructing similar facilities. The data should show the positive community benefits to quality of life and improvement to water quality in the area.

Possible Data Gaps: It is not known if the collection of quantitative water quality data 12 months after the completion of such a project will show the intended

improvements. A longer time period may be required.

Additional Funding Needed: yes

EM-14 Assessment of Harmful Algal Blooms

OBJECTIVES

- To minimize the human health impacts of HABs in the BTES
- To reduce the frequency and intensity of HABs within the BTES by supporting BMPs of watershed nutrient management
- To build partnerships between research scientists and agency resource managers to help prepare for and respond to some HABs whose sources can and cannot be managed from within BTES to help reduce threats to marine organisms, human health, and economic well-being
- To increase public awareness of HABs' threats

to human health and the economic well-being of shellfish and fish industries in the context of increasing or changing nutrient pollution, climate change, coastal land loss, and restoration actions

BACKGROUND/MAJOR ISSUES

HABs in Coastal Louisiana

HABs include those that are dangerous to humans, those that are toxic (poisonous), and those that are very unpleasant. This document uses the term “HABs” as the most inclusive term, recognizing that some species vary in the level of toxicity both spatially and temporally. HABs are commonly observed in fresh, brackish, and marine areas of the Louisiana estuaries, including the BTES (Dortch et al., 1999; Bargu et al., 2011; LUMCON, 2016; Roy et al., 2016). HABs are not always toxic but may prevent fish from feeding or lead to increased organic loading that supports hypoxia development.

At the fresher end of the BTES (e.g., salinities less than eight ppt) potentially toxic cyanobacteria species of *Anabaena*, *Cylindrospermopsis*, and *Microcystis* are likely to be observed (Ren et al., 2009; Garcia et al., 2010; Riekenberg et al., 2014).

The diatom *Pseudo-nitzschia* spp. is a concern in the more saline coastal waters (Dortch et al., 1997; Parsons et al., 2013; Bargu et al., 2016), but there are currently no recorded cases in the BTES. They have increasingly contributed to the primary production in the surface waters of the northern Gulf of Mexico (Parsons & Dortch, 2002; Bargu et al., 2016) and worldwide (Silver et al., 2010). They are a concern to living resources, including humans, because they can produce the neurotoxin domoic acid (DA) which is responsible for amnesic shellfish poisoning in humans (Bates et al., 1989) and death in marine organisms (Bargu et al., 2016).

The dinoflagellate *Karenia brevis* is also a concern as it is widely distributed in the northern Gulf of Mexico and is typically associated with neurotoxic shellfish poisoning (Brown et al., 2006) although it is observed

less frequently in coastal Louisiana waters because of lower salinity across the BTB. When higher salinity conditions occur due to southerly winds, low river flows, and tropical storms or hurricanes, such as in the Breton Sound estuary in the winter of 2015, they can be abundant, resulting in oyster bed closures. Another *Karenia brevis* bloom occurred in the winter of 1996-1997 within lower salinity waters east of the Mississippi River that caused oyster bed closures during a long period of the harvest season (Brown et al., 2006). Even when the numbers of *Karenia* decrease, the toxins may persist.

Other blooms of less frequency do produce toxins and persist for long periods such as the bloom of *Heterosigma akashawi*, a raphidophyte, that produces brevotoxins (Rabalais unpubl. data). In March 2011, satellite imagery (N. Walker, Earth Scan Lab, LSU) clearly showed the intrusion of this bloom into the lower BTES. Several studies indicate that toxin production from HABs is higher in lower salinities where the phytoplankton are stressed (Bourdelaïs et al., 2002; Brown et al., 2006; Bargu et al., 2016).

HABs in the BTE

In areas of the BTE that are more fresh (e.g., salinities less than eight ppt) and during the spring and summer months when nutrient and temperature water conditions are optimal for growth (Ren et al., 2009), the toxic species of cyanobacteria *Anabaena*, *Cylindrospermopsis*, and *Microcystis* may be observed at bloom concentrations (Garcia et al., 2010). These different species of cyanobacteria can produce hepatotoxins, neurotoxins, dermatotoxins, and endotoxins, which may harm human health directly or be assimilated into the food web via foraging higher trophic levels such as shellfish, crabs, and fish. For example, in Lac des Allemands, some blue crab microcystin toxin levels have exceeded human consumption standards set by the World Health Organization (Garcia et al., 2010). Other benthic grazers that use these low salinity habitats such as the recreational and commercially important species of blue catfish, flathead catfish, and white shrimp

may also be impacted by these toxins. BMPs of watershed nutrient management would help reduce the frequency and intensity of these phytoplankton blooms and reduce vulnerability of humans and fisheries to the phytoplankton produced toxins.

At salinities greater than 15 ppt, the neurotoxin producing diatom *Pseudo-nitzschia* spp. is of concern (Dortch et al., 1997; Parsons et al., 2013; Bargu et al., 2016). *Pseudo-nitzschia* spp. collected in Louisiana coastal waters and estuaries are commonly observed year round but are most abundant in the spring (Del Rio et al., 2010; Parsons et al., 2013; Bargu et al., 2016). Detectable domoic acid concentrations have been documented in BTES, such as in the estuarine and coastal Louisiana water samples (Parsons et al., 1999; Bargu et al., 2016) and gulf menhaden (Del Rio et al., 2010). Overall, few studies (e.g., N. Rabalais, unpublished data) have characterized the phytoplankton communities and related toxins along a salinity gradient in the BTES.

In summary, building partnerships between research scientists and agencies to prepare and respond to these blooms is critical. An increase in public awareness and understanding of HAB dynamics would also help address the future threats to human health and the economic well-being of shellfish and fish industries (Smith et al., 2014), especially in the face of nutrient pollution, climate change, coastal land loss, and restoration actions.

DESCRIPTION

To implement BMPs in the watersheds of BTES, the team will:

- promote spatial analysis of the occurrences of HABs and local watershed sources of nutrients and implement BMPs.
- promote minimizing human impacts from HAB events.
- recommend including the following in the existing response system through LDEQ incident

investigation and reporting and LDH beach monitoring program.

- develop a protocol among phytoplankton (HAB) experts and Louisiana and federal agencies for proper collection, storage, and transfer of samples of suspected HABs, not just for incidents but also for routine sampling.
- update key expert contacts in Louisiana and along the Gulf coast.
- locate sample analysis facilities for different algal toxins.
- follow safe and appropriate sampling protocols for the most likely bloom species.
- maintain a system for community members to lodge a notification of suspected HABs.

To Promote Public Awareness and Understanding, the team will:

- promote an informational network of scientists and managers on harmful algal issues within coastal Louisiana.
- promote a common webpage for essential informational resources and key contacts.
- promote core information on different species that can be used at educational events during non blooms and during blooms (safe seafood handling) to increase awareness.

This action applies to the entire BTES watershed.

LEAD AGENCIES RESPONSIBLE FOR IMPLEMENTATION

The lead agencies' responsibilities are divided by task as identified below.

Implementing BMPs in Watersheds of BTES: LDAF, LDEQ, NRCS, EPA, and BTNEP

Preparedness to Minimize Human Impact from Toxic or HAB event: LDAF, LDH, LDEQ - incident

responders, LDWF, USDA, and U.S. Food and Drug Administration (FDA)

Promoting Public Awareness and Understanding: BTNEP, LDAF, LDH, LDEQ, Louisiana Environmental Education Commission (LEEC), LDWF, LUMCON, The Water Institute of the Gulf (WIG), Louisiana Department of Education (LDOE), Louisiana Sea Grant College Program, and EPA/National Environment Programs/Gulf of Mexico Program/Gulf of Mexico Alliance-Private aquariums along Gulf Coast (e.g., Audubon)

TIMELINES AND MILESTONES

Timelines and milestones are divided by task as outlined below.

Implementing BMPs in Watersheds of BTES: as per relevant timelines for watershed management with relevant agencies, ongoing

Preparedness to Minimize Human Impact from Toxic or HAB event: through available opportunities and synergistic activities:

- establish network of scientists and agencies in Louisiana
- collate base knowledge and develop key messages
- develop core web materials for dissemination

Public Awareness and Understanding: through available opportunities and synergistic activities:

- establish network among citizens, agencies, and environmental education resources
- collate base knowledge and develop key messages
- develop core web materials for dissemination

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Costs and funding streams are divided by tasks as

outlined below.

Implementing BMPs in Watersheds of BTES: EPA funds through LDEQ for nutrient reduction strategies/BMPs, CPRA nutrient reduction strategies using coastal restorations strategies, LDAF, LDEQ, and LDH

Preparedness to Minimize Human Impact from Toxic or HAB event: LDEQ, NOAA, Louisiana Sea Grant, LDH, and GOMA – Priority Issue Team (PITs)

Public Awareness and Understanding: LDEQ, NOAA-Louisiana Sea Grant, LDH, BTNEP, RESTORE Act funds, GOMA – PITs, and GOMP/USEPA

PERFORMANCE MEASURES

Performance measures include:

- monitoring of HABs,
- frequency and intensity of HABs,
- public awareness and understanding of HABs

Data Gathered:

- identify: taxonomic and toxin experts; number of experts engaged in an advisory capacity in the panel of experts; number of web pages developed and of times updated; number of fliers, brochures, and informational advisory outputs developed; and number of community submissions/reports of potential HAB events
- employ: spatial analysis system, mapping reports of HABs, NOAA – National Estuarine Eutrophication Assessment and reporting events to the national HAB reporting system (LUMCON)

Monitoring:

Parties Responsible: central host of materials and web page

Timetable for Gathering Data: annual data summary (collected regularly on web page)

How Data are Shared: summarized on the web page and in public communications using the information collated through this mechanism

Possible Data Gaps: basic data on current occurrence and abundance of HAB species within BTES, environmental factors controlling toxicity of HAB species known to occur within BTES, predictions of possible future threat from HABs under increasing water temperature, increasing nutrient concentrations, and alterations to salinity with restoration actions.

Additional Funding Needed: dedicated agency funds for monitoring, assessing, and informing the public. Significant knowledge gaps exist in the science of HABs within coastal Louisiana as, historically, they have not resulted in large numbers of reports of human health impacts. Increasing water temperatures, increasing nutrient loading, and altered sources of freshwater within BTES have the potential to alter the risk to human health of harmful algal blooms. For these reasons, additional funding to increase knowledge of potential future human health risk is needed. Raising public awareness through effective communication of current knowledge would benefit greatly from some additional funds to support this effort.

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Agricultural engineer Jim Fouss observing an algal bloom on Alligator Bayou near Baton Rouge. Image: USDA

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EM-15 Protection and Enhancement of Native Biological Resources

OBJECTIVES

- **Plants** - To support conservation efforts for ecological succession patterns of plant diversity from up-basin to down-basin within each of the habitat zones of the BTB delta ecosystem



The American Beautyberry is a native plant to the estuary. Image: Jonathan Traviesa

- **Pollinators** - To build a framework that encourages landowners to manage their land in a way that maximizes its suitability as habitat for pollinators
- **Fish and Shellfish** - To support conservation efforts to maintain the diverse recreational and commercial invertebrate and vertebrate species harvested for pleasure and profit
- **Birds** - To support conservation measures that maximize available natural habitats that maintain healthy populations of migratory and resident birds across the BTB system

- **Wildlife** - To support conservation efforts to maintain the diverse amphibian, reptile, and mammal populations
- **Threatened and Endangered Species** - To support recovery and conservation efforts for threatened and endangered species

BACKGROUND/MAJOR ISSUES

(1) Plants - A delta's ecosystem is composed of specific habitats found in succession from up-basin to down-basin and is defined largely by the vegetative species found within each which are dependent on three primary interacting environmental parameters: elevation above sea level, soil moisture content, and salinity.

(2) Pollinators - Pollinators and pollinated plants are critical to our nation's economy and food security, ecological diversity, wildlife, and environmental health (National Strategy to Promote the Health of Honey Bees and Other Pollinators, Pollinator Health Task Force, The White House, 2015). Pollinators are a keystone species group and include honeybees, native bees, other insect pollinators, birds, and bats. About 75 percent of flowering plants on the earth rely on pollinators to set seed, and about one third of human food depends on pollinators. Honeybee pollination alone is worth \$15 billion to our agricultural crops each year. Pollinator insects provide many other ecosystem services as well; 90 percent of birds depend on insects during at least one stage of their lives; many flower-visiting beetles are also decomposers, and many flower-visiting insects have larvae that provide pest control. Pollinator populations are struggling. In 2014, beekeepers reported that approximately 40 percent of their honeybee colonies were lost. With this loss of bee colonies, the essential pollination service that bees provide to agriculture is also lost which threatens our nation's agriculture. Monarch butterflies, another pollinator, have declined by 90 percent or more over the past two decades in their overwintering grounds in Mexico.

(3) Fish and Shellfish - Louisiana is the second largest producer of fisheries in the United States behind Alaska. In 2015, commercial landings equaled 1,070,317,980 pounds with a dockside value of \$373,680,966. In 2015, Louisiana contributed 68 percent of all Gulf States' pounds landed and 42 percent of its dockside value with the BTB as a significant contributor. A few of the dominant freshwater and estuarine species contributing to Louisiana's production in 2015 were the bowfin (colloquially known as choupique, 98 percent of the National poundage), black drum (65 percent of the National poundage), white shrimp (63 percent of the National poundage), eastern oyster (58 percent of the National poundage), menhaden (55 percent of the National poundage), wild-caught channel catfish (29 percent of the National poundage), brown shrimp (26 percent of the National poundage), and blue crab (26 percent of the National poundage). Those listed, along with many more commercial species, are extensively found within the BTB. Some of the commercial species listed above are also important recreational species such as blue crab, white and brown shrimp, channel catfish, bowfin, and black drum. Additional recreational species are the estuarine species: red drum (colloquially known as redfish), spotted sea trout (colloquially known as speckled trout), and the freshwater species of the Centrarchidae (sunfish) family (largemouth bass, blue gills, redears, crappies). These species are exceedingly popular for recreational fishers.

(4) Birds – Because of the significant number of migratory species as well as native species, birds have their own separate profile and are not discussed in Wildlife. Over 400 species of birds are known to the BTB. While many are considered “residents,” the majority are migratory in nature, passing through southeast Louisiana twice each year during their long migratory journeys. The BTB are uniquely located along the migratory path of many species of birds. Trans-gulf migrants crossing between the Yucatan Peninsula and North America use the BTB as a landfall for northbound migrants or the final

point of departure for southbound ones. Although trans-gulf migrants reach the Gulf Coast from west of Houston, Texas, to Florida, a large proportion of the migrant population uses the upper Texas coast and coastal Louisiana around to Mississippi. The BTB are, therefore, important areas for the trans-gulf migrants because they cover a significant part of this important section of Gulf Coast. For over 100 years, but especially since the work of Dr. George Lowery in the 1940s and 1950s on Grand Isle (1946, for example), the area of the BTB has been recognized as a very heavily used stopover by Neotropical trans-gulf migrant birds. It is especially critical when foul weather in spring causes migrating birds to reach land exhausted or in fall when bad weather forces the birds to abort their southward migration at the last moment before leaving land.

Although habitats in the BTB are important for transient Neotropical migrant birds, the region is also important for wintering and breeding species as well, whether they are Neotropical migrants or not. Large flocks of waterfowl winter in the BTB as well as significant portions of the populations of some passerine species such as swamp sparrow and yellow-rumped warbler. Some seabird species have major breeding populations on the barrier islands of the BTB, and a few Neotropical migrant passerines such as prothonotary warbler also have significant fractions of their total populations breeding in the swamps of southeast Louisiana.

Review of long term data sets and various scientific studies suggest declines for many species of birds from Neotropical migrant songbirds to forest and marsh dependent residents, to Arctic nesting shorebirds, and to prairie nesting waterfowl. The causes of these declines are, of course, various, complex, and, in many cases, not completely understood. However, a common theme linking these various species is that they have suffered serious loss of habitat necessary to sustain them over some stage of their life cycle.

(5) Wildlife - Wildlife species are abundant and inhabit the swamps, bays, bayous, and marshes of the

BTB. Wildlife for this report are separated into four broad categories: amphibians, reptiles, birds, and mammals. Amphibians found in the BTB include frogs, newts, and salamanders and reptiles include snakes, turtles, and lizards. Mammals consist of bats; small rodents such as mice, rats and shrews; furbearers such as muskrat, mink, otter, opossum, raccoon, bobcat, coyote and black bear; and game species such as white tail deer, grey squirrels, and rabbits. With a mid-1970s survey of the Barataria Basin, investigators identified at least 30 species of mammals and 70 species of amphibians and reptiles. The LDWF identified four major influences on terrestrial wildlife: habitat destruction or conversion, habitat fragmentation, habitat disturbance, and altered habitat composition and structure. LDWF also identified similar threats to aquatic wildlife species: modification of water levels/changes in natural flow patterns, sedimentation, habitat disturbance, nutrient loading, and altered composition and structure.

(6) Threatened and Endangered Species - Approximately 735 species of birds, finfish, shellfish, reptiles, amphibians, and mammals spend all or part of their life cycle in the BTES. Approximately 40 animal species and approximately 50 plant species in the BTES are threatened or endangered. Many factors contribute to declines in animal populations, particularly changes in habitat. Pollution can also have a negative impact on the health of species and their ability to reproduce, and over-harvesting can harm animal populations. Section 4 of the Endangered Species Act directs USFWS and NOAA's NMFS to develop and implement recovery plans for threatened and endangered species unless such a plan would not promote conservation of the species. BTNEP is actively engaged in projects such as the Piping Plover Survey to monitor the distribution and abundance of target threatened and endangered species.

DESCRIPTION

(1) Plants - This action is implemented by protecting, conserving, and creating habitats conducive to preserve the vascular vegetation associated with the

4.2 million acres of wetlands, ridges, forests, and farmlands between the Mississippi and Atchafalaya Rivers that comprise the BTB.

(2) Pollinators - Pollinator habitat can range in size from small residential gardens to larger plots of land and still offer cumulative benefits to nearby agriculture. This action is recommended wherever it is economically and logistically feasible to do so. In 2014, President Obama issued a Presidential Memorandum directing an interagency task force to create a Strategy to Promote the Health of Honey Bees and Other Pollinators. The USEPA and USDA led this task force with the following three main goals.

- Reduce honey bee colony losses to economically sustainable levels
- Increase monarch butterfly numbers to protect the annual migration
- Restore or enhance millions of acres of land for pollinators through combined public and private action

Increasing the quantity and quality of habitat for pollinators was a major part of the Task Force's Strategy and Action Plan to better understand pollinator losses and improve pollinator health.

(3) Fish and Shellfish – This action is implemented by preserving the salinity gradients that exist within the estuaries from fresh to saline. At least 80 percent of the coastal species landed commercially and recreationally in the northern Gulf of Mexico are estuarine-dependent for part or all their life.

(4) Birds - The intent is to build a framework in the BTB for the conservation of bird populations that use the area. This framework will include components to educate the public about bird issues, monitor bird populations, and encourage private, corporate, and government landowners to protect critical areas and manage land under their care in such a way as to maximize its suitability as habitat for migratory and resident birds. Furthermore, this framework



Forested wetlands provide important habitat for migratory birds. Image: Keri Turner

promotes avian tourism and the infrastructure to support public access.

(5) Wildlife – In Louisiana, 90 percent of the land is privately owned. Although the exact statistic is not known, the great majority of land in the BTB is privately owned. Therefore, conservation and maintenance of wildlife diversity requires that landowners be actively engaged in the process. In its 2005 and draft 2015 wildlife Action Plans, the LDWF recognized the following as the greatest threats to maintaining species diversity.

- habitat destruction or conversion
- habitat fragmentation
- habitat disturbance
- altered habitat composition and structure

(6) Threatened and Endangered Species - The Endangered Species Act (ESA) requires that threatened and endangered animal and plant species be identified at the federal and state level. To be

considered for federal listing, the species must meet one of the five following criteria.

- the present or threatened destruction, modification, or curtailment of its habitat or range
- an over use for commercial, recreational, scientific, or educational purposes
- declining species due to disease or predation
- inadequate existing regulatory mechanisms
- other natural or man-made factors affecting its continued existence

LOCATION

(1) Plants - Within the BTB, dominant plant species by habitat are based on their location from up-basin to down-basin (fresh to saline) as listed below:

- Bottomland Hardwoods: These areas occasionally flood but are usually dry. Prominent are overcup oak, water hickory, sugarberry, swamp dogwood, privet, water elm, water oak, sweet gum, box

elder, and winged elm, hawthorns, red mulberry, pecan, hackberry, honey locust, and elderberry.

- **Swamp:** Trees and shrubs that dominate this ecosystem have evolved to tolerate prolonged flooding. Key species are bald cypress and tupelo-gum; others are swamp red maple, black willow, pumpkin ash, green ash, water locust, and buttonbush.
- **Freshwater Marsh:** This habitat supports the greatest plant diversity of all marsh habitats. Common plants of freshwater marshes include maidencane, spikesedge, bulltongue, alligatorweed, giant cutgrass, pickerelweed, pennywort, cattail, southern wildrice, coontail, common duckweed, waterlilies, irises, and bullwhip.

Much of BTB freshwater marsh is “flotant,” which means that it is buoyant during certain times of the year.

- **Intermediate Marsh:** This is a unique habitat zone characteristic of delta regions that are influenced by freshwater and slight oceanic processes that produce a mixture of plants that have some osmotic tolerance to salinity. The two dominant plants that can tolerate salinity are wiregrass and widgeongrass alongside freshwater species such as cattails, bulltongue, giant bulrush, common threesquare, deer pea, switch grass, Walter’s millet, alligator weed, and southern naiad.
- **Brackish Marsh:** Mostly wiregrass thrive in this habitat with few other plant species. Other species in this habitat are olney bulrush, leafy threesquare, and widgeongrass.
- **Salt Marsh:** Relatively few species can tolerate the salinity stress from being in the closest proximity to the Gulf; this habitat is dominated by smooth cordgrass (oystergrass) and black mangroves. Other species are saltgrass, black needlerush, and saltwort.
- **Beach Dunes:** The dunes of Louisiana’s barrier

islands are exposed to moderate to high amounts of salt spray. In addition, limited nutrient availability and substrate instability also affect coastal dune vegetation. A few of the species are wiregrass, sea oats, beach panic, saltwort, morning glory, and seaside goldenrod. If dunes remain stable, allowing natural succession to progress, then coastal dune shrub thickets are formed.

- **Maritime Ridges:** This habitat can be natural stranded beach ridges (“Cheniere” - French for “place of oaks”) or anthropogenic to create elevation above the surrounding marsh. These ridges are mostly four to five feet above sea level. Live oak and hackberry are the dominant canopy species.

(2) Pollinators - Pollinator habitat can range in size from small residential gardens to larger plots of land and still offer cumulative benefits to nearby agriculture. This action is recommended wherever it is economically and logistically feasible to do so.

(3) Fish and Shellfish - An estuary is defined by its prevailing and changing salinity patterns that occur yearly, seasonally, and daily, producing habitats that require fish and shellfish to adapt or perish. This dependence is manifested in the important balance of freshwater and ocean waters mixing within the estuaries producing salinity gradients that create the ideal habitat for each respective species. The major habitat influence of salinity is certainly not a static gradient from up-estuary to down-estuary, due to freshwater influences from increased river and bayou discharges, as well as precipitation, and from increased salinities from southerly winds and tidal currents bringing in Gulf ocean waters. This dynamic salinity flux creates the ideal habitats for those species that can physiologically cope with this changing condition.

A few species are profiled based on their habitat location within the delta with their value as indicators of habitat requirements and public interest. The

importance of a balance between freshwater and salinity within the BTB delta is used as the habitat criteria for estuarine-dependent species. Salinity is measured in ppt with freshwater at < 1 ppt and Gulf ocean water at 32 to 34 ppt.

- **Brown Shrimp:** Brown shrimp spawn in the Gulf primarily in the fall on deep continental shelf waters with post-larvae immigrating into the BTES in great numbers through tidal passes of barrier islands in February-April and needing an ideal salinity of 10 ppt or greater to survive and grow to a size for commercial and recreational harvest. This is known as the “spring shrimp fishery” that usually opens in mid-May for about 60 days or until white shrimp larvae begin to show up in large numbers. The brown shrimp in May-June migrate in large numbers back to the Gulf to mature, mate, and spawn. Life span is one to two years. This is a fishery with the

species contributing a new exploitable population annually. The species is not considered to be in decline.

- **White Shrimp:** White shrimp spawn in the Gulf of Mexico primarily in shallow continental shelf waters from March to November with post-larvae migrating to the estuaries in large numbers usually in June and in October-November. White shrimp migrate farther into the estuaries than brown shrimp and can do well at five ppt salinity. Cold fronts usually force mass migrations in the fall and early winter months. This is known as the “fall shrimp season.” Life span is one to two years. This is a fishery with the species contributing a new exploitable population annually. The species is not considered to be in decline.

Note: Coastal wetland acreage (habitat) in estuaries is historically correlated to long-term carrying capacity for white and brown shrimp, and this



BTNEP supports conservation efforts that increase biodiversity. Image: BTNEP

hydrological connection between marsh and water is considered an important aspect of shrimp production.

- Eastern Oyster: This is an immobile species except as a larva for two to three weeks after fertilization, which requires a minimum salinity of 8 to 10 ppt for competent development and eventual setting onto a substrate where it will exist for the rest of its life. Once the larva has settled, it takes on the typical shape and appearance of an oyster and becomes physiologically tolerant to a wide range of salinity, depending on water temperature. From December to March, with relatively low water temperatures, the oyster can tolerate salinities as low as zero to one ppt for weeks, but in warm to hot waters by late spring/summer, the oyster will succumb to physiological stress and potential death in days if the salinity drops below five ppt. Oysters exhibit some low spawning throughout the year except in the coldest months of December-January with major spawns occurring typically in April-May and in September-October with a salinity minimum of 8 to 10 ppt need for adequate reproductive development. Oysters inhabit a narrow habitat zone within the estuaries because of their immobility and the prevalence of predators. Subtidal oysters are found in estuarine habitats that range from about 5 to 15 ppt, the low end of the salinity range because of physiological needs and the high end because of the abundance of predators. Intertidal oysters are in higher salinities out to the barrier islands because they are protected from major predation because of daily low-tide exposure. Life span is usually six to eight years. This species can mature and spawn within a few months after setting and contributes a new exploitable population within about 15 to 18 months. The species is not considered to be in decline.
- Blue Crab: This mobile species is one of the most salinity tolerant within the BTES and can be found in great numbers from freshwater to ocean habitats. However, two periods within its life cycle occur when salinity becomes extremely

important. It is not known precisely what salinity is needed for mating pairs during March to May, but it is generally recognized that brackish water conditions are necessary. Mating occurs usually in the mid to lower regions of the BTES. Once mating has occurred, the female must migrate farther down the BTES to spawn from May-August in salinities of at least 20 ppt, ideally, for its larvae to hatch and develop properly. This is a species that matures within 10 to 12 months and essentially can contribute an annual crop for exploitation. Life span is usually two to three years. The species is presently considered to be in decline with no conclusive reasons why although commercial and recreational fishing pressure is significantly high.

- Speckled Trout: This highly popular recreational species is found along the coast from barrier islands to inland brackish ponds and lakes. Although substantial migration occurs up and down an estuary, the species does not move much between estuaries thereby creating estuary-specific populations. They are carnivores feeding on shrimp, crabs, and forage fish such as bay anchovy, Gulf menhaden, and even smaller juvenile spotted sea trout and red drum. Adults spawn primarily from May to August in a wide variety of habitats from sandy beaches to shallow vegetated ponds. This is often governed by water temperature and light, but the underlying habitat need is the proper salinity. The species can live and spawn in salinities from 10 to 40 ppt, but optimal spawning habitat is 17 to 35 ppt for best egg viability. Individuals mature and are capable of spawning by the beginning of their second year of life; males usually mature at a total length of 210 to 230 mm (8 to 9 in) and females at a total length of about 300 mm (12 in). Life span is usually five to nine years. This is a fishery with the species contributing a new exploitable population annually. The species is not considered to be in decline.
- Gulf Menhaden: By poundage, this is the

most abundant industrial species harvested in Louisiana and the northern Gulf of Mexico. The adults are harvested in great schools upon the shallow waters of the continental shelf off the barrier islands. This species can be found in a wide salinity range from ocean strength to as low as two to five ppt. Adults and juveniles are also found in large schools in all salinities of the estuaries. All life stages are most abundant in salinities ranging from 5 to 10 ppt. Menhaden mature and spawn offshore in their second year of life and have a protracted spawning period from September to April with a peak generally between December and February. This is a filter-feeding animal eating on microscopic animals and plants that constitute plankton.

Note: Menhaden is not only a commercial species but also a forage species providing a source of food as a prey animal for many important fish species. It provides a key ecological niche within the food web of the BTES. Other extremely important forage species include bay anchovies, killifish, mud crabs, and grass shrimp.

(4) Birds – All living creatures are directly tied to the habitats that sustain them. In general, birds need three things: places to nest, shelter from predators and inclement weather, and adequate food and water. Essentially, these needs are provided by different habitats.

The BTB is a patchwork of many different habitat types. Each of these different habitat types is used by different birds for different reasons. While much of this region consists of water, large expanses of wetland areas exist including saltwater marsh, freshwater marsh, and forested wetlands. These marsh and forested wetland habitats are lower in elevation than the surrounding natural ridges which cause them to remain wet throughout much of the year. Small remnants of upland forests still remain along the natural ridges of bayous and streams; however, many of these upland forests and some forested wetlands have been cleared for agriculture

and residential/urban development.

- **Barrier and Headland Beaches:** Along the coast are the barrier islands and headland beaches, many of which are accessible only by boat. The beaches, mudflats, and adjacent gulf and bay waters form a ribbon of habitats that are extremely important to many species of birds that pass through on their long migratory journey, including shorebirds such as threatened piping plovers, Wilson's and snowy plovers, willets, sanderlings, and red knots. These areas are also important to colonial water birds including brown pelicans, laughing gulls, least and Foster's terns, and black skimmers. These habitats are not only used as staging and refueling areas for migrants, but they are also important for many species that breed in the BTB. Common birds that nest along barrier islands include the royal tern, Caspian terns, black-necked stilts, roseate spoonbills, great egrets, snowy egrets, and tricolored herons.
- **Marshes:** Many places in southeast Louisiana exist where vast freshwater, intermediate, brackish, and saltwater marshes stretch as far as one can see. These seemingly endless lush green fields with their intermittent ponds, lakes, and bays are important habitat for millions of birds. Freshwater marsh gives way to intermediate, brackish, and finally saltwater marsh, representing an increase in salinity and decrease in plant diversity as one progresses southward toward the Gulf of Mexico. Migratory songbirds that spend part of their journey in marsh habitats include northern waterthrush, yellow warblers, common yellowthroats, and indigo buntings. These birds can typically be found in the floating marsh habitats that support shrub species of plants. Resident marsh birds that nest and make their home here include mottled ducks, common moorhens, glossy and white-faced ibis, and marsh wrens. Common loons, horned grebes, lesser scaup, and red-breasted mergansers are usually found on the open lakes and bays that fringe many of these marsh habitats.

Distribution of many species of birds is influenced by salinity with species such as clapper rails and seaside sparrows restricted to salt marsh while least bitterns, king rails, and purple gallinules are found in fresher marshes. Some species tolerate a wide range of salinities and can be found throughout all marsh habitats including red-winged blackbirds, great blue herons, and white ibis.

- **Forested Wetlands:** Inland from the marshes are the seemingly impenetrable forested wetlands of the BTB that include both swamp and bottomland hardwoods. With their cathedral bald cypress, moss draped tupelo-gum, and tea-stained water, swamp forests are a hallmark of Louisiana. These majestic cypress/tupelo forests are important not only to migrants such as yellow-crowned night herons, Acadian flycatchers, northern parulas, and hooded, prothonotary, and yellow-throated warblers but are also equally important to resident great blue herons, wood ducks, red-shouldered hawks, barred owls, and pileated woodpeckers. In the winter, the swamps play host to yellow-bellied sapsuckers, Eastern phoebes, and hordes of yellow-rumped warblers.

Flanking many of these cypress/tupelo swamp forests are the bottomland hardwoods of the BTB. Here, plant diversity is at its greatest. Like the cypress/tupelo swamp, bottomland hardwoods are also very important for migratory songbirds, including yellow-billed cuckoos, summer tanagers, red-eyed vireos, and great-crested flycatchers. Resident birds such as eastern screech owls, northern cardinals, blue jays, and Carolina chickadees are common inhabitants of bottomland hardwood forests. In winter, forested wetlands shelter sharp-shinned hawks, American woodcock, hermit thrushes, ruby-crowned kinglets, blue-headed vireos, and white-throated sparrows.

- **Upland Forests:** Found along the natural ridges of relict distributaries (bayous) and on Cheniers (live oak forests) near the coast are the upland forests of the BTB. Historically, upland forests also dominated many of the barrier islands

that still exist today. Much of these once vast forests were cleared for agricultural and urban development long ago as they represented the highest ground available. This “highest ground” was the last place to flood during periods of high rainfall and strong southerly winds.

Cheniers and upland forests on barrier islands are of particular importance to migratory songbirds just before or after their Gulf crossing including Swainson’s thrushes; yellow-throated vireos; scarlet tanagers; painted buntings; rose-breasted grosbeaks; Baltimore orioles; Tennessee, Cerulean, Blackburnian, Kentucky, Wilson’s, and black-throated green warblers; and many others. These upland plant communities produce seeds, fruit, and insects important to songbirds that spend part of their migratory journey in the BTE’s habitats.

(5) Wildlife - A few species are profiled based on their location within the delta with their value serving as indicators of habitat requirements and public interest.

- **American Bullfrog:** The bullfrog is a very popular commercial and recreational species. A freshwater fishing license is all that is required for collection of individuals. It is the largest frog in North America reaching a length of 200 mm (8 in). Males are usually territorial, and when they mate, the female lays a film of 10,000 to 20,000 eggs on the surface of the water around vegetation. Mating occurs from early March to June. Bullfrogs occur in any freshwater habitat throughout the delta. A general decline in amphibian populations has occurred throughout the southern states. The status of the bullfrog in the BTB is not known; however, it is considered one of the hardiest amphibian species for survival.
- **American Alligator:** The alligator is managed effectively as a ranched (farmed) animal using wild-harvested eggs from nesting females collected from private lands with 12 percent of successful hatchlings returned to wild within



The blue crab is one of the most mobile species in the BTES. Image: Lane Lefort Photography

two years and with an adequate size for better survival. Additionally, the State allows wild harvest for skin and meat in September of each year. As of January 2015, 56 farmers were licensed in Louisiana with 32 having stock with an on-farm inventory totaling 799,047 alligators. During the 2014 tag year (January 2014 through December 2014), an estimated 341,888 farm-raised alligators were harvested with an estimated value of \$81.7 million. Eight of the 32 farms with stock are located in the BTB.

During the 2014 wild season, a total of 36,277 alligators were harvested by 3,279 licensed alligator hunters. Alligators harvested averaged 7.6 feet in length with an estimated value of \$13.8 million. Wild harvest for skin and meat is managed by the LDWF allowing one alligator per prescribed acreage. The importance of habitat acreage for alligator population management

is exemplified in the State allowing Lafourche parish an alligator acreage ratio of 1:160 for cypress-tupelo swamp, 1:90 for freshwater marsh (< one ppt salinity), 1:55 for intermediate marsh (one to three ppt salinity), and 1:140 for brackish marsh (3 to 15 ppt salinity) in 2014. The acreage ratio varies from parish to parish, but the importance of freshwater and intermediate marsh is evident for nesting populations. The success of State management has removed the species from the threatened and endangered species list. The population is healthy but very dependent on adequate nesting habitat.

- **Bottlenose Dolphin:** An estuarine species might not exist that brings more delight to the public than the dolphin. Besides its fame, it has an integral position within the estuarine ecosystem as a top predator. Bottlenose dolphins inhabiting the bays, sounds, and other estuaries adjacent to



Bottlenose Dolphins live in the southern-most edge of the estuary. Image: USFWS

the Gulf of Mexico form discrete communities. Therefore, the Barataria population as well as the Terrebonne population are unique to their respective estuary. A 1995 NMFS study indicated a best estimate population of 209 dolphins in Barataria Bay and 100 in Terrebonne Bay. A dolphin can weigh 135 to 635 kg (300 to 1400 lbs.) and reach a length of two to four m (6.0 to 12.5 ft.). Their life span is 40 to 50 years, and sexual maturity varies by population and ranges from 5 to 13 years for females and 9 to 14 years for males. Calves are born after a 12-month gestation period and wean at 18 to 20 months. On average, calving occurs every three to six years.

Note: After nearly four years of monitoring after the Deepwater Horizon oil spill, NOAA found that only 86.8 percent of the Barataria Bay dolphins survived each year as compared to other populations where

roughly 95 percent of the dolphins survived. The reduced reproductive potential, along with decreased survival, will have long-term consequences for the Barataria Bay dolphin population. Dolphins were noted with disease condition including lung disease and impaired stress response.

- American Black Bear: This species was recently removed from the threatened list in Louisiana. Home populations are known to exist in the coastal wetlands of the Atchafalaya Basin as well as the central and northern habitats of the BTB and in the northern region of the BTB in Point Coupee Parish near False River. Numerous sightings of black bears have occurred throughout the northern and central regions of the BTB.

(6) Threatened and Endangered Species - Threatened and endangered plant and animal species exist in all 16 parishes comprising the BTNE.

Louisiana has identified 20 rare natural communities in the BTES.

LEAD AGENCIES RESPONSIBLE FOR IMPLEMENTATION

- **LDWF** - The lead state agency for fish and wildlife in the State is the LDWF. Major management divisions within the LDWF are Office of Fisheries, Office of Wildlife, Office of Management and Finance and Law Enforcement and Legal, all working together to assure conservation and stewardship of living resources.
 - LDWF factors in pollinators as a keystone species in large-scale land acquisition and restoration.
 - LDWF has developed Management Plans for alligators, shrimp, oysters, speckled trout, red drum, and many more species.
 - The LDWF 2015 Wildlife Action Plan will be effective for the next 10 years.
 - The Louisiana Natural Heritage Program within LDWF develops and maintains a database on rare, threatened, and endangered species of plants and animals and natural communities for Louisiana.
- Boards and commissions within LDWF (listed below) meet to discuss issues of importance specific to the management of a species.
 - Alligator Advisory Council
 - Fur Advisory Council
 - Hunting and Fishing Advisory Education Council
 - Artificial Reef Council
 - Oyster Task Force
 - Shrimp Task Force
 - Crab Task Force
 - Crawfish Task Force
- **LDNR** – LDNR is primarily a regulatory agency with coastal wetlands responsibilities housed within the Office of Coastal Management.
 - The Permits/Mitigation Division. An important activity within the division is the CUP process. The purpose of CUP is to document and regulate coastal zone activities that may increase the loss of wetlands and aquatic resources as well as to reduce conflicts between coastal resources users. A second activity within the office is Mitigation Banking. Mitigation must offset any activity that creates a net loss of wetlands.
 - Interagency Affairs & Field Services Division. This division is responsible for implementing the LCRP (1980 LCRP Final Environmental Impact Statement).
- **CPRA** – A principal function of CPRA is to develop and revise the Coastal Master Plan every five years. Reports have been published in 2007 and 2012, and the draft plan for 2017 was released in January 2017 for public comment. This document is the State's blueprint for coastal restoration and protection activities and has potential significant influence on living resources. Report development has public and agency inputs.
- **LDAF** – The Department has a pollinator education program, the Louisiana Pollinator Cooperative Conservation Program (LPCCP), in cooperation with the LSU Agriculture Center.
- **Federal Agencies:** USDA, NRCS, USFWS, USGS, and NOAA's NMFS.
 - USFWS's Wildlife & Sport Fish Restoration (WSFR) program, collaborating with the Association of Fish and Wildlife Agencies (AFWA), encourages states to address pollinator conservation in projects that use federal financial assistance funds.

- USFWS and NOAA administer the ESA.
- NRCS includes pollinator habitat as part of its EQIP. As of 2016, pollinator habitat projects do not occur in the BTNEP parishes.
- NOAA's NMFS administers the Marine Mammal Protection Act (MMPA), houses the Office of Sustainable Fisheries, and provides technical advice to government agencies and the public on proposed actions that could have a negative effect on living marine resources, including coastal wetlands.
- NOAA established the Coastal and Estuarine Land Conservation Program (CELCP) in 2002 to protect coastal and estuarine lands considered important for their ecological, conservation, recreational, historical, or aesthetic values.
- USGS administers the Amphibian Research and Monitoring Initiative (ARMI). The south-central region of ARMI includes the States of Texas, Oklahoma, Arkansas, Mississippi, and Louisiana.

Support implementers should include BTNEP, other state agencies including the LDCRT, the DODT, and others including NGOs. In particular, BTNEP has collaborated with a number of agencies and NGOs to advance aspects of the CCMP for 25 years. Over the past two decades, BTNEP has joined agencies including the LDWF, USFWS, and National Wildlife Research Center (NWRC) to collect data and synthesize information regarding colonial nesting birds. BTNEP, in collaboration with a number of other entities, has developed an extensive database regarding nesting shorebirds along the Louisiana coast. More recently, BTNEP, through partnerships with CPRA, LDWF, and USFWS, has developed an extensive dataset regarding wintering birds along the Caminada Headland including the threatened and endangered piping plover and red knot. Efforts to advance our knowledge regarding the life history requirements of these birds should continue through

efforts similar to these. Furthermore, BTNEP has worked with a number of partners including the Greater Lafourche Port Commission (GLPC) to restore habitat for Neotropical migrants in the Port Fourchon area, with oil and gas companies to manage their properties for nesting shorebirds, and with CPRA to enhance habitat for birds in lower Plaquemines Parish. With the increased scope of this new Action Plan, BTNEP seems poised to work with many different partners to conduct similar work to support other wildlife and fish projects that benefit people and the natural habitats these species require.

TIMELINES AND MILESTONES

In part, as referenced here, the CCMP supports implementing the various plans developed by other agencies/entities. Each of those individual plans has their own specific timelines and milestones. Implementing actions through the BTNEP MC and financing through Section 320 funding are typically developed annually by various Action Plan teams. These actions typically involve partnerships/collaboration with various agencies/institutions; as such, many are considered opportunistic and do not follow specific timelines. Annual work plans developed through this process define timelines and milestones.

- **Pollinators** - The National Strategy to Promote the Health of Honey Bees and Other Pollinators outlines the following goals.
 - * Reduce honeybee colony losses during winter (overwintering mortality) to no more than 15 percent by 2025
 - * Increase the eastern population of the monarch butterfly to 225 million butterflies occupying an area of approximately 15 acres (6 hectares) in the overwintering grounds in Mexico through domestic/international actions and public-private partnerships by 2020
 - * Restore or enhance seven million acres of



The American alligator needs healthy wetlands for nesting populations. Image: Lane Lefort Photography

land for pollinators by 2020 through federal actions and public/private partnerships

- * Pollinator habitat projects should be implemented within the BTES as suitable project sites and funding are identified

- **Threatened and Endangered Species** - For threatened and endangered species, federal recovery plans set timelines specific to each species varying from three to six years to completion after listing. Recovery plans will vary for each species and must include:

- * a description of “site-specific” management actions to make the plan as explicit as possible.
- * the “objective, measurable criteria” to serve as a baseline for judging when and how well a species is recovering.

- * an estimate of money and resources needed to achieve the goal of recovery and delisting.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

As defined above, lead agencies/entities are legislatively mandated to manage issues related to EM-15. Furthermore, each agency/entity develops annual budgets and programmatic budgets internally to address those legislatively mandated requirements. These budgets and discussion thereof are not presented here.

BTNEP as a co-lead implementer works with other lead agencies/entities on an annual basis to define data gaps and develop partnerships with these organizations to address those data gaps. This includes an annual tiered process with first convening meetings of various Action Plan teams to

discuss needs for a particular Action Plan. Projects are defined during this phase along with appropriate costs/budgets. These costs vary according to the size and scope of the individual projects. As the process moves further, these project concepts and associated budgets are presented to the BTNEP MC where they are discussed and approved and included as part of individual BTNEP work plans. Funding sources vary, including CWA Section 320 funding. Other funding sources include but are not limited to the State Wildlife Grant Program administered through LDWF, Section 6 Grant Program administered through the USFWS, various funding sources through CPRA, and the RESTORE Act. Since the process of selecting projects to address data gaps is used annually, no reasonable expectation of costs can be presented beforehand.

PERFORMANCE MEASURES

Performance measures include:

- monitoring of Threatened and Endangered Species,
- abundance and distribution of select native species of conservation concern

Data Gathered:

For Plants, Pollinators, Fish and Shellfish, Birds, Wildlife, and Threatened and Endangered Species, lead agencies collect data as needed for the various species/habitats identified within this action plan. Certain data collection efforts are routine and extensive datasets exist for certain species/habitat types over time. Examples include LDWF fish



The American bald eagle uses wetlands to hunt and to feed its young. Image: Kim Comeaux

sampling and colonial nesting wading and seabird surveys. Other examples include CRMS vegetative surveys, agency lists of acres/square feet of pollinator habitat restored, and specific assessments for T&E species that could address presence/absence, reproductive success, breeding, survival, abundance, and density. BTNEP relies on these resource agencies' efforts to collect and supply data to inform project development and to use as certain indicators in the various BTNEP indicator reports. BTNEP has also collected data for certain species related to extensive habitat assessments and place-based surveys.

Monitoring:

Parties Responsible: Lead agencies conduct monitoring routinely for certain species and habitat types. See above. Other monitoring efforts are conducted as monetary resources become available. The State Wildlife Grants program administered annually through the LDWF State Wildlife Action Plan provides monetary resources for many of the projects conducted across the state. More specifically, the BTNEP Program collects data annually on nesting birds of the Caminada Headland and routinely across the coastal habitats of the State. Most of these efforts represent partnerships across several state and federal agencies and NGOs. The Endangered Species Act requires USFWS and NOAA to monitor species recovered and removed from the endangered species list "in cooperation with State..." and "for not less than five years."

Timetable for Gathering Data: See the LDWF Wildlife Action Plan at <http://www.wlf.louisiana.gov/wildlife/wildlife-action-plan>. Data gathering timelines vary significantly depending on species or habitat type while Threatened and Endangered Species are usually addressed in annual reports.

How Data is Shared: Much of the data collected is shared via agency web sites, technical reports, and through specific requests. Some data can be found in annual reports.

Possible Data Gaps: See the LDWF Wildlife Action Plan and species recovery plans developed by USFWS and NOAA.

Additional Funding Needed: Yes, additional funding is needed as available.

EM-16 Reduction of Impacts from Invasive Species

OBJECTIVE

- To prevent and reduce negative impacts caused by the proliferation of invasive exotic species in order to protect the native organisms and resources of the BTE

BACKGROUND/MAJOR ISSUES

Invasive exotic species can be plants or animals that have not historically been part of the natural community and that have the capacity to disrupt natural communities. When invasive exotic organisms move into an area, either through expansion of their range or importation, they leave their natural competitors and predators behind. Without these stressors, invasive exotic species can become established in natural areas and out-compete native species causing adverse ecological changes.

Invasive plants can form monocultures in previously diverse habitats, decrease forage value, and displace wildlife habitat. Noxious weeds are very difficult to eradicate, and millions of dollars are spent in the U.S. every year to control them. Noxious weeds occur on all types of land, public and private. In addition to species richness, noxious weeds affect farming, recreation, and navigation. Noxious weeds can be imported either accidentally, such as in agricultural crops brought into the U.S., or on purpose, such as the infamous water hyacinth give-away at the 1884 Cotton Exposition in New Orleans. To prevent new noxious weeds from establishing in the BTES, controls must be in place on both methods of entry.

Exotic plant species impact thousands of acres of wetlands and waterways in the BTES. Aquatic, exotic plants are a particular problem for the BTES with aquatic weeds invading previously unvegetated water and impeding water flow and navigation. Exotics can change submerged aquatic vegetation community structure and aquatic species composition by impacting food availability, photic zone, dissolved oxygen, and other physical qualities of water. Dozens of exotic plant species are established in the BTB. Among the most serious plant pests are: water hyacinth (*Echhornia crassipes*), water spangle (*Salvinia minima*), Eurasian watermilfoil (*Myriophyllum spicatum*), hydrilla (*Hydrilla verticillata*), alligatorweed (*Alternanthera philoxeroides*), giant salvinia (*Salvinia molesta*), Chinese privet (*Ligustrum sinense*), air potato (*Dioscorea bulbifera*), and Chinese tallow tree (*Sapium sebiferum*).

Invasive animals normally move into an area through importation and eventual release into the wild. Releases can be either accidental or planned. Examples of accidental releases in Louisiana include the escape of nutria (*Myocaster coypus*) imported for the fur industry. Escape was caused by natural disaster. In other areas of Louisiana, people intent on improving hunting opportunities have moved wild hogs (*Sus scrofa*) from one area to another. The aquarium industry has been a source of invasive species for many areas because aquarium owners release fish such as Rio Grande cichlids (*Herichthys cyanoguttatus*) or snails such as apple snails (*Pomacea maculata*) when they grow tired of maintaining an aquarium. Finally, increases in ambient and water temperatures are allowing some cold intolerant invasive species to expand their ranges. Invasive animals can out-compete native animals for food, consume commercially important plant species, and cause major disruptions of the food web.

Nutria are the best known invasive exotic animal in the BTES. However, many other animal species representing numerous taxa are known to have established and growing populations in, or adjacent

to, the BTES. These include apple snails, wild hogs, Rio Grande cichlids, brown anoles (*Anolis sagrei*), spotted jellyfish (*Phyllorhiza punctata*), lionfish (*Pterois volitans*), Asian tiger shrimp (*Panaeus monodon*), red imported fire ants (*Solenopsis invicta*), house sparrows (*Passer domesticus*), and four species of Asian carp (*Hypophthalmichthys nobilis*, *Hypophthalmichthys molitrix*, *Mylopharyngodon piceus*, and *Ctenopharyngodon idella*).

Controlling exotic species is an ongoing battle. Several steps can be taken to help battle the problem. Once a species becomes established, it is very difficult, if not impossible, to eradicate it. Therefore, education and prevention should be considered as a first step in invasive species management. Once populations become established, management and control generally become the only feasible alternative to prevent adverse impacts on the environment. Control efforts will require regional cooperation and planning to prevent new exotic species from becoming established and to control existing species. Continued monitoring and repeat control efforts are necessary for sustainable natural resource management.

DESCRIPTION

Four key strategies are necessary to address the invasive species problem in Louisiana. These strategies are: (1) education, (2) prevention, (3) control, and (4) data collection and dissemination. While overlap exists in action items that could be taken to address the invasive species problem, the following identify the general and/or specific steps under each strategy that BTNEP could take to prevent or control invasive species.

Education

- Educate the public on the impact of invasive species in the BTES and in adjacent areas. A special effort should be made to identify invasive species that have the potential to establish, or have established, populations in coastal Louisiana. Sources of such information include other states'

invasive species reports as well as exotic species country and region import lists.

- Provide guides to identify invasive species that will include how they may be differentiated from similar native species. Included in those guides should be appropriate contact information to report observations of species of special concern.
- Release (or encourage/assist the creation of) public service announcements on the impacts of invasive species on the human environment and recommend actions people can take to prevent the spread of invasive species.
- Post, or encourage the posting of, educational signage at major boat ramps recommending efforts be undertaken to ensure exotic plants on boats and trailers be removed prior to placing potentially infested boats or trailers into the water.
- Use a grant program to encourage education efforts specific to controlling, preventing, collecting data on, and monitoring invasive species.

Prevention

- BTNEP will encourage legislative efforts to prevent the import of species identified as potentially invasive to southern Louisiana habitats.
- Post, or encourage the posting of, educational signage at major boat ramps recommending efforts be undertaken to ensure exotic plants on boats and trailers be removed prior to placing potentially infested boats or trailers into the water.

Control

- Help develop laws and regulations aimed at controlling the spread of invasive species, especially those reported to be of most concern or of future threat. Activities include coordinating with federal and state law makers as well as federal and state agencies charged with enforcing

the regulations.

- Develop projects to encourage the harvest of invasive species using bounties or developing markets for those species.
- Develop or encourage developing projects to involve scientists, educators, and the public in controlling, managing, and eradicating various life stages of invasive species.

Data Collection and Dissemination

- Compile an annual review of information concerning invasive species in the BTES including a list of documented invasive species that highlights species of most concern, species that are currently being targeted by research, and species that are most likely to be invasive in the future.
- Summarize this information in the BTNEP Indicator Report published every five years.
- Sponsor and/or encourage original research efforts on invasive species through projects headed by internal and external research teams.
- Use a grant program to assist in the development of data collection protocols specific to invasive species.

This action will concentrate on locations throughout the BTES, but in order to prevent and control invasive species within the BTES, the program may address areas adjacent to the designated boundaries of the BTES.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

BTNEP will be responsible for compiling primary data, species lists, results on control projects, and Summary Reports on efforts within the BTES. However, as a component of that activity, it will also include results from other sources including numerous federal, state, and local agencies;

academics; and intergovernmental organizations doing projects involving invasive species. These include the following:

- The USDA has a nation-wide Noxious Weed List. Species on that list cannot be imported into the U.S. except for some limited scientific research exemptions. They do not, however, regulate plant imports into Louisiana from other states.
- The Animal and Plant Health Inspection Service (APHIS) of the USDA operates a Biological Control Program that studies, develops, and deploys biocontrol agents to protect agriculture and natural areas.
- The USGS maintains reporting and monitoring data and publishes factsheets and reports on its Nonindigenous Aquatic Species website.
- The USGS Wetland and Aquatic Research Center in Lafayette, Louisiana, maintains an active effort in studying and controlling invasive species.
- The Bureau of Land Management (BLM), National Biological Service (NBS), U.S. National Park Service (USNPS), USDA Agricultural Research Service, USDA Forest Service, NRCS, and USFWS have entered into a MOU for Federal Native Plant Conservation. The understanding sets up a committee to work with state and non-federal cooperators on native plant conservation on federal lands, including exotic species management.
- USACE has been the leader in research and control of aquatic exotic plants. Continuing the program, especially biological control research, is critical to long term management of exotic plants in the BTES. The USACE Aquatic Growth Control Unit works on biological, mechanical, and chemical control of aquatic weeds in navigable waterways. In the past, USACE has participated in a 50/50 cost share program with the state to manage aquatic weeds in other water bodies. USACE has worked on selection

and release of biocontrol agents in the region including the alligatorweed flea beetle, the water hyacinth weevil, and the hydrilla fly.

USFWS and NOAA oversee an invasive species program funded under the authority of the National Invasive Species Act. This Act created the Aquatic Nuisance Species Task Force to oversee developing and funding individual state invasive species programs. LDWF has created an invasive species program, the Louisiana Aquatic Invasive Species Council and Task Force, using funding derived under this statute. This organization developed a state-approved Statewide Management Plan for Invasive Species in 2005, which is currently under implementation.

- USFWS is also responsible for oversight of importing invasive species under the authority of the Lacey Act. This act identifies a number of species as being injurious and regulates the import of such species.
- LDAF enforces seed certification laws. It lists noxious weeds for different crops that cannot be present or can be present in only small amounts when the seeds are shipped.
- LDWF maintains a noxious aquatic plant list. Plants on the list cannot be imported into Louisiana. The list is in the fishing regulations pamphlet that is distributed to fishing license applicants. LDWF has developed brochures to educate citizens about the impacts of exotic plants and to encourage the use of native species when possible.
- The LSU Cooperative Extension Service has weed scientists who are available to help land owners with noxious weed problems.
- CWPPRA, while not developed to address the problem of invasive species, provides funds for the Coastwide Nutria Control Program, a project to control nutria populations in coastal



Nutria continue to cause devastation in Louisiana marshes. Image: LDWF

Louisiana through incentive payments to hunters and trappers. Under this program, approximately 400,000 nutria have been eradicated annually in Louisiana's coastal zone.

TIMELINES AND MILESTONES

In part, as referenced here, the CCMP supports implementing the various plans developed by other agencies/entities. Each of those individual plans has their own special Section 320 list of timelines and milestones. Implementing actions through the BTNEP MC and financing through Section 320 funding are typically developed annually by various action plan teams. These actions typically involve partnerships/collaboration with various agencies/institutions; as such, many are considered opportunistic and do not follow specific timelines. Annual work plans developed through this process define timelines and milestones. Examples of possible plans and potential responsible parties follow.

Education

E.1 Produce a brochure for home/land owners explaining impacts from exotic species; provide

a list of alternative native species for use in landscaping, aquariums, and ponds. Emphasize the impacts from non-native species and the benefits of natives, such as opportunities to view more bird and butterfly species (LSU Cooperative Extension Service and USDA).

E.2 Develop an outreach program that identifies species of concern in the BTES. Identify cost-effective means to eradicate species based on geographic scope of removal area.

E.3 Support the establishment and funding educational programs that highlight and encourage the control of a specific exotic species.

E.4 Develop species specific information sheets for the public that explain plant biology and least toxic management (LSU Cooperative Extension Service, USDA).

E.5 Inform the public, school, and scout groups about impacts from exotic species by promoting that USFWS, USNPS, and state parks implement the exotic species programs including tree removal and replanting with native species

(USFWS, USNPS).

Prevention and/or Control

P.1 Identify legislation that regulates introduction of exotic species and urge the appropriate agencies to fully enforce those regulations. For example, recommend banning the sale of Chinese tallow trees in Louisiana.

P.2 Identify problematic species of concern to Louisiana where introduction of such species are not regulated. Recommend State legislation which would disallow the introduction and sale of those species in Louisiana.

P.3 Develop a noxious weeds law for Louisiana that includes a noxious weed list making interstate import or transplant of invasive exotic species illegal within the state (LDWF responsible for compiling list; LDAF lead agency for listing terrestrial species).

P.4 Study the noxious plant and exotic animal control program in Florida. Contact Exotic Pest Plant Councils in Florida, California, and the Pacific Northwest to see if similar activities could work in Louisiana (USFWS, LDWF, and USNPS).

P.5 Study the hydrilla biocontrol program in Florida to determine if it will work in Louisiana (USACE, LDWF).

P.6 Support projects that eradicate or control exotic species. For example, BTNEP could encourage the continued funding of the nutria control program by CWPPRA or new funding by CWPPRA of the salvinia weevil propagation program. BTNEP could promote projects to eradicate Chinese tallow trees at designated areas within the BTES.

P.7 Keep the Louisiana noxious plant list updated (LDWF, USDA, and LDAF).

P.8 Require all aquatic plants for sale to be native

species; provide information about the impacts of aquatic exotic plants at pond and aquarium shops (LDAF, LDWF, and LSU Cooperative Extension Service).

P.9 Develop biocontrol for other invasive exotic species (USACE, USDA, LDWF, and LDAF).

Data Collection and Dissemination

D.1. Identify a suite of recommended monitoring protocols, by species, for use in quantifying density of exotic species in various habitats within the BTES.

D.2 Set up a contact point where users can report infestations of new exotic weeds and new management techniques (LDWF and USDA).

D.3 Encourage the creation of a database to monitor and report effectiveness of eradication efforts within the BTES.

D.4 Designate areas of exotic infestation to use for demonstrating successful exotic species removal and native species replanting projects (USFWS, NRCS, USNPS, USACE, LDWF, and LDAF).

D.5 Research a second biocontrol organism for water hyacinth (USACE and LDWF).

D.6 Study biocontrol for Chinese tallow trees (USDA and LDAF).

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

As defined above, lead agencies/entities are legislatively mandated to manage issues related to EM-16. Furthermore, each agency/entity develops annual budgets and programmatic budgets internally to address those legislatively mandated requirements. These budgets and discussion thereof are not presented here.

BTNEP as a co-lead implementer works with other lead agencies/entities on an annual basis to define projects, programs, and data gaps and develop



Water hyacinth choke local waterways. Image: BTNEP

partnerships with these organizations to address these. This includes an annual tiered process, first convening meetings of the BTNEP Invasive Species Action Plan Team (ISAPT) to discuss needs for a particular action plan project or program. Scopes of work are defined during this phase along with appropriate costs/budgets. These costs vary according to the size and scope of the individual projects. As the process moves further, these project concepts and associated budgets are presented to the BTNEP MC where they are discussed, approved, and included as part of individual BTNEP work plans. Funding sources vary, including CWA Section 320 funding. Other funding sources include but are not limited to the LDWF and various other state and federal programs dealing with invasive species. Because the process of selecting projects to address invasive species issues is used annually, no reasonable expectation of costs can be presented beforehand.

PERFORMANCE MEASURES

Performance measures include:

- location, number, and abundance of invasive species
- minimize number of new introductions of invasive species

Data Gathered:

State and federal resource agencies routinely conduct surveys to identify animal and plant species under various scopes of work that can be used to identify invasive species presence/absence. Examples include LDWF fish sampling, CRMS vegetative surveys, bird surveys, etc. BTNEP relies on these resource agencies' efforts to supply data to inform project development. BTNEP also conducts its own surveys for tracking the presence/absence of various species



Invasive species removal is often accompanied by chemical control. Image: Woodlands Conservancy

as well as contracting original scientific research specific to project goals.

Monitoring:

Parties Responsible: See **TIMELINES AND MILESTONES.**

Timetable for Gathering Data: annual and special reports from state and federal agencies

How Data is Shared:

- quarterly report activity at BTNEP MC meetings
- document meetings and activities of the ISAPT
- regularly report to EPA

Possible Data Gaps: none identified

Additional Funding Needed: yes, as available

EM-17 Improvement of Water Quality through the Reduction of Inshore and Marine Debris

OBJECTIVE

To improve water quality by significantly reducing the amount of trash entering the BTB's water bodies and the ocean through education and awareness activities targeted at students (K-12), parish governments, business communities, and individual citizens.

BACKGROUND/MAJOR ISSUES

Despite Louisiana having the highest fine for littering in the country, Louisiana waterways are still full of trash and debris. Marine debris results in animal fatality through ingestion, entanglement, and habitat damage. It also results in engine damage through a tangled propeller or clogged intake, a loss of tourism revenue because of unsightly shorelines, and a decrease in water quality from toxic pollutants. The breakdown of plastics creates toxic pollutants that are dangerous to sea life that see the microplastics as a food source. Research on the effects of this plastic ingested by sea life as food is ongoing.

Current/past programs of BTNEP include:

- Bayou Lafourche Cleanup
- Marine Debris Education and Prevention Program
- Lake Field's Cleanup
- DEQ's Trash Free Water participant
- Canvas Bag Distribution
- School Sustainability Programs (recycling)
- Derelict Crab Trap Removal Program

DESCRIPTION

This Action Plan will support education and awareness of the issues surrounding marine debris through hands-on projects to promote removing and preventing marine debris in the BTES. We will strive to create common understandings concerning the severity of aquatic trash in Louisiana communities and educate citizens through workshops and volunteer opportunities.

The primary goal of this Action Plan is to reduce inshore and marine debris in the BTES. It will serve to educate and engage stakeholders. These stakeholders will be informed and concerned and create a responsible citizenry within the BTES. The population will become more literate in issues

surrounding marine debris such as animal fatality, engine and propeller damage, tourism reduction, and impacts to water quality.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

The BTPO staff will be the co-lead implementer with the BTNEP MC, EPA, GOMP, Louisiana Sea Grant, LDWF, LDEQ, NOAA, Keep Louisiana Beautiful (KLB), Keep America Beautiful (KAB), LSU, and BTEF.

TIMELINES AND MILESTONES

Timelines

- Bayou cleanups sponsored by BTNEP will be held as funds are available.
- The Marine Debris Education and Prevention Program are held as funds are available.
- Involvement in EPA's Trash Free Waters Initiative is ongoing.
- Education/outreach events are ongoing.

Milestones

The team will:

- create common understandings concerning the severity of aquatic trash in Louisiana communities and watersheds.
- understand applicable anti-littering State laws.
- attend and host seminars and presentations pertaining to existing prevention and education programs especially those near waterbodies.
- partner with appropriate marine debris removal initiatives located inside the BTES.
- promote healthy watershed education and outreach.
- review and incorporate ongoing research.



Students identify common household items that can easily become marine debris. Image: Alma Robichaux Jackson, BTNEP

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Range of cost:

Total Funding Necessary (Annually): \$50,000 to \$100,000

Sources of funding:

- local, state, federal, industry, institutional, non-governmental organizations, and private
- BTEF and its partners
- marine debris grants (i.e. NOAA, GOMA, KLB, and KAB)

PERFORMANCE MEASURES

Performance measures include:

- amount of material removed from water bodies, shorelines, and riparian and coastal areas
- educational activities related to marine debris prevention reported on BTNEP MC agendas

Possible Data Gathered:

- document marine debris collected
- document meetings and activities of the BTNEP staff
- report regularly to BTNEP MC and appropriate partners

Monitoring:

Parties Responsible: BTNEP staff and its partners

Timetables for Gathering Data: as required by funding source entities

How Data is Shared: All data and projects are available on the BTNEP website and/or partner websites. Data is collected and shared with GOMA, NOAA and Ocean Conservancy.

Additional Funding Needed: Additional funding is always needed.

EM-18 Protection of Drinking Water Sources

OBJECTIVES

- To have a clear delineation of all drinking water sources
- To identify possible problems and potential sources of contamination including but not limited to toxics, sewage, microplastics, pharmaceuticals, and other emerging contaminants
- To use BMPs to diminish or eliminate problems
- To engage citizens in active protection of their drinking water
- To educate about appropriate actions to protect drinking water in the event of an emergency
- To support improvement in appropriate training and pay to develop an experienced workforce related to drinking water
- To participate in the education of public officials about the long term commitment that is needed to properly train certified water operators and related jobs
- To support appropriate improvements to the water resources infrastructure
- To support emerging technologies related to protecting drinking water sources

- To support and recommend sweeps of the water systems

Background/Major Issues

The quality of a drinking water source depends largely on what happens on the land surface above it (in the case of groundwater) or around it (in the case of surface water).

In 1996, the Safe Drinking Water Act Amendments required all states to submit a source water assessment plan to the EPA by February 1999 and complete a Source Water Assessment Program (SWAP) by May 6, 2003. The State of Louisiana was one of only ten states to complete all assessments by the statutory deadline.

The purpose of the SWAP was to assess the potential susceptibility to contamination of each drinking water source. Through the SWAP, LDEQ delineated source water protection areas around water supply wells and intakes and mapped the locations of all public supply wells, surface water intakes, and significant potential sources of contamination (SPSOC) within the 3,500 public water supply wells, 85 surface water supply intakes, and 18,058 SPSOC were identified in the State. SPSOC may include gas stations, dry cleaners, or other facilities that sell, store, use, or dispose of chemicals or fuels. Chemicals and fuels, if not handled properly, have the potential to contaminate our surface water and ground water. For ground water systems, the delineated protection area is a 1609.3 meter (one mile) radius circle around wells less than 304.8 meters (1000 feet) deep. For wells greater than 304.8 meters (1000 feet) deep, the area is reduced to a 804.7 meters (0.5 mile) radius for wells drilled before the Louisiana Department of Transportation and Development Water Well Construction Standards were adopted in November 1985; for wells deeper than 304.8 meters (1000 feet) drilled after November 1985, the radius is further reduced to 304.8 meters (1000 feet). For surface water systems, the delineated area is the upstream portion of the watershed within 8046.7 meters (five miles) of the intake. This is

known as the “critical area,” and SPSOC in this area were located by GPS. In addition, the “non-critical area” is the entire watershed upstream of the intake up to the boundary of the state border. SPSOC in the non-critical area were identified by a database search.

Due to the unique hydrologic setting and SPSOC associated with the Mississippi River, the assessment approach differed from that of other surface water sources. SPSOC were identified by GPS within the navigable waterway of the river from the St. Francisville Ferry Landing to the lowest drinking water supply intake at Boothville, Louisiana. This is considered the critical area for the Mississippi River and is bordered by levees. Vulnerability risk rankings were based on a four-hour time of travel, or 53,108.4 meters (33 river miles). Rankings are highest if a SPSOC is within 53,108.4 meters (33 river miles) of the intake and decrease with each 53,108.4 meter (33 mile) segment.

Other factors that could affect the susceptibility of a drinking water source to contamination were also considered. For ground water systems, the age and depth of the well, the average groundwater velocity in the aquifer, and the aquifer recharge potential were considered. For surface water systems, the age of the intake, average annual rainfall, vegetative cover, slope of the land, and the number of feeder streams to the water source were considered. LDEQ issued a final report to each system assessed through the SWAP. The report ranked each system’s susceptibility to contamination. The susceptibility to contamination rankings are used as a priority-setting approach to implement the Drinking Water Protection Program and to assist local communities in implementing drinking water protection measures. Parishes with numerous systems having high susceptibility rankings are targeted first, especially in higher population centers, and protection activities are driven by the most prevalent and most threatening SPSOC identified by the assessment. The most threatening SPSOC are defined as the high-risk SPSOC found within 304.8 meters (1000 feet) of public supply wells or intakes in the parish. High

risk SPSOC include above and underground storage tanks, auto body shops, abandoned water wells, dry cleaners, chemical plants, animal feedlots, military facilities, petroleum plants, and truck terminals. The most prevalent SPSOC are the most common SPSOC found for all protection areas in the parish.

“Drinking Water Protection Area” signs are placed on major highways at the boundary of the drinking water protection areas for drinking water wells and surface water intakes to remind citizens that the actions they take in these sensitive areas may have an impact on the quality of their drinking water. LDEQ gives educational presentations to schools and other organizations and speaks to local citizens, officials, and water system operators about the importance of drinking water protection. Businesses and industries within the drinking water protection area that store or handle chemicals have a greater chance of inadvertently contaminating the drinking water source because of their location. Therefore, LDEQ also visits, or recruits volunteers to visit, businesses and other establishments within the drinking water protection area to educate them on BMPs or measures taken to prevent or reduce the possibility of contamination.

Local water system managers and operators also have a distinctive interest in protecting the quality of the water they provide to their customers. LDEQ visits the operators and/or managers of each community water system in a parish selected for a drinking water protection program. The LDEQ staff review the SWAP reports with the water system personnel, answering any questions and pointing out possible risks to drinking water source contamination. The staff discusses with the water system personnel possible prevention tools and BMPs, such as contingency planning, to prevent contamination of drinking water. They also assist the operator or manager in developing a contingency plan for their water system.

Ordinances are also an important means of protecting drinking water. An ordinance is a statute enacted



Clean, safe drinking water contributes to public health as well as a healthy environment. Image: BTNEP

by the city or parish government. A drinking water protection ordinance is designed to protect the community's drinking water sources. Zoning and ordinances can provide a high level of drinking water protection by specifying and regulating the type of activity surrounding drinking water sources. The Louisiana State Sanitary Code (12:008-3) promulgated in 1988 requires a minimum setback distance from a potable water well of 15.2 meters (50 feet) from septic tanks, storm or sanitary sewers, and drainage canals, ditches, or streams. In addition, the minimum setback distance from a cesspool, oxidation pond, subsurface absorption field, mechanical sewage treatment plant, sanitary landfill, animal feed lot, manure pile, or solid waste dump is 30.5 meters (100 feet). Also, potable water wells must be spaced at least 7.6 meters (25 feet) apart. Aside from the few setback distances required by the Sanitary Code, no state regulations specifically protect drinking water wells from potential sources of contamination. A

local ordinance affords that protection.

LDEQ recommends that communities adopt a drinking water protection ordinance and consider the location of public water supplies in planning and zoning activities. LDEQ can provide maps in electronic or hard copy format to planning and zoning boards that show where wells and drinking water intakes are located and the extent of the drinking water protection area around each well or intake.

A model drinking water protection ordinance is provided to local officials to assist them in preparing their own ordinance. The model ordinance defines the area covered by the ordinance or the "critical area" as a 304.8 meter (1000 feet) radius around a public water supply well. It also lists the types of facilities that are prohibited in the critical area. These are SPSOC that were identified by the SWAP. The list and the critical area can be modified if the community chooses to do so. The model ordinance also contains a grandfather

clause for existing facilities. If the facility already exists, it can remain there when the ordinance is adopted.

Community involvement is a very effective and inexpensive means of protecting drinking water resources. An informed public is often a more responsible public. With education and guidance, local stakeholders can take actions to reduce or eliminate threats to the drinking water supply thereby benefiting their health, the economy, and the environment.

DESCRIPTION

This Action Plan is designed to preserve and work to protect drinking water for all of the residents of the BTES. This Action Plan will also provide for building support from local residents for clean drinking water and the use of BMPs to diminish or eliminate problems. Additionally, the Action Plan will serve as a way to engage citizens in active protection of their drinking water and to educate about appropriate actions to protect drinking water in the event of an emergency.

Each of the objectives is addressed in the description below. The first step in the Action Plan is to be sure that all public drinking water sources and source water protection areas are properly identified.

1. The State has a clear delineation of all drinking water sources and source water protection areas.

Parish drinking water source data is maintained by LDH. LDH Drinking Water Branch maintains a database of information for drinking water sources and is engaged in recording the annual operating periods, populations served, service connections, sources of water, service areas, and water purchases.

Information about the data base can currently be found on the web at LDH - http://sdw.opd.dhh.la.gov/DWW/Maps/Map_Template.jsp

Water System Type

Water systems are classified according to rules developed by the EPA and each state. Water Systems fall into two broad categories: public and non-public. A public water system can be further classified as one of the following:



It is important to support appropriate improvements to water resource infrastructure. Image: Lane Lefort Photography

Drinking Water Acronyms

The following acronyms, terms, and descriptions are used to describe drinking water information.

C - Community	Serves at least 15 service connections used by year-round or regularly serves 25 year-round residents.
GU - Groundwater Under the Direct Influence (UDI) Surface Water	System has a source that provides water UDI of surface water (e.g., unprotected well or springs) and no surface water sources.
GUP - Purchased Groundwater UDI Surface Water	System purchases water that originates from source that provides water UDI of surface water (e.g., unprotected well or springs) and no surface water sources.
GW - Groundwater	System has a groundwater source that is not UDI of surface water (e.g., protected wells) and no surface water or groundwater under the influence of surface water sources.
GWP - Purchased Groundwater	System purchases water that originates from groundwater source that is not UDI of surface water (e.g., protected wells) and no surface water or groundwater under the influence of surface water sources.
NC - Transient Non-Community	Regularly serves at least 25 non-residential individuals (transient) during 60 or more days per year.
NTNC - Non-Transient Non-Community	Serves at least the same 25 non-residential individuals during six months of the year.
SW - Surface Water	System has a surface source (e.g., river, reservoir, intake).
SWP - Purchased Surface Water	System purchases water that originates from a surface source (e.g., river, reservoir, intake).

Primary Source Water Type categorizes the primary source water used by a water system. Permitted entries include the following: **Primary Source** categorizes the primary water source for the public water system. The source of water determines treatment requirements or other standards. For example, the presence of any surface water sources in a public water systems inventory forces a Surface Water (SW) classification, even though more groundwater may be supplied than surface water. Any groundwater under the influence of surface water

sources in a water system inventory necessitates a Ground Water Under the Influence of Surface Water (GUISW) classification. These higher classifications dictate higher monitoring requirements for the water system and greater public health protection.

Additionally, LDEQ maintains information and a GIS database of all intake wells and protected drinking water areas in a five-mile radius of drainage areas. This information is available to the public on an as needed basis. In compliance with security protocols,

a list of all people requesting information is kept by appropriate agencies.

2. Identify possible problems and potential sources of contamination including but not limited to toxics, sewage, microplastics and pharmaceuticals.

LDEQ is monitoring or is prepared to monitor carcinogenic compounds in high organic drinking water, estrogen mimics in drinking water (phthalates), pharmaceuticals in the drinking water, possible pesticide and herbicide inputs, too much fluoride in the drinking water, and microplastics in drinking water supply.

LDEQ keeps abreast of trend in research of additional sources of contamination that are showing up in all surface water body and receiving stream and keeps stakeholders apprised of the changes.

LDEQ also keeps a database of ambient water quality data active on their website at <http://deq.louisiana.gov/page/ambient-water-quality-monitoring-data>.

LDEQ collects ambient surface water data at approximately 125 sites across the state each month. This data is used for establishing water quality criteria or standards, assessment of conditions, and development of TMDLs. TMDLs are one means of establishing water quality discharge permit limits and NPS Pollution reduction recommendations for the protection and improvement of surface water quality in Louisiana.

Over 600 monitoring sites have been established by LDEQ since 1958, but not all sites are currently in use. Data has been collected at some of these sites since the inception of the program; however, most sites were established more recently. In 1998, LDEQ established a rotating basins monitoring program in order to expand the coverage of monitoring efforts. Under this plan, approximately 100 sites are selected each year for monitoring once a month. In addition, 21 sites on 16 water bodies are monitored every month of every year as long-term trend sites.

3. Use BMPs to diminish or eliminate problems.

LDEQ maintains a website and information on BMPs that should be used for protecting Louisiana's water. LDNR also provides the public with information on BMPs to improve water quality in watersheds. LDAF and USDA NRCS share information and implementation assistance for farming, agricultural, and forest management BMPs with the public as well. LSU Ag Center also works with farmers on environmental BMPs that improve water quality. Local industry associations are also instrumental in sharing information with their members. A suite of BMPs is available for residents of the estuary, and as new scientific information becomes available, the information is shared.

BMPs may also be assigned through ordinances for public water wells and wastewater treatment. These ordinances keep new sources of chemical contamination from coming within dangerously close proximity to wells and treatment facilities. Ordinances also ensure that wastewater should have properly functioning Onsite Sewage Disposal System (OSDS).

4. Engage citizens in active protection of their drinking water.

BTNEP's efforts to improve water sources are also identified in the following CCMP Ecological Management Action Plans: EM-8 Pollutant Identification and Assessment, EM-9 Oil and Produced Water Spill Prevention and Early Dedication, EM-10 Improvement of Water Quality through Reduction of Sewage Pollution, EM-11 Improvement of Water Quality through the Reduction of Agricultural Pollution, EM-12 Improvement of Water Quality through Stormwater Management, EM-14 Assessment of Harmful Algal Blooms, EM-17 Improvement of Water Quality through Reduction of Inshore and Marine Debris.

BTNEP also has a long history of engaging citizens in active protection of their drinking water sources. Activities and education related to activities that

The active parish water systems in the estuary are listed alphabetically by parishes. By clicking on the links for each water system, additional data such as populations served can be identified.

Parish	Water System Name	Status	Primary Water Source	Water System Number
Ascension	PARISH UTILITIES OF ASCENSION	A	SW	1005035
Assumption	ASSUMPTION PAR WW DIST 1	A	SW	1007001
Iberville	A. WILBERT & SONS TRAILER PARK	A	GW	1047021
Iberville	AIR LIQUIDE AMERICA INCORPORATED	A	GW	2047009
Iberville	ANNADALE PLANTATION	A	GW	1047011
Iberville	CHOCTAW MOBILE HOME PARK NORTH	A	GW	1047025
Iberville	CHOCTAW TRAILER PARK SOUTH	A	GW	1047020
Iberville	CITY OF PLAQUEMINE	A	GW	1047005
Iberville	G.W. LONG HANSENS DISEASE CENTER	A	GW	1047008
Iberville	GEORGIA GULF CORPORATION	A	GW	2047004
Iberville	IBERVILLE WATER DISTRICT #4	A	GW	1047024
Iberville	IBERVILLE WATER WORKS DISTRICT #3	A	GW	1047002
Iberville	SHINTECH LOUISIANA	A	GW	2047043
Iberville	STONESTHROW SUBDIVISION	A	GW	1047017
Iberville	SYGENTA	A	GW	2047001
Iberville	TIMBERLANE SUBDIVISION	A	GW	1047014
Iberville	TOWN OF WHITE CASTLE	A	GW	1047009
Iberville	VILLAGE OF MARINGOUIN	A	GW	1047003
Iberville	VILLAGE OF ROSEDALE	A	GW	1047006

Parish	Water System Name	Status	Primary Water Source	Water System Number
Lafourche	LAFOURCHE WATER DISTRICT #1	A	SW	1057001
Lafourche	THIBODAUX WATERWORKS	A	SW	1057003
Pointe Coupee	ALMA PLANTATION	A	GW	1077048
Pointe Coupee	BIG CAJUN II POWER PLANT	A	GW	2077010
Pointe Coupee	BIG CAJUN POWER PLANT	A	GW	2077009
Pointe Coupee	BIG RIVER INDUSTRIES	A	GW	2077011
Pointe Coupee	CITY OF NEW ROADS	A	GW	1077026
Pointe Coupee	FALSE RIVER WATERWORKS	A	GW	1077041
Pointe Coupee	JUDGE DIGBY AMOCO	A	GW	2077049
Pointe Coupee	LABARRE ELEMENTARY SCHOOL	A	GW	2077022
Pointe Coupee	POINT COUPEE CENTRAL HIGH SCHOOL	A	GW	2077048
Pointe Coupee	POINTE COUPEE DETENTION CENTER	A	GW	1077046
Pointe Coupee	POINTE COUPEE WATER DISTRICT #1	A	GW	1077043
Pointe Coupee	POINTE COUPEE WATER DISTRICT #2 HIGHWAY 10	A	GW	1077047
Pointe Coupee	SUGARLAND PLANTATION	A	GW	2077005
Pointe Coupee	TORBERT - FRISCO SERVICE	A	GW	1077037
Pointe Coupee	VILLAGE OF FORDOCHE	A	GW	1077009
Pointe Coupee	VILLAGE OF LIVONIA	A	GW	1077022
Pointe Coupee	VILLAGE OF MORGANZA	A	GW	1077025
Pointe Coupee	WATERLOO WATER SERVICE	A	GW	1077039
St. Mary	MORGAN CITY WATER SYSTEM	A	SW	1101005
St. Mary	ST. MARY PARISH WATER SEWERAGE COMMISSION NO 1	A	SW	1101009
Terrebonne	HOUMA WATER TP SERVICE AREA	A	SW	1109001
Terrebonne	SCHRIEVER WTP SERVICE AREA	A	SW	1109002
West Baton Rouge	CARGO CARRIERS	A	GW	2121001

Parish	Water System Name	Status	Primary Water Source	Water System Number
West Baton Rouge	SID RICHARDSON CARBON PLANT	A	GW	2121008
West Baton Rouge	WEST BATON ROUGE DISTRICT #4	A	GW	1121027
West Baton Rouge	WEST BATON ROUGE DISTRICT 4, A. R. BROTH	A	GW	1121026
West Baton Rouge	WEST BATON ROUGE DISTRICT 4, HOLIDAY INN	A	GW	1121024
West Baton Rouge	WEST BATON ROUGE PUBLIC UTILITIES	A	GW	1121008
West Baton Rouge	WEST BATON ROUGE WATER DISTRICT #1	A	GW	1121017
West Baton Rouge	WEST BATON ROUGE WATER DISTRICT #2	A	GW	1121018
West Baton Rouge	CITY OF PORT ALLEN	A	GW	1121014
West Baton Rouge	PORT OF GREATER BATON ROUGE WELL 3	A	GW	

protect drinking water can be found in Action Plans related to Sustained Recognition and Citizen Involvement SR-2 Civic Engagement.

5. Educate about appropriate actions to protect drinking water in the event of an emergency.

The LDH has prepared a Lower Mississippi River Waterworks Warning Network Plan that was created in cooperation with the USCG, Louisiana Law Enforcement, First Responders, LDQ, LA Emergency Management Officials, and many industries along the Mississippi River.

Past experiences of almost complete deterioration of Mississippi River water quality from the health, safety, taste and odor standpoint due to accidental discharges by industry or shipping vessels indicated a need for the development of a warning system so that all water treatment plants could take any necessary precautions to assure the production of the best quality water possible in the event of such

accidental discharge. A warning system involving the participation of the waterworks facilities, LDH, LDEQ, and industry was developed to provide a reasonable safeguard to maintain the quality of the drinking water going to consumers.

The 2017 Waterworks Warning Network Plan and Directory was updated with no significant changes to the original plan as it has operated satisfactorily to date.

The purpose of the Waterworks Warning Network Plan is to set up the specific procedures to be followed and to provide a listing of the responsible persons to be contacted in the event of a reported discharge. These procedures were outlined in the September 2017 plan.

These procedures are as follows:

- If a water plant operator becomes aware of a deterioration in the quality of raw water, either

by personal observation or by reports from consumers using the finished water, or learns of discharges which may affect supply or others, the operator will immediately notify the nearest downstream plant with a water intake as well as one of the LDH officials.

- The LDH official, upon receiving the report, will proceed to advise all those downstream plants with a water intake which might conceivably be affected by the discharge, in a descending order from the point of discharge.
- As a practical matter, the USCG is the first to be notified of the majority of spills or other incidents affecting river water quality, and, therefore, routinely notifies LDH personnel of such incidents. For this reason, a water plant operator, upon becoming aware of a spill, should also immediately notify the USCG.
- Sheriff's offices and State Police in the area parishes may be of great assistance in notifications of waterworks personnel.
- Additionally, it should be noted that reporting of certain abnormalities detected in permitted discharges is also required by DEQ regulations. In those instances, where such reportable permit violations occur, the permittee should, in addition to the standard notifications to be made in accordance with this plan, notify LDEQ.
- In emergency situations, the Bayou Lafourche Fresh Water District will, upon notification of a spill, in turn, notify those plants with intakes in Bayou Lafourche.
- Local governments will, in turn, make the public aware of the emergency.

The remaining objectives were created to provide guidance to the BTNEP MC and staff to provide support for:

6. improvement in appropriate training and pay to develop an experienced workforce related to

drinking water.

7. the education of public officials about the long term commitment that is needed to properly train certified water operators and related jobs.
8. appropriate improvements to the water resources infrastructure.
9. emerging technologies related to protecting drinking water sources.
10. the BTNEP MC to recommend sweeps of the water systems.

The true value of clean drinking water is not always respected. Humans must be taught again to recognize the economic value of water. According to EPA, "Much of the public trusts that safe drinking water will come out of their taps every day. However, many do not understand the service that water utilities provide in delivering safe water to their communities."

Clean drinking water keeps our communities healthy and our economies growing. The people who work in the industry and the water infrastructure are largely out of the public eye but necessary for our very existence. Few people realize what it takes to treat and deliver drinking water every day or how wastewater is cleaned so that it can be safely reused or returned to the environment. Investments in water professionals and in water infrastructure puts people to work and builds a reliable water resource. The costs to individuals, government, and businesses for water service disruption is vastly underestimated. By providing support for the aforementioned objectives, the BTNEP MC and staff help to insure the safety of our drinking water.

PERFORMANCE MEASURES

Performance measures include:

- drinking water quality as reported by local water districts
- drinking water quality as measured at the tap

Data Gathered

LDEQ:

- locations of wells
- locations and sources of drinking water as a database
- delineation of water protection areas
- SPSOC locations including information that is associated with possible concerns
- ambient groundwater monitoring program data (Aquifer Sampling and Assessment Program ASSET)
- sewage survey data and associated GIS layers on maps
- ambient water monitoring data
- aquifer water monitoring data

LDH:

- water intakes
- groundwater wells, LDNR layer

- infrastructure for the water system as GIS layers
- drinking water watch data
- (CCR) from individual water works
- pump station data
- treatment plant reports
- the results from Lower Mississippi River Waterworks Warning Network

Local Water Districts:

- drinking water reports,
- CCRs
- local water district commission reports

USDA/LDAF:

- mixing station reports
- Farm/Nutrient and Management Plans
- current BMPs

Business and Industry Leaders:



State and local agencies work together to provide quality drinking water for residents. Image: Lane Lefort Photography

Lead Agencies Responsible for Implementation

LDH	enforce EPA and state regulations of drinking water; from intake through treatment and delivery of polished water
LDEQ	maintain the environmental quality of the waters of the state - both surface and groundwater; source water protection, NPS protection, and permitted discharge, prohibit discharge without a permit, enforcement of permits
LDNR	permit water well drilling for private and commercial wells, plugging of wells, registration information SONRIS, unconventional reservoirs, permits for injection wells
USDA, NRCS, & LDAF	share technical expertise, planning, information and costs for implementation of BMPs with local farmers and foresters

Local Water Districts and Water Providers

BTNEP MC	host volunteer and educational events
Local Citizens	participation on volunteer activities to improve drinking water quality
Water Advisories	water system calls LDH; voluntarily done by the local waterworks – precautionary until samples come from LDH and a boil order comes from LDH based on the evidence, boil orders come from the state

- share current BMPs

BTNEP Staff and MC Members:

- opportunities to provide support to improvements of clean drinking water, water professionals, and water infrastructure

BTNEP staff and BTNEP MC members report to BTNEP MC about opportunities to provide support to improvements of clean drinking water, water professionals, and water infrastructure.

Monitoring:

Parties Responsible:

LDEQ, LDH, local water districts, USDA NRCS, LDAF, BTNEP staff and BTNEP MC

Timetable for Gathering Data:

A timeline for reporting data gather is developed by the funding agency and the implementer and will provide the basis for the monitor to assess plan implementation.

How is the Data Shared:

The primary way to share data is online at the various agencies. Additionally, some print materials are distributed to the public.

Possible Data Gaps:

It should be noted that data provide a snapshot of time with regards to drinking water. Additional surveys are needed to update the source water assessment for potential source survey.

Is additional funding needed: yes

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Louisiana Department of Health and Hospitals, 1988, Louisiana State Sanitary Code, Louisiana Administrative Code 51: XII.

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Lower Mississippi River Waterworks Warning Network Plan.



Educators learn the value of good water quality. Image: BTNEP



Image: Lane Lefort Photography

SUSTAINED RECOGNITION AND CITIZEN INVOLVEMENT

Community, Civic, & Media Engagement

The Sustained Recognition (SR) and Citizen Involvement and Participation (CI) Action Plans maintain a strategy to build public stewardship of the estuary, encourage strong, informed public involvement in estuarine planning, and motivate the public to action. Towards this end, these Action Plans concentrate on issues such as providing for a mechanism for organized public involvement, increasing the opportunities and activities available to the public, and developing methods through which the public can become directly involved in the protection of the estuary. In addition, BTNEP has become increasingly more visible at events throughout the BTES, ensuring that information about the program is available to the public.

Citizen engagement and participation is imperative in developing and maintaining healthy ecosystem characteristics. These plans aim to build and develop a grassroots movement by which active engagement, education, and volunteerism implements restoration, protection and stewardship initiatives throughout the BTES. Through these Action Plans, groups of stakeholders will ascertain if the original BTNEP MC decisions truly reflect the will of the public. These Action Plans provide two-way communication with valuable feedback in order to give the BTNEP MC continual input about the value of CCMP implementation. These plans keep communications open so that a shared vision for

CATEGORY 3

restoration which respects multiple viewpoints can move the program forward through consensus.

Education, both formal and informal, is an important component of this CCMP. For citizens to form and change opinions and become advocates for conservation, preservation, and restoration, they must have a reliable source of information. The education action plans provide these resources. BTNEP materials provide science-based, consensus-driven accurate, technical, and up-to-date information about the BTES and its CCMP goals.

The ultimate aim is that through the distribution of this information, the BTES will have the same level of recognition and urgency as other nationally

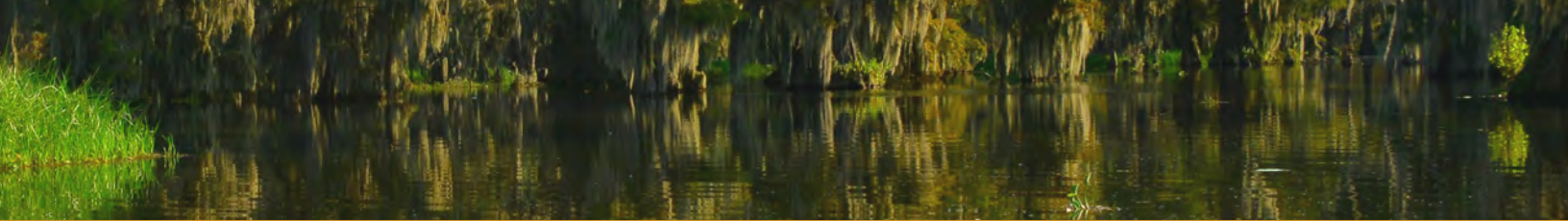
significant estuaries, such as the Everglades and the Chesapeake Bay.

The final component of this suite of Action Plans is cultural heritage and lifeways. Because of the strong ties between the cultural heritage of the BTES and the area's natural resources and the imminent land loss, adapting to risks and fostering collective and individual resiliency is paramount to helping humans deal with the ever changing environment of the BTES. BTNEP will continue to provide for its citizens a coalition of partners to preserve the culture and lifeways of its vanishing people.

The goal of this group of Action Plans is to remind everyone that we are saving this estuary for the



Houseboats near Bayou Felix. Image: Keri Turner



people who live here and the nation who needs us.

SR-1 Community Engagement

OBJECTIVE

To develop educated, informed stakeholders who are willing to become active participants in outreach, restoration, preservation, and protection activities in the BTES to include:

- citizen monitoring.
- vegetative planting.
- storm drain stenciling.
- data collection and mapping (inserting waypoints, photos, etc. on Google maps to create reference points for restoration efforts).
- community outreach and social media (“Pic on a Post” and social media hashtag photo reference points for restoration works).

BACKGROUND/MAJOR ISSUES

This Action Plan is the result of combining four separate Action Plans from the original CCMP, (namely SR-1 – Community Sectors and Leader Teams, SR-3 – Citizen Involvement Programs and Activities, SR-4 – Citizen Monitoring Program, and SR-7 – Storm Drain Stenciling) which were all designed to encourage and enhance citizen education, engagement, and active volunteer participation in hands-on activities which support the overarching goal of BTNEP, which is to preserve, protect, and restore the BTES.

Citizen engagement and participation is imperative

in developing and maintaining healthy ecosystem characteristics. The SR-1 Community Engagement Action Plan aims to build and develop a grass-roots movement by which active engagement, education, and volunteerism implements restoration, protection, and stewardship initiatives throughout the BTES. These initiatives include but are not limited to citizen monitoring, vegetative planting, storm drain stenciling, observational data collection, and community outreach.

DESCRIPTION

The BTNEP staff will craft and collate educational materials for stakeholders, foster relationships with residents and non-residents alike, and encourage them to become active participants in restoration and other related activities. The BTPO staff will also leverage volunteer and financial resources from BTNEP MC members, corporate and government entities, educational groups, community and civic organizations, mission groups, and other stakeholders and partners. Observational data can be collected and reported to relevant agency partners.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

The primary implementer for this Action Plan will continue to be the BTNEP staff. The BTNEP MC and BTPO will continue these efforts, coordinating all education and outreach efforts. BTNEP will include individual BTNEP MC members, consultants, and community leaders as possible leads and partners in this Action Plan.

TIMELINES AND MILESTONES

These efforts will be ongoing throughout the program life. Each project will have different achievements

and milestones. Project milestones will be reported to the BTNEP MC, EPA, invested partners, and the community through various media sources.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Total range of funding necessary annually for SR-1 is \$250,000 to \$500,000 which includes but is not limited to:

- salaries.
- operating services.
- supplies.
- equipment.

Sources of funding include local, state, federal, individual, industrial, institutional, NGO, and private organizations.

PERFORMANCE MEASURES

Performance measures include:

- # of volunteer hours related to restoration activities
- location of volunteer restoration activities

Data Gathered:

Measures could include:

- # of volunteer hours recorded per year
- # of unique volunteers
- # of volunteer events per year, per region of the BTES
- # of waypoints identified and mapped

Monitoring:

Parties Responsible: BTNEP staff, BTNEP MC members, and partners

Timetable for Gathering Data: quarterly for BTNEP MC and regularly for EPA

How Data is Shared: BTNEP MC quarterly meetings, media reports

Possible Data Gaps: none expected

Additional Funding Needed: always

SR-2 Civic Engagement

OBJECTIVES

- To give the public a continued mechanism for regular and methodical expression of issues, concerns, and possible solutions for the BTES
- To engage the public in the decision making process and possible action items within the BTES
- To provide a public forum for disseminating current information and receiving feedback about issues facing the BTES

BACKGROUND/MAJOR ISSUES

The CCMP, developed by a group of stakeholders including BTNEP MC members, is needed to protect the estuarine system. Public meetings were very important to ascertain if the original BTNEP MC decisions truly reflect the will of the public. These public meetings, special task forces, and focus groups have and continue to provide emphasis on certain proposed actions, valuable feedback, and informed citizens for more than 20 years. Participatory activities are key to conveying to the public the importance of their continual input to implement the CCMP.

DESCRIPTION

Through its quarterly public meetings, the BTNEP MC will provide the key mechanism to implement this Action Plan. Public engagement is provided and



Student volunteers working on vegetative planting. Image: BTNEP

encouraged through this Action Plan. APT meetings, public meetings, and workshops provide other avenues for public forums.

Key to these meetings are:

- shared vision.
- respect for multiple points of view.
- movement to consensus.

The BTNEP MC and the BTPO should mutually agree on the meeting location.

The BTPO will produce and nationally distribute materials from public meetings, APT meetings, and workshops. The BTPO will also monitor all two-way communication (social media, 1-800 number, e-mail, etc.). BTPO staff will train Speakers Bureau participants who will speak on local, regional, state, and possibly national levels.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

The lead implementer for this Action Plan will be the BTPO, BTNEP MC members, and consultants when necessary. Support implementers will include BTNEP MC members, volunteer speakers, volunteer businesses, agencies, chambers of commerce, economic councils, tourism offices, and other public points-of-interest at the local and state level. The BTPO should also partner with the Nicholls Department of Mass Communication for assistance in creating and disseminating communication, social media strategy and monitoring, and other communication activities. At the national level, agreements will be developed with appropriate federal agencies, nonprofit organizations, and special interest groups to distribute, display, and use BTES informational materials.

TIMELINES AND MILESTONES

Throughout the project life, this Action Plan will:

- continue to identify and create a database of all BTES target audiences. The database should include geographical, educational, socio-economic, and other demographic aspects of target audiences. Building from the community sector approach, the team will determine issues of concern and the educational needs of specific target audiences to include in the database.
- determine the most effective formats (printed, audio, and/or visual) for conveying the overall message and information to each target audience and produce products that align with each.
- create a database to track and evaluate the dissemination campaign including quantities of materials distributed, formats of information distributed, and dissemination methods corresponding to each target audience, dates, and locations.
- enhance two-way communication with the public through marketing of all channels (1-800 number, social media, informational e-mail address, and contact features on website).
- create a social media strategy to reach multiple audiences. This strategy should include all forms of social media and should consider new platforms as they emerge.
- recruit, train, and market the Speakers Bureau. Speakers should be prepared to deliver the overall message of the BTES as well as specialized information for targeted groups.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Costs for production and dissemination of information will vary depending on chosen tactics. The Speakers Bureau and two-way communication tactics addressed above are at no cost.

PERFORMANCE MEASURES

Performance measures include:

- BTNEP MC will host public meetings to provide opportunity for civic engagement
- various reports to EPA and BTNEP MC about civic engagement activities

Data Gathered:

- most effective format for conveying the message of the BTES
- number of materials given out at different events/locations
- number of hits on specific web sites or social media posts

Monitoring:

Parties Responsible: BTPO staff

Timetable for Gathering Data: ongoing

How Data is Shared:

- quarterly social media report to BTNEP MC
- track dissemination of materials
- quarterly Speakers Bureau report to BTNEP MC

Possible Data Gaps: none at this time

Additional Funding Needed: as available

SR-3 Media Engagement

OBJECTIVE

To establish a consistent working relationship with local and national media including broadcast, print, digital, and social media in order to elevate community and national awareness about the mission and projects of BTNEP

BACKGROUND/MAJOR ISSUES

Media knowledge and understanding of the work of BTNEP and its importance to the sustainability of the BTES will help generate interest among various media platforms to develop and circulate stories and messaging about BTNEP projects.

DESCRIPTION

In developing a cooperative relationship with the media, editors and reporters should be presented with science-based, credible, reliable, and compelling story ideas. It is also advisable to exercise judgement if not restraint in alerting media to potential story ideas and availability.

Suggested approaches include but are not limited to:

- scheduling editorial meetings to educate editors and managers about BTNEP and its mission as well as specific projects.
- advancing direct outreach to reporters to provide background information as well as to cultivate personal relationships.
- creating press releases regarding specific projects, progress of projects, individual recognition, and advisories about areas of need, concern, or crisis.
- establishing a ‘stable’ of spokespersons who can become known to media as reliable sources of information. Individuals can be identified to speak in certain areas of expertise, and the media made aware of these potential sources for interviews.



Ben Malbrough, Bayou Lafourche Freshwater District Director and BTNEP MC member, explains the value of restoration to media sources. Image: BTNEP

- training media for selected spokespersons.
- scheduling BTNEP principals and/or selected spokespersons for media appearances for regular segments as well as for specific event appearances.
- producing video segments to be offered to media for use in reports and features.
- maintaining active social media (video streaming) messaging to inform and also to entice consumers to seek more in-depth information about events and projects.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

The primary implementer for this Action Plan will continue to be the BTNEP staff. The BTNEP MC and

BTPO will continue these efforts, coordinating all education and outreach efforts. BTNEP will include individual members of the BTNEP MC, consultants, and community leaders as possible leads and partners in this Action Plan.

TIMELINES AND MILESTONES

These efforts will be ongoing throughout the program life. Each project will have different achievements and milestones. Project milestones will be reported to the BTNEP MC, EPA, invested partners, and the community through various media sources.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

The total range of funding necessary annually for SR-3 is \$50,000 to \$100,000, which includes but is



BTNEP scientists and public relations coordinator work with media. Image: Lane Lefort Photography

not limited to the following.

- salaries
- operating services
- supplies
- equipment
- content production and distribution

Sources of funding include local, state, federal, individual, industrial, institutional, NGO, and private organizations.

PERFORMANCE MEASURES

Performance measures include:

- summary of media on quarterly BTNEP MC agenda
- list of all media requests and press releases kept in BTNEP office for one year.

Data Gathered

- level of awareness and interest in BTNEP, its mission, and projects by local and national media
- number of requests for interviews and information from news organizations
- analytics from website and social media sites, number of inquiries, views, etc

Monitoring

Parties Responsible: News coverage can be monitored either by BTNEP staff, BTNEP MC members, and/or paid monitoring services.

Timetable for Gathering Data: Data will be gathered quarterly for BTNEP MC, regularly for EPA, and/or as events occur or projects progress.

How Data is Shared: BTNEP MC quarterly meetings, media reports, and electronically using the most current technologies available. Broadcast video

stories can be archived and uploaded to the BTNEP website and other BTNEP social media sites.

Possible Data Gaps: Rapidly changing technology demands continued research and funding in this area.

Additional Funding Needed: Additional funding is always needed.

SR-4 Public Engagement

OBJECTIVES

- To produce a communications package that provides informational and educational materials about the BTES and CCMP in formats that relate and correspond to identified target audiences
- To develop and implement a well-coordinated, cohesive campaign for distributing informational and educational materials about BTES issues and CCMP actions in BTES businesses and public points of interest
- To provide multiple forums for community engagement including website, social media, e-mail, and 1-800 number
- To effectively and efficiently spread the word about BTNEP throughout the BTES by using the expertise of the BTNEP MC members and volunteers in the form of a Speakers Bureau

BACKGROUND/MAJOR ISSUES

For citizens to form or change opinions and become advocates of CCMP actions, they must be informed and educated about the BTES and CCMP goals. Communication packages that are tailored to specific target audiences will increase the likelihood of the audience's acceptance of the material. Targeting information to the audience is more appealing and gains the interest of the reader, listener, or viewer.

It presents a direct link between the audience and the BTES. Throughout the distribution campaign, information must appear and be provided where the people live, work, recreate, and visit in ways that relate to public needs. This kind of dissemination is essential in order to gain recognition for the BTES as a nationally significant area of the country.

DESCRIPTION

This action will develop sets of educational materials tailored to BTES target audiences that provide science-based, consensus-driven, accurate, technical, and up-to-date information about the BTES and CCMP actions. All materials will be part of a communication package and will share a consistent message. Materials will be developed in a cohesive manner by building on the overall message. Using this consistent message, materials will be presented in various formats—printed, audio, and visual—specific to the target audiences’ needs. Additionally, this Action Plan will involve a massive,

targeted distribution of information to educate and influence BTES citizens about the BTES and CCMP actions. The distribution will be coordinated to reach local, state, and national target audiences in an appropriate manner with interesting, credible materials. A Speakers Bureau program will also assist in disseminating this important information to civic groups, schools, parish and city governments, and the like.

To facilitate a true understanding of the BTES and the program’s message, the public must have an opportunity to participate in two-way communication. The BTPO has used a 1-800 number in the past to serve this end. New tactics such as website features, social media, and a designated e-mail address will be used.

The BTPO staff will produce and nationally distribute materials. The BTPO will also monitor all two-way communication (social media, 1-800 number, e-mail, etc.). Speakers Bureau participants will be prepared



BTNEP scientists discuss the value of healthy bird habitat with media. Image: Lane Lefort Photography

by BTPO staff and will speak on local, regional, state, and possibly national levels.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

The lead implementer for this action will be the BTPO, BTNEP MC members, EPA, and consultants when necessary. Support implementers will include BTNEP MC members, volunteer speakers, volunteer businesses, agencies, chambers of commerce, economic councils, tourism offices, and other public points-of-interest at the local and state level. The BTPO should also partner with the Nicholls Department of Mass Communication for assistance in creating and disseminating communications, creating strategy for and monitoring social media, and other communication activities. At the national level, partnerships will be developed with appropriate federal agencies, nonprofit organizations, and special interest groups to distribute, display, and use BTES informational materials.

TIMELINES AND MILESTONES

Throughout the project life, this Action Plan will:

- continue to identify and create a database of all BTES target audiences. The database should include geographical, educational, socio-economic, and other demographic aspects of target audiences. Building from the community sector approach, the team will determine issues of concern and the educational needs of specific target audiences to include in the database.
- determine the most effective formats (printed, audio, and/or visual) for conveying the overall message and information to each target audience and produce products that align with each.
- create a database to track and evaluate dissemination campaign including quantities of materials distributed, formats of information distributed, and dissemination methods corresponding to each target audience, dates, and

locations.

- enhance two-way communication with the public through marketing of all channels (1-800 number, social media, informational e-mail address, contact features on website).
- create a social media strategy to reach multiple audiences. This strategy should include all forms of social media and should consider new platforms as they emerge.
- recruit, train, and market the Speakers Bureau. Speakers should be prepared to deliver the overall message of the BTES as well as specialized information for targeted groups or projects.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Costs for production and disseminating information will vary depending on chosen tactics. The total range of funding necessary annually for SR-4 is \$75,000 to \$500,000, which includes but is not limited to the following.

- salaries
- operating services
- supplies
- equipment
- content production and distribution

Sources of funding include local, state, federal, individual, industrial, institutional, NGO, and private organizations.

PERFORMANCE MEASURES

Performance measures include:

- communication plan
- publication of materials for easy public access
- sets of materials for target audiences

Data Gathered

- most effective format for conveying the message of the BTES
- number of materials given out at different events/locations
- analytics on specific web sites or social media posts

Monitoring

Parties Responsible: BTNEP staff, BTNEP MC members, and partners

Timetable for Gathering Data: quarterly for BTNEP MC and regularly for EPA

How Data is Shared: BTNEP MC quarterly meetings, media reports

Possible Data Gaps: Rapidly changing technology demands continued research and funding in this area.

Additional Funding Needed: always

an informed citizenry.

Developing knowledge, appreciation, and value for the BTES as a national treasure and depository of cultural and natural resources important to the State of Louisiana, the United States, and the global economy is essential. In the last decade, educational programs for teachers have expanded through efforts by LUMCON, Nicholls faculty, South Louisiana Wetlands Discovery Center (SLWDC) staff, Jean Lafitte National Historical Park and Preserve staff, and BTNEP.

Many teachers have taken the opportunity to participate in environmental in-service training such as the Nicholls workshop on the BTES priority problems or the Louisiana Coastal Wetlands Workshops at LUMCON and Jean Lafitte National Historical Park and Preserve. Teachers learn critical science information and hands-on activities to bring back into the classrooms. Moving-forward teacher education programs such as these need to continue, and these programs need to be expanded as funds are available.

DESCRIPTION

This Action Plan will support developing and disseminating curriculum and instructional materials and programs to support estuarine education at the K-16 (kindergarten through college) formal and informal levels. This includes a review of available curriculum materials, decisions on where gaps exist, developing materials, and disseminating materials into state and/or national curriculum frameworks. These materials will focus on the environment as well as the cultural heritage of the BTES.

This Action Plan will serve to facilitate developing BTES constituents as stakeholders in the resources of the region. Developing stakeholders will produce an informed, concerned, and responsible citizenry, from children to adults, within the BTES. The population will become more literate in estuarine issues (i.e. climate change) as voters, harvesters, and developers. The educational programs will be recognized and

SR-5 Estuarine Curriculum Development

OBJECTIVE

To continue to develop and produce curriculum and instructional materials and programs for estuarine education for the BTES

BACKGROUND/MAJOR ISSUES

An organized effort to enhance education within schools is essential to the long term success of the CCMP. Understanding the major scientific, social, and economics issues of the BTES requires a complex knowledge base. Developing curriculum materials that address these issues will help produce



Public engagement in the field is an important part of outreach and engagement. Image: Lane Lefort Photography

used in estuarine education throughout the nation. Therefore, knowledge and appreciation of the BTES will be increased on a national level.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

The LDOE develops and provides the framework and standards for estuarine content. The BTNEP Education APT will be the lead implementer. Support implementers will include the BTNEP MC, LEEC, EPA, LDOE, Louisiana Science Teacher's Association (LSTA), Jean Lafitte National Historical Park and Preserve, LUMCON, National Sea Grant, LPBF, National Wildlife Federation (NWF), LDWF, LDEQ, LSU AgCenter (4-H), and/or other informal learning centers.

TIMELINES AND MILESTONES

- Distribute course materials throughout Louisiana

State System through LSTA Newsletter/Website/Annual Conference, Office of Environmental Education, local teachers associations, national associations, and university continuing teacher education courses.

- Develop curricular materials and/or resources for K-16 and systematically integrate curricular materials into the K-16 Program of Studies.
- Review and update curriculum documents as needed.
- Support career and technical education.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Range of cost:

Total Funding Necessary (Annually): \$300,000 to \$500,000

Sources of funding:

- local, state, federal, industry, institutional, non-governmental organizations, and private
- the BTEF and its partners

The monitoring strategies are intended to serve as mechanisms to assess the effectiveness of projects implemented under the Action Plans. These strategies should be used only as a guide, not as a requirement. It must be recognized that the monitoring strategies will be expensive to implement and that because all levels of government and much of the private sector currently have severe funding restraints, they may not be affordable without significant modification. The monitoring strategies do not override or replace project monitoring that would be done by an agency related to specific agency-sponsored projects.

PERFORMANCE MEASURES

Performance measures include:

- curricular materials and/or resources for K-16 available to educators
- summary of education activities related to curriculum reported on BTNEP MC agenda

Date Gathered

- quarterly report curriculum activity
- document meetings and activities of the Education APT
- document inventory of existing materials and its presentation to the BTNEP MC
- regularly report to EPA



Teachers and students benefit from BTNEP estuarine curricula. Image: BTNEP



BTNEP staff members participate in a variety of continuing and informal education programs. Image: BTNEP

Monitoring

Parties Responsible: The BTNEP Education APT and the BTNEP MC are the parties responsible for monitoring.

Timetables for Gathering Data: The BTNEP Education APT will report annually, and the BTNEP MC will gather data quarterly.

How Data is Shared: All curriculums are available on the BTNEP website and partner websites.

Possible Data Gaps: The BTNEP Education APT and the BTNEP MC will determine possible data gaps.

Additional Funding Needed: Additional funding is always needed.

SR-6 Continuing Education Programs and Informal Education Programs

OBJECTIVE

To provide opportunities for a comprehensive continuing education program and an informal estuarine education program

BACKGROUND/MAJOR ISSUES

Historically, environmental education courses have been successfully offered at universities. Highly popular workshops have also been held at LUMCON, Jean Lafitte National Historical Park and Preserve, and other sites throughout the basin to allow teachers

to work with and receive curricula and laboratory/field equipment to be used in their classrooms. These program formats can be expanded to reach many other segments of the populace including children and the general public.

People from all age groups and backgrounds must understand that they, as individuals, make a difference in the health and well-being of the BTES. They must be introduced through educational activities about the importance of their action(s) or lack of action(s). They must also learn that each individual has responsibilities for the estuarine system and the extrinsic and intrinsic resources it provides. BTNEP's Rain Barrel Workshops and Native Plant Workshops are examples of this work plan.

DESCRIPTION

This action supports continuing education programs, classes, and events that address environmental issues of the BTES. These programs will provide opportunities that will help the public understand their role in the environment and the value of the environment to them in their health, occupational, and recreational endeavors.

These types of programs provide a means for groups of individuals to gain new knowledge, to interact with others with similar interests, and to be introduced to the BTES issues and challenges. Many offer participants a chance to do hands-on activities in natural environments. These are often relaxed, comfortable, and engaging events which encourage continuing awareness and involvement.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

The lead implementer for this action will be the BTNEP MC and the BTNEP Education APT. Support implementers will include the LEEC, EPA, LDOE, LSTA, Jean Lafitte National Historical Park and Preserve, LUMCON, Louisiana Sea Grant, LPBF, NWF, LSU AgCenter (4-H), LDWF, LDEQ, and/or other informal learning centers.

TIMELINES AND MILESTONES

- Continue, establish, and strengthen partnerships with stakeholders who have an interest in BTNEP's priority issues.
- Recruit program coordinators, faculty, and partners to propose and implement projects.
- Regularly hold programs in a variety of settings.
- Regularly review program offerings and the relevance and value to the continuing education needs of the BTES.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Range of cost:

Total Funding Necessary (Annually): \$300,000 to \$800,000

Sources of funding:

- local, state, federal, industry, institutional, non-governmental organizations, and private
- BTEF and its partners

PERFORMANCE MEASURE

Performance measure includes:

- summary of continuing education and informal education activities or programs on BTNEP MC agenda

Data Gathered

- quarterly report activities to the BTNEP MC
- document meetings and activities of the Education APT
- regularly report to EPA

Monitoring

Parties Responsible: The Education APT and

the BTNEP MC are the parties responsible for monitoring.

Timetables for Gathering Data: The BTNEP Education APT will report annually, and the BTNEP MC will gather data quarterly.

How Data is Shared: All program activities are on the BTNEP website, partner websites, and/or social media outlets.

Possible Data Gaps: The Education APT and BTNEP MC will determine possible data gaps.

Additional Funding Needed: Additional funding is always needed.

SR-7 Financial Support for Educational Initiatives

OBJECTIVE

To garner support and secure financial resources for the implementation of curriculum, professional

development and other estuarine educational initiatives.

BACKGROUND/MAJOR ISSUES

Education has been identified to be a key in sustaining awareness and long-term involvement in stewardship of the estuary. However, funding for these efforts is highly competitive. Seeking funds for estuarine education efforts should be coordinated among partners to maximize impact and prevent duplication.

This action will serve to build support from stakeholders in the BTES who have an interest in education related to the restoration, conservation, and preservation of the estuary's natural and cultural resources and are concerned about the BTES as a national treasure.

Historically, funds that have been secured have funded curriculum development, Environmental Education Symposiums, teacher workshops and other estuarine educational activities. BTNEP recently received a grant from the Louisiana Environmental Education Commission in order to host a WETMAPP Workshop for teachers.



Student volunteers at the BTNEP plant propagation facility. Image: BTNEP

DESCRIPTION

This action will create community support for funding by developing an awareness of the need to invest in environmental education. This plan calls for the strategic development and coordination of support from national and local foundations, from corporations and through legislative action. This includes cooperative efforts with other programs, support of indirect or direct costs from private donations, as well as grants and contracts.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

The lead implementers for this action will be the BTNEP MC and other stakeholders.

TIMELINES AND MILESTONES

- Identify potential funding sources for new and sustained educational activities.

- Develop strategies for fund raising to support educational activities.
- Leverage partner and program assets.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Range of cost:

Total Funding Necessary (Annually): \$5,000 to \$100,000

Sources of funding:

- BTPO
- BTEF, its partners, and its donors
- Local, state, federal, industry, institutional, NGOs, and private

PERFORMANCE MEASURE

Performance measure includes:



Teachers prepare for field session sponsored by BTNEP and LUMCON to learn about water quality. Image: BTNEP/ LUMCON



BTNEP provides financial support for informal education and volunteer programs. Image: BTNEP

- summary of successful funding opportunities reported on the BTNEP MC agenda quarterly

Data Gathered

- quarterly reporting of activities to the BTNEP MC
- BTEF quarterly report

Monitoring

Parties Responsible: The BTPO, the BTEF, and the BTNEP MC are the parties responsible for monitoring.

Timetables for Gathering Data: BTEF (quarterly) and the Barataria-Terrebonne National Estuary Program (BTNEP) office (quarterly)

How Data is Shared: All donations and financial support is shared annually at a public meeting.

Possible Data Gaps: NA

Additional Funding: Additional Funding is always needed.

SR-8 Cultural Heritage and Lifeways

OBJECTIVES

- To explore, investigate, and identify the cultural/lifeways connections that improve human resilience due to the vulnerability of the land and water of the BTES
- To protect the rich cultural lifeways that are connected to the natural resources of the BTES
- To educate about the historical interaction of BTES residents and the BTE's resources through active research projects that use maps, film, photos, documentaries, oral histories, and other techniques that will document this interaction to preserve the cultural aspects of the region
- To promote a demand for information that highlights the uniqueness of our cultural heritage through creating and supporting events that attract the attention of scholars, students, and

a public audience for the endangered cultural resources nurtured in the BTES

- To advance greater awareness of the way the lifestyles and unique historical traditions of the BTES are a living classroom that demonstrate the interaction between the region's natural and cultural resources
- To support the complex dynamics of transition through the preservation and memorialization of community histories when those communities must transition from their traditional lands due to coastal land loss or ecological disasters
- To prepare communities to adapt to new coastal lands as successful restoration practices as the natural cycle of delta lobe shifting re-shapes the BTES

BACKGROUND/MAJOR ISSUES

This Action Plan will develop and support a series of activities which protect and educate the public about the cultural richness of the BTES while emphasizing the stewardship of resources for future generations. These proposed activities, sponsored by existing culturally-related organizations, will enhance ongoing cultural awareness efforts, enhance pride in the region, and invite others to visit, study, and participate in our unique and culturally significant events.

Because of the strong ties between the cultural heritage of the BTES and the area's natural resources, the cultural traditions and unique lifestyles of the BTES are threatened as the overall quality of the BTES is diminished. Southern Louisiana has a strong multi-cultural heritage of history, food, music, language, folklore, and lifestyles, all clearly related to the beauty, mystique and richness of the natural resources of the area. Sixty years ago, this was an area characterized by large families, faith, neighbors who stuck together, and people who bartered for food and goods. People depended upon the land and the water for their livelihood.

With the discovery of oil and the changes in industry, many people are no longer directly dependent upon the "land" for their income and do not engage in traditional "ways of doing things" on a full-time basis. Still, many families are engaged in hunting, fishing, shrimping, or crabbing for all or part of their livelihood just like their ancestors, and even more people use these resources for recreation. To maintain this historical tie to the land, we must sustain and maintain the BTES to a productive level that can support the socio-economics and recreational use by coastal communities and the associated cultures that have been a part of the region's economic life for, in many cases, more than 10 generations. Further, we must also look carefully at how cultural and industrial use contributed to degrading this area's resources and find ways to generate stewardship of the BTES using our rich heritage. As one member stated, "People need roots that tie them to their culture and wings that allow them to move forward."

Nationally, people have held a consistently incorrect expectation that the coastal estuaries are sustainable - perhaps that was the case in the mid 1990s and perhaps that is true for certain areas of this geographic province. But as coastal land loss has already decimated many historic communities of the BTES, the role of BTNEP to preserve the stories and oral traditions of this region has become even more essential. We are experiencing a population shift as evidenced by census data. Social services and infrastructure are diminishing. It is only a matter of time before people must resettle to a new location. away from a catastrophic loss of several communities such as those lying closest to the Gulf of Mexico.

Further, in coastal Louisiana, subsidence and sea level rise combine to create one of the highest rates of relative sea level and coastal land loss ever measured on the planet. This relative sea level rise has an acute effect on coastal communities in the BTES particularly those made up of indigenous peoples and historical communities that are intricately tied to their surrounding aquatic habitats like the many underserved, underrepresented, and Native

communities that exist in the BTES. As relative sea level rise changes the environment, affecting the land, resources, and livelihoods in the communities that make the coast their home, the number of individuals at risk increases exponentially. Many at-risk BTES communities and their citizens deal with this and other environmental changes in their ecosystem-dependent livelihood on a daily basis. For more than two centuries, these wetland inhabitants have adapted and continue to try to mitigate these changes in order to continue to thrive in their coastal homeland. However, the changes are becoming increasingly severe so that modifications in coastal existence become more and more challenging. It is valuable, therefore, to maintain; we must protect the cultural/lifeways and traditional ecological knowledges.

However, adapting to the risks that these BTES communities experience is their collective and individual resiliency and their inherent ability to deal with environmental change. This adaptive capacity can come from both the environment and the people. For example, many communities in the region's

bayou-based communities plant food crops instead of relying on grocery stores. In addition, community members often take it upon themselves to repair the landscape through placement of rocks or small levees and/or elevating their homes. Further, many BTES communities have close social networks stemming from familial connections and ancestral lands. Like other tightly knit communities (*gemeinschaft*) such as the Amish, the members of these communities look after one another, providing help and resources to other members of the community when needed. All of these community traits contribute to the ability to adapt and to mitigate to the environmental hazards; however, as the community is diminished, their existence becomes more and more tenuous.

The adaptive capacity of these communities has been honed over many generations of living and working in this dynamic and ever changing environment. Consequently, the regional geography and geology, particularly the health of barrier islands, breadth of protective marshes and swamps, and the ecological integration and maintenance of the natural levees, often promote or add to the overall resilience of



Volunteer groups work to protect barrier shorelines that also help protect culture. Image: BTNEP

their community. Resilience emerges from local knowledge and informed hazard mitigation planning by local government. Informed planning comes from a blending or integration of local knowledge and science. Since this local knowledge is the basis for how these people interact and depend upon the land and the water for their livelihood and recreation, this information is at the heart of the region's cultural heritage. Therefore, by integrating science with local knowledge to inform hazard mitigation and restoration planning, we are promoting and enhancing sustainability and resiliency by leveraging the rich cultural heritage that exists in the BTES. Systematic methods are being developed to best integrate science and traditional local knowledge. BTNEP can use aspects of these methods to effectively promote the region's resiliency through its cultural heritage and to better understand the area's environmental subtleties through the individuals who live and work in the area daily. Moreover, because Louisiana Sea Grant

is a BTNEP partner, their staff could help facilitate education and outreach activities associated with this plan by implementing the latest developments in research associated with traditional ecological knowledge. This approach could easily serve as a template for many other NEP's ability to advance the understanding of their citizens' adaptive capacity and of each coastal community's understanding of resiliency.

Many opportunities exist to highlight a linkage between the environment and the culture of the BTES. Large-scale agency projects, collegiate academic research, parish libraries, regional schools, and summer camps offer the most logical means to organize and publicize culturally-based activities. Each has a number of resources including collections, archives, film, and others that could form the basis for developing activities. In addition, the schools and locally-based cultural organizations (i.e., the USNPS, the Nicholls Center for Bayou Studies, historical



Teachers learn that environmental subtleties affect individuals who live and work in the area daily. Image: LUMCON



Traditional offshore shrimp boat. Image: Keri Turner

and genealogical societies, arts councils, and crafts guilds) could also organize activities such as art shows or photography exhibits in local museums, malls, or festivals and other community events.

Also, numerous existing activities, such as fairs, festivals, Pow-wows, dances, and other special events could be used to highlight the important relationship between the environment and the culture. Numerous historical and archeological sites and landscapes exist in the BTES that could be the focus of research, preservation, and special events through a framework based on traditional ecological knowledge. Finally, organizations such as the Louisiana Historical Society and the LDCRT could provide valuable support in organizing and publicizing activities. In addition, Louisiana Public Broadcasting (LPB), Louisiana Endowment for the Humanities (LEH), or other outlets can assist in attracting professional/amateur documentary film makers and photographers to document these activities.

DESCRIPTION

This Action Plan calls for several distinct components that support and leverage the partners' existing activities. This Action Plan could:

- create a Cultural/Lifeways Heritage APT.
- explore gaps in knowledges and avenues to improve human resilience.
- use the BTNEPMC to explore gaps in knowledges and avenues to improve human resilience.
- develop tie-ins with local, regional, and international festivals to broadcast the cultural uniqueness, significance, and joie de vivre of the BTES.
- encourage each participating organization within the coalition to host at least one annual event dedicated to the stewardship of the BTES or as a component of stewardship in their event.

- develop a cultural/history curriculum.
- host a set of annual BTES related cultural events and invite the organizers of these events to the BTNEP MC to make sure that they understand that they are part of a larger process and a larger effort to preserve cultural heritage.
- host volunteers and educational groups to preserve the wealth of folk-ways and traditions as well as to attract visitors from all over the world who are interested in learning, preserving, and participating in our unique cultural practices.
- develop a manual to act as a resource guide for creating stewardship of culture and the BTES.
- compile and share information.
- create best principles for mitigation and adaptation strategies for cultures and communities.

This Action Plan calls for the coordination of many groups to realize the objectives and develop the suggested components. The groups forming this team are represented in the basin. This is consistent with the grassroots approach taken by the original CCMP.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

Lead implementers will include parish libraries, local and parish historical societies and museums, BTES schools, the USNPS and Cultural Resources Climate Change Strategy, the NSU Center for Bayou Studies, Louisiana Sea Grant, the Lowlanders Center, universities, genealogical societies, arts councils, tourist commissions, local and regional governments, and other individuals and organizations presently involved in culturally-based activities. The support implementer for this Action Plan will be the BTNEP MC and the BTPO.

TIMELINES AND MILESTONES

The team will immediately hold meetings with libraries, educators, museums, and cultural

ambassadors to provide continued support for objectives as well as to brainstorm new goals.

The following focus on establishing a Cultural Organization APT could include the lead and support team implementers with support from others to educate and inform citizens, to explore funding sources, and to create a cultural/environmental manual. Specific plans could include:

- inviting parish library directors and other organizations to an informational meeting about CCMP at the BTPO.
- conducting meetings to explore issues and plan activities (BTPO/ libraries, National Park).
- establishing a team to advance objectives.
- exploring funding sources and preparing grant applications.
- maintaining an online calendar with a schedule of activities.
- creating online resources.
- encouraging each participating organization to host at least one event dedicated to the stewardship of the BTES.
- partnering with state and federal agencies with access to the public to produce and create interpretive signage about folkways and natural and cultural resources throughout the BTES.
- developing campaign slogan(s) to encourage preservation of the BTES and to encourage local professionals such as local artists to become active stewards of BTNEP.
- initiating oral history/storytelling projects that focus on local knowledge transfer (shrimpers, oystermen, businessmen, boat builders, market hunters, cattlemen, duck carvers, net makers, former cannery workers, recreation guides, crabbers, seafood dealers, retired trappers, and those surviving individuals whose first language

is French).

- working to create updated films on issues facing the BTES.
- holding small events and enrichment workshops such as boatbuilding, carving, music, food, etc. in conjunction with partners.
- supporting research related to culture and ecosystem.

Other plans call for the coalition to expand and maintain an awareness of the role of the BTES culture in preserving the BTES. These activities may include the following.

- developing a volunteer travel program for adults and family to come to learn about the BTES
- supporting immersion programs

- helping to support eco-tourism/eco-adventures throughout the BTES that enable both locals and visitors to immerse themselves
- supporting a cultural history curriculum
- establishing tie-ins with festivals such as the New Orleans Jazz and Heritage Festival, Festival Internationale, the annual T-Bois Blues festival, Swamp Stomp and/or similar type events as part of the BTNEP outreach
- creating a best principles document for cultural resources

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Range of Cost:

Total Funding Necessary (Annually): \$30,000 to \$100,000



Traditional Cajun cottage. Image: Keri Turner



College students participate in restoration activities and learn that protecting ecosystems protects cultures
 Image: BTNEP

Sources of Funding:

- local, state, federal, industry, institutional, NGOs, and private
- BTEF and its partners

PERFORMANCE MEASURE

Performance measure includes:

- summary of cultural heritage and lifeways activities reported on the BTNEP MC agenda quarterly

Data Gathered

- quarterly report activities to the BTNEP MC
- document meetings and activities related to Cultural Heritage in the BTES
- regularly report to EPA

Monitoring

Parties Responsible: The BTNEP MC and the BTPO are responsible for monitoring.

Timetables for Gathering Data: The BTNEP MC could report quarterly.

How Data is Shared: All program activities are on the BTNEP website, partner websites, and/or social media outlets.

Possible Data Gaps: The BTNEP MC will determine possible data gaps.

Additional Funding Needed: Additional funding is always needed.

What Can YOU Do to Protect Estuaries?

Estuaries are found where rivers meet the sea. Clean estuaries sustain vibrant economies and healthy coastal communities.

AT HOME



Reduce, reuse, and recycle plastic packaging



Have your septic system inspected



Choose non-toxic products for household use

IN THE COMMUNITY



Help plant trees to reduce stormwater pollution



Volunteer at a local clean-up to pick up trash



Don't dump chemicals or trash down storm drains

IN THE YARD



Pick up your pet's waste and dispose of it properly



Plant a rain garden or install a rain barrel



Limit use of fertilizers and pesticides on your yard

ON THE WATER



Use designated sewage pump-out stations



Keep your boat out of seagrass beds



Respect wildlife and keep your distance

Learn more about protecting estuaries: epa.gov/nep





Image: Lane Lefort Photography

ECONOMIC GROWTH

Education, Business, and Project Examples

BTNEP has always been unique amongst the National Estuary community nationwide not just for the incredibly wide diversity of the living and natural resources, habitat types, distinct cultures, and foodways of the BTES but also for the economic opportunities inherent in this region.

Since the first settlement of the BTES by the Native American tribes who called this area home, human endeavors in this region have been focused on not just the beauty, but the bounty of this BTES. Native American tribes found a natural pantry overflowing with foods of all types: fin, feathers, and fur as well as a landscape which offered up building materials such as clay-rich soils, Spanish moss, and palmettos perfect for constructing shelter from the harsh elements. They found rich soils constantly being deposited by the Mississippi and Atchafalaya Rivers and Bayou Lafourche suitable for growing food crops as well as medicinal plants, and they found these same waterways so interconnected as to provide a level of mobility facilitating trade that few other tribes in the United States were able to enjoy.

Using the web of waterways as a highway system to trade their harvest of the land with neighboring peoples, these first residents of the BTES were the first people to understand that this BTES is so bountiful that it is possible not merely to survive but to thrive and to harness these plentiful resources to their economic advantage. They would not be the last people to learn this lesson.

The first European settlers, too, found the BTES an overflowing larder and, like the Native Americans, soon realized that they would not merely survive in this place. They could prosper. They could trade using the natural waterways and eventually added canals to enhance the economic value of the system of waterways connecting people and trade throughout the BTES. And so, from the very earliest times of settlement, human energy in the BTES has gone towards harnessing the power and bounty of the natural resources for the purpose of economic development.

As the first European explorers and traders were replaced with subsequent generations of displaced Acadians, Spanish, French, German, Irish, Anglo, Isleno, Chinese, Vietnamese, and other migrants,

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their energies also focused on how not merely to survive here but also on how to live well. These waves of migrants brought their respective experiences and skill sets to bear on the landscape, drawing from the rich soils and teeming waterways the bounty that a nation has come to rely upon.

Today, their descendants are responsible for approximately one in every five barrels of oil produced in the United States, 37 percent of the nation's sugar production, and one third of all fisheries landings in the coterminous United States.

In addition to this rich natural heritage, the foodways and cultures of the region are symbiotically linked to the natural resources in ways seldom found in the developed world. Quite simply, our residents live closer to the land and water in all aspects of their culture than most other regions and peoples in the developed world. This closeness to the natural resources drives a spirit of sustainability in economic

development opportunities not often seen elsewhere.

In this section of the CCMP, you will encounter project examples of businesses, individuals, public authorities, and others who are working to harness the bounty and the power of the natural resources of the BTES for commercial gain for economic and community development. These project examples range from oil and gas infrastructure development, place-based tourism and eco-tourism operations, and opportunities as well as next-generation investments in water resources management and the services sector.

Each of these projects will illustrate the progression of economic growth that we have experienced here in the BTES, which can, by and large, be distilled to a continuum or cycle which looks like the following.

The original CCMP included nine distinct action items for economic growth, but committee members believe a more concise structure is warranted and



Harvesting sugar cane. Image: Lane Lefort Photography

that regardless of the examples offered, economic opportunities all follow a basic pattern. From port development to value-added seafood and all points in between, the action items under this section of the CCMP can be classified within one or more of the following categories: 1) Education, 2) Technology and Development; 3) Business Assistance; and 4) Marketing. A brief description of each of these new action items is provided below along with a listing of the associated objectives identified by the committee. The examples serve as models to use as the BTES advances the way it harnesses the power and beauty of the estuary.

EG-1 Economic Education

This initial phase of development is typified by the process of learning about the resources available in the BTES or the opportunities to solve a problem and of beginning to conceptualize ways to harness the resources available to fill a gap in the marketplace. This process of education is both foundational and continual and not a one-off effort. Education continues to refine solutions and improve efficiency and quality and drives innovation throughout the entire cycle.

OBJECTIVES

- To educate business leaders, elected officials, university officials, and the general public about the economic value and the potential of BTNEP as a future economic engine for southern Louisiana with relationship to sustainable development
- To become a thought leader for the impact of regulations and how they affect both the economic and ecologic environments of BTNEP

- To drive economic diversification and stability through the appropriate use of natural resources found in the BTES, including:
 - a. extracting higher value products from existing resources through the use of research and development
 - b. demonstrating and supporting eco-tourism ventures and related support systems and services to enable entrepreneurs to find wetland-based recreational and tourism “adventures” that will support environmentally friendly business
- To explore opportunities to create new courses, programs, certifications, and degree programs in conjunction with higher education and business leaders related to ecological economics

EG-2 Technology (R&D) and Market Development

This next natural step in the progression builds upon the knowledge gained during the Education phase and begins to translate that knowledge to action. This phase includes the development of products/solutions and the testing of assumptions about not only the product but also the marketplace as well as the resources. This phase relies heavily on constant education in order to drive refinement to improve the product/solution. However, often without assistance to make these necessary improvements, many opportunities would not make it beyond the “really great idea phase.”



Ecotourism includes birders on Grand Isle. Image: Wendy Wilson Billiot

OBJECTIVES

- To drive R&D in key sectors. These may include the following list but have the potential to change over time as new opportunities and new technologies are developed.
 - nature-based tourism
 - coastal restoration
 - nutria market development
 - sustainable fisheries
 - sustainable farming practices
- To create value-added products in conjunction with higher education and business partners

- To promote technology transfer of ecologically appropriate processes that are developed
- To understand best practices of ecological entrepreneurship both in the US and globally

EG-3 Business Assistance

Without assistance from entities like BTNEP, South Louisiana Economic Council (SLEC), Terrebonne Economic Development Authority (TEDA), the Small Business Development Center (SBDC), and others, great ideas, new technologies, and solutions to problems may never make it to the marketplace. These entities are critical in assisting innovators and economic developers to navigate the often

complex and winding path from idea to market. This assistance is not purely financial. It includes essential training, mentoring, coaching, networking support, business incubator/office space, grants, loans, and other methods to support, scaffold, and assistance in launching new business opportunities. Once this support system is in place, and these products/solutions are refined, tested, and applied to the marketplace, marketing is essential to the ultimate success of the product/solution.

OBJECTIVES

To identify, catalog, and promote access to financial tools to environmentally friendly businesses in the key sectors that could assist in business formation and growth contributing to environmental sustainability (Examples: America's Small Business Development Center, SCPDC's revolving loan programs, etc.)

- To identify, catalog, and promote federal, state, and local incentive programs to businesses in key sectors that could assist in business formation and growth that decrease negative impacts in the seven priority problem areas
- To identify, catalog, and promote federal, state, and local grant programs that could assist environmentally friendly businesses, non-profits, and/or public institutions in developing programmatic activities related to wetland resources and the key sectors
- To operate as a conduit linking businesses in key sectors with other resources in the area, including other businesses, small business support, economic development professionals, and access to researchers in Louisiana universities
- To identify and promote solutions for any financial or regulatory gaps consistently faced by businesses in the key sectors (Examples: US Dept of Commerce, Economic Development Administration (EDA), Delta Regional Authority, etc.)

EG-4 Marketing Sustainable Products and Practices

Not only is marketing the refined product essential to the product's success, but it also helps to re-start the cycle by inspiring other solutions. If imitation is the most sincere form of flattery, then innovation is the most sincere form of approval. Good products/solutions marketed well will inspire other innovators to attempt to solve the same or similar problems more efficiently or look at the same resources in new and different ways which fosters a series of spin-off ideas and re-starts the cycle of education, technology and market development, business assistance, and marketing to the advantage of the BTES and its people.

OBJECTIVES

- To explore opportunities to create a new brand or maximize the existing brand throughout southeast Louisiana
- To create place-based marketing programs that will reinforce the positive messages about quality of life and economic opportunities in the BTNEP region
- To serve as a connector and promoter of BTNEP related businesses through the support or creation of an exposition that focuses on business, technology, and academic research related to estuaries

Economic Growth Project Examples

In the following section, we provide specific examples for economic growth that have been identified by the subcommittee. These examples are formatted in a consistent manner by which the target project/program is briefly described, followed by details of specific objectives, partnering agencies, timelines, and performance measures.

PE-1. Place-Based Benefits of the Barataria-Terrebonne Estuary System (EG-1, EG-4)

A strong sense of place and a value of the unique beauty and bounty of the natural resources of the BTES has always been essential to the residents of the BTES. This love of the place and its natural resources is infectious. From the very beginning of human settlement, survival and prosperity have been rooted in the bounty and the beauty of the BTES, and Native Americans passed their traditional knowledge of the resource to Europeans and other settlers, who in turn shared their experiences with wider audiences. From John James Audubon's illustrations of the unique birds and landscapes of the

region to "Hollywood South's" film and TV industry boom, the beauty of this region's environment and landscape have been marketed to global audiences for over 200 years. As an increasing societal value is placed on travel, tourism, and experiential tourism, the value of the BTES as a tourism resource has and will continue to increase.

OBJECTIVES

The objectives are to work collaboratively with regional tourism and economic development entities to assist tourism operators and entrepreneurs to:

- recognize, understand, and value the rich natural and cultural resources of the BTES.
- enhance the quality and the quantity of nature-based and cultural experiential tourism opportunities and operations in the BTES.



Cajun style home. Image: Lane Lefort Photography.



One of the many iconic Catholic churches Image: Lane Lefort Photography

- support the development and operation of new and existing tourism activities through traditional economic development techniques/education.

DESCRIPTION

BTNEP is an ideal lead agency to help drive this Action Plan in that BTNEP is designed to educate natural, and cultural resources of the BTES.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

This effort will require the collaboration of many different agencies and entities to implement the objectives listed above. This group includes but is not limited to BTNEP, the Lafourche Convention and Visitors Bureau, the LDCRT, the Louisiana Travel Promotion Association and its members in the BTES, SLEC, TEDA, SCPDC, and others.

TIMELINES AND MILESTONES

While the growth of place-based tourism and lifestyle

is a long-term trend, it is envisioned that the objectives listed above are a constant process of improvements, starting with a 12 month period of initial stakeholder engagement following the adoption of this CCMP document and incorporating a two-year cycle of initiatives to support the objectives listed above.

POSSIBLE RANGE OF COST AND SOURCES OF FUNDING

Costs for the objectives listed above can vary, depending on multiple factors; however, it is safe to say that costs to BTNEP can be limited to staff travel and time if needed. These costs could be increased to include a focus of a mini-grant program or could be entirely born by the travel and tourism entities whose funding is designed to fund these types of objectives. As a point of reference, it is important to note that in Lafourche Parish alone, the amount of promotional and tourism development funds allocated by BP following the Deepwater Horizon oil spill was \$2 million and included a heavy focus in major media buys nationwide.



Fisherman Dan Mechant with a nice big redfish straight from the Gulf. Image: Wendy Wilson Billot

PERFORMANCE MEASURES

Performance measures will vary depending on the program-supported events that are approved in the annual workplans.

Data Gathered

Preservation copies of digital materials will be held by the project on hard drives then provided to the Nicholls State University Archives.

Monitoring

Metrics will include an annual accounting of the number of program-supported presentations, events, venues, and attendees.

Parties Responsible: BTNEP and/or collaborative team

Timetable for Gathering Data: pre- and post-surveys and annual reports

How Data is Shared: via presentations, conversations, online, archives, and eventually through proposed public library kiosks

Possible Data Gaps: individuals and segments of the community not reached

Additional Funding Needed: The first funding request has been submitted. Other possible sources are being identified and possible applications/proposals submitted as seems appropriate.

PE-2. Scientific Literacy on Water (EG-1, EG-2)

Water is at the heart of life and work in the BTES. This area suffers some of the Gulf Coast's highest rates of coastal erosion and land loss and was ground-zero for the 2010 BP oil spill with subsequent staging of cleanup and now ongoing study of possible ecological and health impacts. The region also faces multiple chronic environmental challenges - coastal erosion, land loss, saltwater intrusion, and high TMDLs - as well as acute risks from natural and human-caused disasters. Recurrent severe weather events like Hurricanes Katrina and Rita, Gustav, Ike, and Isaac, and the March and August 2016 flooding create "teachable moments" for raising regional awareness and scientific literacy on issues of water supply, quality, flood-risk, and sea-level rise to help advance community sustainability and resilience.

OBJECTIVE

To support development and implementation of enhanced public outreach, based in use of accessible language, interactive dialogue, and respect for local water knowledge and culture.

The purpose is to help empower regional public officials, stakeholders, and regular citizens with knowledge that structural solutions are often prohibitively expensive and can never be 100

percent fail-safe and that sustainable and resilient communities need more nuanced and flexible understanding of what it takes to live with water.

BTNEP is well positioned to assume a leading role in advancing this objective. From its inception, BTNEP has been a model of interdisciplinary, cross-sectoral collaboration spanning scientific disciplines, regional industries, and government and community stakeholders. The public outreach process will also help highlight the importance and value of BTNEP as a future economic engine for regional sustainable development.

The concept "scientific literacy" refers to a reasonable level of understanding and competence. The people of the BTNEP region already know a lot about water and show strong support for environmental concerns. Like other environmental issues, water has the advantage of being readily accessible. However, while water here seems ever present and abundant, the complexity of issues, multiple variables outside controlled laboratory conditions, and diverse voices of scientists, industry, and environmental groups often make grasping cause and effect and arriving at actionable consensus difficult.

An excellent starting point will be explicitly acknowledging that both lay and scientific/technical communities possess potentially complementary expertise for confronting regional risks and opportunities. In effective communication, information cannot flow in only one direction with scientists/technical experts talking, and non-technical people listening. This is known as the "Deficit Model" because it focuses on what people don't know. In contrast, the "Dialogue Model" emphasizes what people do know and promotes active listening on both sides with thoughtful responses to community questions and concerns and mutual respect. Research has highlighted the importance of scientists and technical experts speaking in understandable language and using tools like storytelling and metaphor to convey knowledge useful to non-technical audiences within community context and

experience. Encouraging both lay community and scientific/technical experts to step out of familiar comfort zones helps level the field and can produce results well worth the effort. Research also recognizes that informed public participation helps improve the quality and legitimacy of environmental decisions and, thus, produces better results.

DESCRIPTION

Models for Enhancing Scientific Literacy

BTNEP is part of a collaborative team exploring a variety of approaches for enhancing regional scientific literacy. This process raises some significant questions. What audiences will be addressed? What knowledge will be offered at what venues? Existing initiatives, such as the Louisiana Water Economy Network (LAWEN) and a non-technical session at the Coalition to Restore Coastal Louisiana (CRCL) 2016 State of the Coast Conference have shown the way and had success in reaching non-technical regional government and industry stakeholders. While work still needs to be done in raising scientific awareness among those audiences, BTNEP recognizes a gap in outreach to regular, non-technical citizens.

Another key question is the level of public participation anticipated or hoped for. The International Association for Public Participation (IAP2) has developed a participation spectrum, ranging from Informing through Consulting then Involving, Collaborating, and Empowering, with each allowing for an increasing level of public impact. DEMOS, a UK think tank, has suggested that discussions with the public should take place before any new scientific developments or technologies become reality. While that degree of participation seems unlikely, some degree of participation is widely accepted by those likely to be effected by major decisions. Experience with processes like Louisiana Speaks that gathered public input on recovery after Hurricane Katrina demonstrated that when given appropriate information in usable form,

regular people will take ownership of outcomes and stay involved.

Questions have been raised regarding what kinds of information participants would likely find most useful. Options range from the specific, such as local scientific/technical issues regarding water, to the general, such as describing the trial-and-error process of scientific method, how science is done in practice, and levels of uncertainty and probability. A combination of the two seems likely to be most useful. All potential topics would benefit from evaluation in a “Message Box” process (Baron, 2010), which asks for succinct “elevator speech,” statements on the Issue; the Problem; Why it Matters; the Solution; the Benefit to the region, to the community, and society in general.

The easiest to arrange venues may be on university campuses. However, such settings may prove intimidating for non-technical citizens. Groups like LAWEN have used public libraries. Some format models recommend using informal venues like restaurants or bars where people might feel more comfortable just taking part in a conversation.

Public outreach researchers and practitioners have developed an array of outreach models. Presentation formats might include a mix of elements from two or more of the following:

- **TED-Talk like model** has been shown to have the capacity to convey complex information in short presentations by well-prepared speakers using engaging and accessible language, storytelling, and limited use of visuals.
- **Café Scientifique**, first developed in France and later adapted in the United Kingdom, also involves a short presentation by an expert but is more interactive with the presentation providing a basis for discussion. Lay audience and culture experts with special knowledge are treated as equals. Emphasis is on being both informative and enjoyable with sufficient time allowed to clarify complex ideas. The format encourages

human connections through questioning experts about motives (for participating, entering their field, choice of research topics), funding, scientific method, etc.

- **Demonstration Lectures** use a portable apparatus, leave no harmful residue, and are set up within an hour and disassembled again as quickly as possible. This format can create opportunities for audience participation. The fact that some demonstrations may not work or may discussing the trial and error of how science is done in actual practice.
- **Book Clubs** may discuss non-fiction books on water topics or novels with water science themes.
- **Scenario Workshops** are based on asking “what if” questions.
- **Dialogue** applies focused approaches using established methods for discussing controversial topics with guidelines for maintaining civility.
- **Eco-Tourism** engages local people acting as visitors and/or guides to regional features.

Equally balanced dialogue is probably not achievable because scientists and technical people will invariably know more about their subjects and disciplines. However, all outreach models’ use of common language have potential to create shared learning space as a platform for building mutual trust and understanding, legitimacy, and credibility. BTNEP has great experience in using this common language to communicate science.

Enhanced scientific literacy also has potential to help drive economic diversification and greater stability based on identifying possible appropriate use of natural resources found in the BTES and promoting research and development to create higher value-added products based on regional resources. Referrals to technical assistance will help raise community-level water knowledge and awareness of business and workforce opportunities to smooth out impacts in energy industry “boom and bust” cycles.

Use of pre- and post-surveys of participant perceptions of the experience, scientific knowledge, and perceived capacity to actively participate could help guide improvements for more effective



Shrimp trawl boat in early morning fog. Image: Lane Lefort Photography

communication, which may also be transferrable to other outreach efforts.

As appropriate, BTNEP will collaborate in organizing presentations within the region. Presentations will be digitally recorded, posted on YouTube and partner web sites, and used to spark community and online conversations on water. Digital recordings could eventually become part of content for proposed water-knowledge kiosks at regional public libraries. Results of pre- and post-surveys will guide refining formats and shared language for maximum effectiveness in raising scientific literacy and self-perceived capacity to actively participate in public discourse on water. These talks could also be used by the education community as appropriate.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

BTNEP may take the lead in networking to implement scientific literacy programs and is also part of a collaborative effort that builds on existing water management networks around the New Orleans

based LAWEN, which also convenes meetings in Baton Rouge and Lafayette. Other partners might be Research Park Corporation/NexusLA and Good Work Network, which promote technology and ecosystem development and entrepreneurship.

TIMELINES AND MILESTONES

The scientific literacy initiative will have an approximately two-year timeline for selecting and training speakers to deliver presentations, digital recording of presentations, and organizing conversations around digital recordings.

POSSIBLE RANGE OF COST AND SOURCES OF FUNDING

The collaborative team has submitted an application to the Gulf Capacity Building program of the National Academies of Sciences, Engineering, and Medicine. The proposal involved development of the TED-Talk like format and use of accessible language. The funding request was slightly under \$250,000. If awarded, the grant period would be two years.



Live Louisiana crawfish. Image: Louisiana Sea Grant

The project team is identifying other possible funding sources and will use information developed for the Gulf Capacity grant application to request funding for the same and other possible formats and models. Funding requests will again be in the \$250,000 range.

PERFORMANCE MEASURES

Performance measures will vary depending on the program supported events that are approved in the annual workplans.

Data Gathered

Preservation copies of digital recordings will be held by the project on hard drives then provided to the Nicholls State University Archives. The Nicholls Archives do not have the facilities to serve as a repository for the survey data and make it available to researchers but will advise the project team on identifying a repository with the appropriate facilities to make the survey data available to researchers.

Monitoring

Metrics will include the number of presentation events, venues, and attendees as well as online views. The project will also analyze pre- and post-survey data to identify patterns indicating growth in knowledge and shifts in attitudes on capacity to participate.

Parties Responsible: BTNEP and/or collaborative team

Timetable for Gathering Data: pre- and post-surveys and annual reports

How Data is Shared: via presentations, conversations, online, archives, and eventually through proposed public library kiosks

Possible Data Gaps: individuals and segments of the community not reached

Additional Funding Needed: The first funding request has been submitted. Other possible sources are being identified and possible applications/proposals submitted as seems appropriate.

PE-3. Seafood Promotion, Technology, and Marketing (EG-1, EG-2, EG-4)

Louisiana's seafood harvesting sector has been in decline for more than two decades due primarily because of stagnant prices caused by an influx of imported seafood (Asche et al., 2012; Josupeit, 2004; Bene et al., 2000). This competitive pressure has been compounded by rising input costs and a succession of natural and man-made disasters. Together, such factors have led to a 56 percent decline in commercial fisherman license sales in the last 25 years with more than half of this reduction occurring in the past decade alone (LDWF, 2016). The number of seafood dealers and processors in Louisiana has also been in decline as the globalization of fisheries commodity markets has led to downsizing, consolidation, and closure of more than half of the firms in this sector.

As a result of these external forces, remnant seafood firms operating in the BTES have been forced to embrace alternative business models for commercial harvesting and processing. New industry realities require that fishermen, dock owners, and processors are equipped to understand business trends and strategies, technologies, and policies required to survive in an increasingly competitive industry. For these firms, remaining competitive in a global market requires being efficient as possible and maximizing revenues received for seafood products.

OBJECTIVES

Education, technology transfer, and new market development are critical factors for the economic survival of seafood harvesting and processing firms operating in the BTES region. The BTNEP MC will support developing and implementing enhanced public outreach initiatives and partnership opportunities to inform and promote new handling and processing technologies, value-added products, and innovative practices and byproduct uses that



Fresh Louisiana shrimp. Image: Louisiana Sea Grant

maximize the quality and profitability of seafood resources in the BTES region.

DESCRIPTION

The BTNEP MC members are already engaged in various seafood promotion and value-added initiatives. Some specific examples follow:

Direct Marketing: Dockside sales of BTES seafood is a small-scale but effective way for harvesters to capture a greater profit margin for their locally caught fishery products. Once common in the BTES, the practice fell out of fashion in recent decades as U.S. domestic seafood sources were assimilated

into a globalized, commodity market. BTNEP MC partners such as the agents and specialists of the LCES are working with vessel captains to teach improved product handling and marketing techniques to ensure higher quality seafood is available via direct sales to consumers. Examples of this effort in the BTES include LaTerre Direct Seafood (www.laterdirectseafood.com), a regional expansion of the Louisiana Direct Seafood marketing effort launched in 2012 by BTNEP MC partners in the LSU AgCenter (<http://louisianadirectseafood.com>).

Place-Based Promotion: The Louisiana Seafood Certification Program is a marketing initiative of the Louisiana Seafood Promotion and Marketing

Board (LSPMB) and the LDWF. The intent of the program is to establish a unified, widely recognized brand that will introduce new consumers and buyers to Louisiana Seafood. As members of the BTNEP MC, these agencies are uniquely positioned to provide guidance on place-based product promotion and development. Examples of this work include promotion the Certified Wild Louisiana Seafood campaign (<http://certified.louisianaseafood.com>) and efforts to promote the ecological origin of the region's seafood (www.louisianaseafood.com/ecology).

Micro-processing: Small batch processing of finfish and shellfish products has emerged in recent years as an economic opportunity for entrepreneurs. Analogous to the growth of micro-breweries, these businesses process for high-end supermarkets and restaurants that are increasingly demanding authentic, locally sourced seafood products in alternative forms of packaging and preparation. As a member of the BTNEP MC, the LDH provides guidance to this growing sector and regulates the sanitation and permitting of individual businesses.

Value-added Quality: Historically, value-added

applications in seafood have translated only to heavily processed product forms (e.g. pre-portioned, pre-breaded, and pre-cooked). More recently, however, value-added approaches have shifted towards a growing consumer demand for high quality, locally sourced products with an emphasis on freshness and chemical free processing. Louisiana Sea Grant and the LSU AgCenter, both BTNEP MC partners, aid start-up companies and products via technology transfer, product development and food business incubator services, nutritional analysis of value-added recipes and ingredients, and expertise on market development.

Workshop and Conference Support: Through its partner members and directed funding, BTNEP will continue to support developing and presenting promotional campaigns and value-added training opportunities via conferences, workshops, and invited presentations.

Training and outreach opportunities will be held at various locations in the BTES depending on specific needs for education, technology transfer, or market development with seafood harvesters and processors.



Direct marketing of Louisiana seafood. Image: Louisiana Sea Grant

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

BTNEP will collaborate as needed with extension agents, subject matter experts (faculty and staff) of public and private institutions such as the LCES, the Louisiana Sea Grant College program, the LSU AgCenter, the LDWF, the LSPMD, and commodity and trade organizations representing the harvesters, dealers, processors, and retailers of commercial finfish and shellfish species.

TIMELINES AND MILESTONES

BMPs for enhanced quality harvesting and value added processing will be an ongoing focus of the program over the coming five years. The primary mechanisms for achieving these goals will be through partner-member initiatives of the BTNEP MC, guest speakers' presentations at quarterly meetings, and targeted support and sponsorship of ongoing workshops, conferences, and curricula.

POSSIBLE RANGE OF COST AND SOURCES OF FUNDING

State and federal sources of expertise and project

funding include the LDWF, LDH, NOAA, LCES, LSU AgCenter, Louisiana Sea Grant, and the Gulf State Marine Fisheries Commission. Collectively, these institutions expend approximately \$1.5 to \$2 million annually towards seafood product development and marketing campaigns in Louisiana.

PERFORMANCE MEASURES

Performance measures will vary depending on the program supported events that are approved in the annual workplans.

Data Gathered

Presentations and curricula developed with full or partial support from BTNEP will be archived at the BTNEP office at Nicholls.

Monitoring

Metrics will include an annual accounting of the number of program supported presentations, events, venues, and attendees.

Parties Responsible: BTNEP and collaborative partners and BTNEP MC members



Port Fouchon Fisheries Docks. Image: Port Fouchon

Timetable for Gathering Data: annual reports

How Data is Shared: via presentations, conversations, online, archives, and eventually through proposed public library kiosks

Possible Data Gaps: individuals and segments of the community not reached

Additional Funding Needed: A reevaluation of this action item will occur in year five to determine whether additional funding resources are required.

PE-4. Development at Port Fourchon (EG-2, EG-3)

Established in 1960, the Greater Lafourche Port Commission (GLPC) is a political subdivision of the State of Louisiana, and manages the development of Port Fourchon – the nation’s premier energy services port. The GLPC also manages the South Lafourche Airport in Galliano.

Since its establishment in 1960, the GLPC has sought to make Port Fourchon an economic and community development asset for the community of southern Lafourche Parish at the heart of the BTES and has been very successful in that endeavor.

The Port is located on the Gulf of Mexico near the mouth of Bayou Lafourche and is the only Louisiana port directly on the Gulf of Mexico. Fourchon serves as the intermodal offshore energy services and supply port. More than 250 companies utilize Port Fourchon to service offshore rigs in the Gulf of Mexico, carrying equipment, supplies and personnel to offshore locations. In terms of service, Port Fourchon’s tenants provide services to more than 90 percent of all deepwater rigs in the Gulf of Mexico and roughly 45 percent of all shallow water rigs in the Gulf. In total, Port Fourchon plays a key role in providing nearly 20 percent of the nation’s oil supply – or one in every five barrels of oil in the country.

The Port’s economic impact on the BTES is tremendous, as examined in a recent study conducted by Dr. Loren C. Scott, former Chair of the LSU Economics Department. This study found that across the state, Port Fourchon accounts for just over \$4 billion in direct economic activity each year, which includes over \$800 million in household earnings. Most encouraging is that 80 percent of these economic benefits – business sales, jobs, and household earnings – generated by the Port at the state-wide level stay within the BTES in Lafourche and Terrebonne Parishes. One in every 13 workers in Lafourche and Terrebonne parishes are employed directly by activities at Port Fourchon.

This same Loren Scott economic impact study referenced above also modelled the Nationwide impacts of a 3-week shut down of LA1/Port Fourchon and found such a shutdown would cause a loss of \$11.2 billion in sales to US GDP, plus an additional \$3.2 billion in lost household earnings because 65,502 jobs would be lost nationally – for just a 3 week shutdown.

In the 50-plus years since its establishment, Port Fourchon recognizes the needs to balance sustainable development in a fragile, dynamic coastal environment by employing sustainable building practices and employing nature-based defenses for the built assets in and around the Port to implement its vision of holistic resiliency. Further, its community’s heritage is one based on the subsistence, recreational, and commercial fisheries. One would be hard-pressed to find another group of Americans whose culture, character, and fortunes are tied so closely to their natural environment as those of us who call the BTES home, which is why the port has been developed with the need to preserve and protect the environment at the heart of its ongoing capital construction program.

OBJECTIVES

The BTNEP MC has identified the continued expansion of Port Fourchon as an opportunity to

generate increased adoption of the planning and construction of green infrastructure and a holistic approach to resiliency of traditional hard (grey) assets through the construction of natural protective buffers (green infrastructure) throughout the BTES.

DESCRIPTION

BTNEP has a long history of providing strategic scientific advice to Port officials as they plan port development projects, and this successful partnership has greatly assisted and informed the Port's philosophy of holistic resiliency in its current and future iterations of development.

To date, Port Fourchon has completed the industrial development of nearly 1,800 acres for specialized energy industry service facilities and infrastructure. This is supported by over 66,000 linear feet of bulkheaded waterfrontage, and utilized by over 200 companies. In order to construct these industrial facilities in mostly shallow open water areas, the GLPC has had to perform mitigation activities to offset the habitat loss resulting from converting these watery areas in to industrial lands.

Consistent with the advice from BTNEP, the GLPC has chosen not to purchase mitigation credits to

offset this development in some far-off mitigation bank but has, instead, constructed nearly 1,000 acres of vibrant saline marsh immediately adjacent to the port. Over and above this mitigation marsh creation work, the Port has also constructed an over 100-acre maritime forest ridge and marsh complex through a partnership with BTNEP. These environmental restoration projects have provided enhanced storm protection to the Port's built assets through storms including hurricanes Katrina, Rita, Gustav, Ike and Issac.

The BTNEP MC will work with the GLPC and a host of other partners to highlight the GLPC's efforts to scale up these holistically-resilient development works for the benefit and restoration of key areas within the BTES in order to demonstrate the commercial viability of sustainable development in an environmentally-sustainable manner.

LOCATION

Port Fourchon is in extreme southern Lafourche Parish and is located at the mouth of Bayou Lafourche on the dividing line between the Barataria and Terrebonne Basins.

Future developments to employ this holistic



Aerial Image of Port Fourchon looking south to the Gulf of Mexico. Image: Port Fourchon

resiliency approach to constructing both grey and green infrastructure will be located in both Basins and within potentially a larger radius than traditionally developed due to the magnitude of dredging required for the Port's planned expansion.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

While the GLPC is the lead agency for the actual construction and development works, the BTNEP MC and a host of other partners will continue to be a critical clearinghouse of scientific and technical advice on how best to leverage dredged materials to meet and exceed mitigation requirements for development in a manner which enhances the resiliency of built assets. Likely partners in this endeavor include, but are not limited to the following

- BTNEP
- BTEF
- Nicholls State University
- Louisiana State University
- Environmental NGOs and non-profits
- Louisiana's Coastal Protection and Restoration Authority
- The energy industry
- Media

TIMELINES AND MILESTONES

The GLPC is planning to continue its conventional development with its upcoming Slip D development in its Northern Expansion area in 2017 through 2020, and will construct over 90 acres of saline marsh as mitigation for this development in a highly visible and accessible location.

Separate to the proposed Slip D development, the GLPC is working to complete a feasibility study of deepening the entrance to Port Fourchon in Belle

Pass to the intersection with Pass Fourchon to a depth of up to -50 feet. This channel deepening project is estimated to generate approximately 25 million cubic yards of material, of which roughly 12 to 15 million cubic yards will be available for beneficial use for restoration projects over and above mitigation throughout the region. The timeline for this development is anticipated to run from initial approval of the proposed development in 2018 through phased development over the next 15 years.

POSSIBLE RANGE OF COST AND SOURCES OF FUNDING

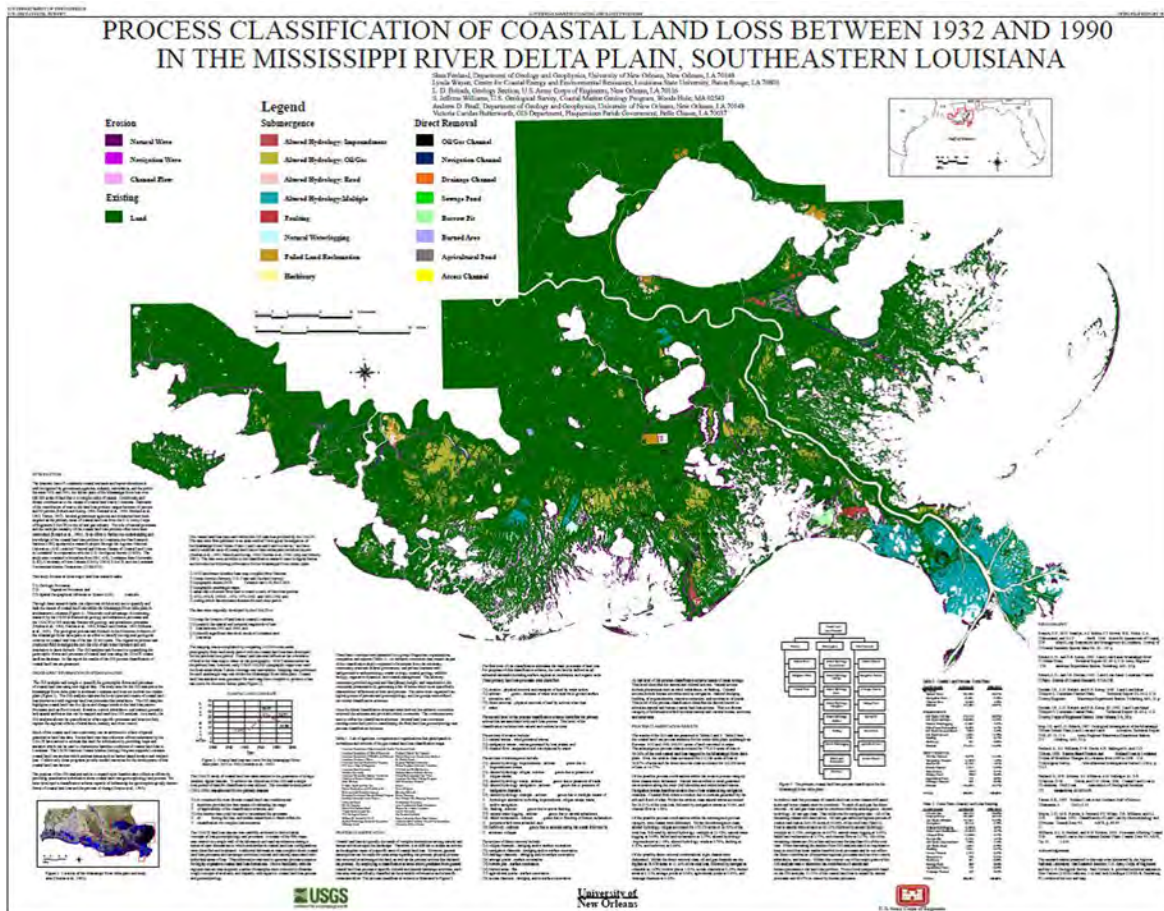
The costs of the BTNEP MC's involvement are relatively low and mainly limited to assisting with regular outreach and educational efforts to promote the concept of holistic resiliency and sustainable development in coastal areas.

Depending on the level of engagement that the BTNEP MC chooses to generate for this concept, the costs could range between entirely in-house staff time and existing efforts to promote sound design practices upwards to \$100,000 to include promotional and educational materials, programming, scientific and technical support in the design and implementation of green infrastructure such as vegetative plantings, etc. In the instance of some of these enhanced support techniques, funding may be available from either the GLPC or other stakeholders benefitting from this more intensive support. Other funding streams include private philanthropy, industry corporate social responsibility support, and grant programs such as Gulf of Mexico Program, etc.

PERFORMANCE MEASURES

Data Gathered

Data points to measure performance include acres of property developed and restored in the region as well as number of volunteer events and hours, hours of staff time spent on outreach and technical assistance, media coverage and exposure, and number of outreach events and contacts generated.



Map and information on landloss. Image: USGS

<https://www.usgs.gov/media/images/example-usgs-ofr-418-penland-et-al-2001>

Monitoring

- **Parties Responsible:** GLPC, BTNEP, and other agency and NGO partners
- **Timetable for Gathering Data:** commencing in Fall 2017 with commencement of Slip D mitigation development
- **How Data is Shared:** via email, reporting tools (to be developed), social media, media, etc.
- **Possible Data Gaps:** performance of other projects in the region or future projects inspired by this model
- **Additional Funding Needed:** Funding for the actual construction of the green and

gray infrastructure development will be the responsibility of the GLPC in the case of development of additional infrastructure at and for Port Fourchon.

PE-5. Climate Change as an Economic Driver (EG-1, EG-2, EG-4)

The economy of the BTES is situated within a low elevation landscape that is increasingly vulnerable to coastal inundation, subsidence, and erosion. These processes are compounded by chronic and acute forcing (geologic and meteorological) that is

exacerbated by a changing climate. Approximately 2,000 square miles of wetlands have been converted to open water in coastal Louisiana since the 1930s - with the largest portion of this loss occurring within the boundaries of the BTES. It's a region with one of the highest documented rates of relative sea-level rise in the world. The southernmost portion of the BTES, Grand Isle, recorded an average annual increase of 9.34 mm per year in mean sea level from 1947 to 2006 (NOAA, 2016). More than any other single factor, coastal subsidence and its contribution to relative sea level rise has and will continue to affect patterns of land use, resource access, and commercial development in the region. The coastal communities of the BTES must continue being advised and plan for the realities of a changing climate and landscape. Their response to this challenge will have substantial implications for their economic security, physical protection, and cultural identity.

OBJECTIVES

BTNEP will continue to help individuals, businesses, and communities plan for and adapt to projected climate changes, by:

- supporting and sharing the latest assessments on coastal landscape change and climate-based projections.
- promoting awareness and understanding of adaptive restoration and protection options and the capacity of these strategies to mitigate changing conditions.
- developing information and tools to aid residents and businesses on economic decisions related to development, settlement, and risk mitigation.
- promoting the BTES region as a global leader in the development of coastal restoration technologies and community adaptation approaches for dealing with climate change.

DESCRIPTION

BTNEP MC members are already engaged in various

climate-related programs and projects. Specific examples follow.

- outreach presentations at BTNEP MC meetings that provide detailed status and projections for coastal land-loss
- dissemination of coastal mapping and visualization tools for improving public understanding of inundation levels from storm surge and long-term climate change
- active participation on task force and advisory committees that address coastal restoration and mitigation of climate-related risk
- participation in conferences and workshops that identify and promote the economic opportunities and constraints presented by these landscape challenges and the unique contributions of BTES in coastal restoration and climate change mitigation options

Training and outreach opportunities will be held at various locations in the BTES depending on specific needs for education, technology transfer, or program development with specific audiences (residents, businesses, commercial sectors, and state and federal government agencies).

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

BTNEP will collaborate as needed with subject matter experts of public and private universities, federal agencies such as EPA, NOAA, USGS, state agencies such as CPRA, and the Louisiana Sea Grant College program as well as scientists, engineers, and planners from the private sector.

TIMELINES AND MILESTONES

Climate-based programming will be a regularly featured topic on the agenda of BTNEP MC meetings over the coming five years. To the extent possible, the program will sponsor/support demonstration projects, ongoing workshops, conferences, and

climate-based curricula that focus on economic alternatives for residents and businesses.

POSSIBLE RANGE OF COST AND SOURCES OF FUNDING

State and federal sources of expertise and project funding include EPA, NOAA, CPRA, and Louisiana Sea Grant.

PERFORMANCE MEASURES

Performance measures will vary depending on the program supported events that are approved in the annual workplans.

Data Gathered

Presentations and curricula developed with full or partial support from BTNEP will be archived at the BTNEP office at Nicholls.

Monitoring

Metrics will include an annual accounting of the number of climate-related programs supported (e.g. presentations, workshops, conferences), a description of the target audience, and an estimate of the number of attendees.

- **Parties Responsible:** BTNEP, collaborative partners, and BTNEP MC members
- **Timetable for Gathering Data:** annual reports
- **How Data is Shared:** via presentations, conversations, online, archives, and eventually through proposed public library kiosks
- **Possible Data Gaps:** individuals and segments of the community not reached
- **Additional Funding Needed:** A reevaluation of this action item will occur in year five to determine whether additional funding resources are required

PE-6. Business Financial Assistance as an Economic Driver (EG-1, EG-2, EG-3 & EG4)

Economics and the environmental considerations are often thought of as being polar opposites. The relationship between the BTES and the economy requires, however, that citizens and community leaders balance the use and protection of the bountiful natural resources. Resources are available to entrepreneurs to build and grow small to medium businesses. Nature based business is often considered a bit more risky and is often not funded by national, state, or even local banks. The SCPDC has low interest funding available and has identified eco-tourism and nature based business as a target for the diversification and growth of our economy.

OBJECTIVES

- To educate business leaders, elected officials, university officials, and the general public about the economic value and potential of BTNEP as a future economic engine for southern Louisiana with relationship to sustainable development
- To drive economic diversification and stability through the appropriate use of natural resources found in the BTES
- To identify, catalog, and promote access to financial tools to environmentally friendly businesses; incentive programs that could assist in business formation and growth; and grant program development to assist in programmatic activities related to wetland resources
- To operate as a conduit linking businesses with resources
- To identify and promote solutions for any financial and regulatory gaps faced by business



Local businesses must use wise economic decision-making related to development, settlement, and risk mitigation. Image: Lafourche Parish Tourist Commission

- To create place-based marketing programs that reinforce the positive messages about the quality of life and economic opportunities in the BTNEP region

DESCRIPTION

- Economic Development Planning's multiple opportunities include BTNEP's unique balance and partnership between economic opportunities, environmental awareness, and proper use of natural resources. With the participation of local government, the SPCDC can/will continue to include and encourage eco-tourism opportunities and value added measures to complement existing resource use and acknowledge continued consideration of the protection of the BTES as we use our natural resources. (Planning Documents include SCPDC's Comprehensive Economic Development Strategies and Delta Regional Authority's 5 Year Strategies, etc).



Swamps of Louisiana's estuaries provide great space for ecotourism. Image: Lane Lefort Photography

- Encourage Environmental Awareness in federal, state, and local economic development trainings for newly elected officials and through chambers and other forum opportunities where businesses form, grow, and bring in new staff
- Link or develop financial and business assistance guides with BTNEP's web and communication network
- Push incentives and grant opportunity information as it is discovered to BTNEP's web and communication network to encourage environmentally friendly programs and business opportunities
- Support and assist entrepreneurs who express interest in eco-friendly business ventures
- Highlight and include the unique value and availability of BTES resources for work and play as Quality of Place grows as a key component in site selection and workforce recruitments

Opportunities are endless for BTNEP-based businesses to create and grow BTES-related businesses that responsibly conserve natural resources, to export value added products to the world to treat visitors to the tremendous adventures that the BTES provides, and to encourage responsible recreational use of our BTES resources.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

Collaboration is key within the BTES for leaders in economic development and tourism (SCPDC, SLEC, the SBDC, the chambers, and local government) to know the resources and to use every opportunity to disseminate grants and incentive and financial opportunities to the public. Key additional players are our bankers. Entrepreneurs often go to their bank when they have ideas. Bankers need to be aware of technical assistance opportunities and gap financing opportunities so that entrepreneurs have alternatives and information and an understanding of the importance of the balance between economic

and environmental considerations. All parties need to be a part of and aware of BTNEP's resources to complement, support, and provide proper cautions when businesses create or expand in a way that affects the BTES.

TIMELINES AND MILESTONES

The SBDC, SLEC, and SCPDC operate year round to provide services to entrepreneurs and existing businesses. Milestones would include a review of new business starts and contacts made between their agencies and members of the business community.

POSSIBLE RANGE OF COST AND SOURCES OF FUNDING

The noted agencies often provide free or low business and technical assistance services. SCPDC's Revolving Loan Funds are a low interest tool offered to businesses that cannot otherwise get traditional bank financing.

PERFORMANCE MEASURES

Performance measures will vary depending on the program supported events that are approved in the annual workplans.

Data Gathered

In partnership with SBDC, SLEC, SCPDC, TEDA, and other local economic development officials, BTNEP could gather information on BTES and resource based businesses. This could provide examples for people interested in getting into this type of business.

Monitoring

BTNEP could annually request data on services provided to BTES based businesses.

Parties Responsible: TEDA SBDC, SLEC, SCPDC, and TED

Timetable for Gathering Data: annually

How Data is Shared: This information could be provided to the BTNEP MC and made available on its website and through BTNEP's communication network.

Additional Funding Needed: Additional funding may be needed to provide financial business assistance.

PE-7. Liaison roles of BTNEP (EG-1, EG-2, EG-3 & EG-4)

BTNEP and the BTPO and staff are unique resources to serve and supplement economic and business development within the region. With the partnering and benefit of the BTNEP MC membership from federal, state, local, academic and business community leaders, BTNEP is properly viewed as a neutral resource to provide balance when parties consider the use versus the protection of our precious natural resources.

OBJECTIVES

- To educate business leaders, elected officials, university officials, and the general public about economic resources
- To become a thought leader for the impact of regulations and how they affect both the economics and ecologic environments
- To drive research and development in key sectors
- To promote technology transfer
- To understand and explain best practices
- To operate as a conduit
- To identify and promote solutions
- To serve as a connector and promoter of BTNEP related businesses

DESCRIPTION

SBDC, SCPDC, and TEDA should add/include BTNEP in resource guides for small businesses. These guides offer a variety of services that entrepreneurs might tap into when considering or developing new or expanding opportunities.

While recognizing their lobbying prohibition, BTNEP should be invited to provide information when economic development activities involve significant or unique potential environmental impacts.

By keeping an ear on the needs of the community and the BTES when funding opportunities are made available, BTNEP should stand ready to propose research and development projects to gather and access data that responds to frequently asked questions and assist in pending community and political decisions.

BTNEP should showcase new technologies and service/support federal and state agencies in this capacity.

BTNEP should showcase eco-based tourism and business activities that promote respectfully using BTES resources.

This action plan will be implemented throughout the BTES and in state and national forums.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

- BTNEP

TIMELINES AND MILESTONES

- Continual

POSSIBLE RANGE OF COST AND SOURCES OF FUNDING

Federal and state programmatic resources provide some funding to support BTNEP's role as a liaison for the BTES. When opportunities arise for available outside funding, the opportunities should be used as

long as the methods of funding are in line with ethics and other legal boundaries.

PERFORMANCE MEASURES

Performance measures will vary depending on the program-supported events that are approved in the annual workplans.

Data Gathered

Types and location of eco-tourism based business operations, best practices for eco-based operations, and information specific to a pending problem of issue could be gathered.

Monitoring

Parties Responsible: BTNEP

Timetable for Gathering Data: continual

How Data is Shared: web based and other communication network

Possible Data Gaps: individuals and segments of the community not reached.

Additional Funding Needed: Additional funding may be needed to provide financial business assistance.

PE-8. Business Education and Training (EG-1, EG-2, EG-3)

Educational support activities shall include education efforts for elected officials, university leadership, the business community, and the general public about the economic opportunity inherent in creating and sustaining a new industry sector aligned with BTNEP's environmental goals.

OBJECTIVES

- To educate business leaders, elected officials, university officials, and the general public about



Sunset in the swamp. Image: Lane Lefort Photography

the economic value and the potential of BTNEP as a future economic engine for southern Louisiana

- To become a thought leader for the impact of regulations and how they affect both the economic and ecologic environments of BTNEP
- To drive economic diversity and stability through the appropriate use of natural resources found in the BTES, including extracting higher value products from existing resources through the use of research and development
- To explore opportunities to create new courses, programs, certifications, and degrees in conjunction with higher education and business leaders

The objective is to support developing and implementing education and certification programs throughout the education ecosystem. Aligning with existing economic development strategies to make coastal restoration a legitimate “export industry” in south Louisiana, BTNEP can drive smart strategies for workforce development.

Education institutions have expressed a strong desire to be more aligned with economic development in their respective areas. With partners like Fletcher Technical College and Nicholls, BTNEP can assess the needs of the future workforce and assist higher education institutions in developing curricula that will help fill those future needs.

DESCRIPTION

Creating Coastal Curricula

Creating curricula generally takes excess time and money. Given the economic climate, seeking alternative ways to create programs at higher education institutions could be the answer. This consists of three main components:

- 1. Assess Existing Programs:** Understanding what programs and courses currently exist locally is the first component to solving this challenge
- 2. Assess Future Workforce Needs:** While more complicated, understanding what

companies will need over the next 10-20 years is critical in linking programs to actual jobs.

3. Fill the Gaps: To execute, BTNEP should work only on filling the gaps. It is estimated that many certificate programs could be created without the addition of any new courses. By restructuring existing courses to create programs, it is possible to create impactful programs with little to no new funding.

These activities can be undertaken at all higher education institutions in the BTNEP region.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

BTNEP will collaborate with the respective institutions and economic development organizations throughout the region to implement these initiatives.

TIMELINES AND MILESTONES

Evaluation should take place through year one of the initiative. Working on certificate programs with Fletcher and Nicholls will likely take another year. Continuously assessing and improving these programs will be critical to their success.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

This initiative could be implemented with minimal additional funding. A more practical approach would be to fund the assessment activities through grant activities connected to BTNEP partners. Conducting a thorough analysis could cost between \$25,000 to \$50,000.

PERFORMANCE MEASURES

Performance measures will vary depending on the program supported events that are approved in the annual workplans.

Possible Data Gathered

The possible data gathered will include programs and reach.

Programs: The primary metric will be the number of programs created.

Reach: The secondary metrics will include the number of students completing the programs and the percentage of them who receive jobs in the industry.

Additional metrics should be developed for each individual program created.

PE-9. Marketing the Barataria-Terrebonne National Estuary Program (EG-4)

Marketing activities for BTNEP should focus on establishing a strong brand around environmental opportunities and the coastal restoration industry.

OBJECTIVES

- To explore opportunities to create a new brand or maximize the existing brand throughout southeast Louisiana
- To create place-based marketing programs that will reinforce the positive messages about the quality of life and economic opportunities in the BTNEP region
- To serve as a connector and promoter of BTNEP related businesses through the support or creation of an exposition that focuses on business, technology, and academic research related to estuaries
- Leveraging the strong environmental brand already associated with BTNEP, future activities should build upon that brand to promote economic and technological opportunities for environmentally sustainable businesses.

DESCRIPTION

Becoming a hub for economically sustainable businesses.

In general, marketing takes a large, sustained investment to make a lasting impact. However, BTNEP has an opportunity to become the flag bearer for environmentally sustainable businesses in its region without a large marketing budget. To accomplish this, BTNEP should:

- maximize its brand exposure. With existing conferences in key areas already underway, BTNEP can gain by partnering with those entities to bring value to the conference through in-kind contributions.
- focus on earned media. Creating and distributing talking points on the quality of life and economic opportunities in the BTNEP region will situate the organization as a thought-leader in the area and should create earned media opportunities.
- use word of mouth. Inherent in this small region in South Louisiana, BTNEP can spread its message to its desired audience by becoming a trusted and valued partner to both business and academic partners.

These activities can be undertaken throughout south Louisiana.

LEAD AGENCY RESPONSIBLE FOR IMPLEMENTATION

BTNEP will collaborate with the respective institutions and economic development organizations throughout the region to implement these initiatives.

TIMELINES AND MILESTONES

An annual marketing strategy should be put in place.

POSSIBLE RANGE OF COSTS AND SOURCES OF FUNDING

Much of this work can be accomplished with very little cost. Although it should be noted that with more resources put into marketing activities, the higher the success rate should be. It is recommended that EDA dollars be spent to further marketing goals. Further,

the State of Louisiana and local tourism commissions occasionally open grant opportunities to fund marketing of tourism assets in their respective areas.

PERFORMANCE MEASURES

The primary metric will be the number of marketing initiatives created.

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Image: Lane Lefort Photography

FINANCE STRATEGY

Current Program Funding, Ongoing Support, The Barataria-Terrebonne Estuary Foundation (BTEF), and Enhanced Finance Strategy

Implementing this revised CCMP will require funding through diverse resources and partners. This includes maintaining funding from current sources of support, developing new funding sources, and identifying new partners.

CURRENT PROGRAM FUNDING

The NEPs, including BTNEP, seek funding to implement core water programs of the EPA. Through Section 320 of the CWA, Congress created the NEP's in order to restore and improve water quality in the "Estuaries of National Significance." As a result, BTNEP seeks to eliminate activities that threaten the estuary's water quality and public water supply, harm shellfish, fish and wildlife, and otherwise would have a negative impact on recreational activities for estuary residents and visitors.

BTNEP is one of 28 National Estuary Programs that receives base program funding from the EPA to implement its CCMP. While EPA funding is one of the primary sources of revenue for its work, BTNEP is required to match the EPA grant one to one. The primary source of matching funds comes from the State of Louisiana; however, many other sources of funding have been obtained by BTNEP. Each year BTNEP reports to EPA its leveraging activities related to cash investments by state, local, and private organizations as well as its in kind match.



BTNEP Management Conference lunch sponsored by BTEF. Image: Lane Lefort Photography

The initial host agency for BTNEP was the LDEQ, where BTNEP was located from 1990 – 2001. In 2001, a Louisiana Senate amendment to House Bill 1 (HB 1) directed LDEQ to transfer the fiscal agency for BTNEP to the LUMCON, effective July 1. All personnel, financial resources, and assets came under LUMCON's management at that time. In accordance with NEP guidance, the fiscal host agent of the program will provide the fiscal and administrative oversight of existing awards and potential awards provided by private, local, state, and federal grant funds. PI-2 Maintain Points of Contact for the State of Louisiana provides the details of how the BTPO interacts with the fiscal agent. The BTNEP MC also adopted operational procedures in 2000 that also identifies the relationships BTNEP and its host agency. Additional information on this can be found in P1- Management Conference. In this Action

Plan, the organizational structure, including the host agency, of the BTNEP MC could be modified, as it deems necessary.

The funding for implementation of the CCMP provides a framework for investing in the health of the Barataria-Terrebonne area. These investments can produce real value through improved environmental quality and enhancements in the region's economy and quality of life. Wise investment in the Barataria-Terrebonne area will ultimately provide more resilient and sustainable returns in property values, water quality, storm protection, recreation and tourism, and other goods and services.

ONGOING SUPPORT

There are two types of costs associated with implementation of the CCMP. The first cost is

associated with maintaining the BTNEP staff. The second type of cost is the expense to implement the Action Plans identified in this CCMP. Members of the BTNEP MC and their organizations also help to fund projects that implement the CCMP. Anticipated costs have been allocated to each Action Plan. These estimated costs are meant to be estimates and are not intended to represent final budgetary allocations. Such final adjustments of cost will necessarily be done during the implementation of an action, when more detailed information about existing level of efforts, available funds, and other design criteria can be more accurately assessed. The accuracy of the anticipated cost estimates contained in the implementation strategies are limited. Regardless, the estimates provide some idea of the level of effort implied in the Action Plan.

The investments needed to support the BTNEP's estuarine research, protection, and restoration efforts do not come from a single program or government agency. Funding is needed across jurisdictions, including federal, state, and local governments in partnership with the private sector, including individuals, corporations, and foundations. Historically, BTNEP has attracted funding and support through strategic partnerships with numerous organizations, and BTNEP has repeatedly shown its ability to leverage the support provided by partners to implement high-value projects and programs. Maintaining and expanding these strategic partnerships will be critical to the ability of BTNEP to provide sustained support for the current budget and for additional growth over the next years.

Federal, state, and local government grants have historically constituted the majority of funding for BTNEP. As part of the NEP, BTNEP receives federal funds from the EPA under Section 320 of the Clean



Louisiana State Capitol: <http://house.louisiana.gov/pubinfo/VirtualTour/Default.htm>



Donors, BTEF, and BTNEP team up to host the annual White Boot Gala fund raiser. Image: BTNEP

Water Act. While these funds account for only a portion of the government revenue used to support program operation and CCMP implementation, these federal funds play a very important role in leveraging additional dollars from other governmental organizations.

Funding from EPA and the State of Louisiana has been received annually since the inception of the program. BTNEP has also received support from several corporate sponsors. BTNEP applies for a number of grants each year to support specific projects, such as marsh restoration, invasive species management, shorebird research, and education programs. Many of these grant opportunities are also associated with government funding sources. BTNEP also received funds from various foundations (Table 6-1).

THE BARATARIA-TERREBONNE ESTUARY FOUNDATION (BTEF) - CURRENT and FUTURE SUPPORT

The mission of the BTEF is to involve a representation of a broad base of people to support BTNEP. This includes supporting the mission of stewardship of



<https://www.supportbtnep.org/>

Table 6-1 List of BTNEP Annual Estimates for Major Funding Sources

Government	
EPA	about \$600,000
State of Louisiana	about \$600,000 (state funding and in-kind)
Federal Grants	\$100,000* (includes in-kind)
State Grants	\$100,000* (includes in-kind)
Foundations	
BTEF	\$20,000* (includes in-kind)
Regional	\$50,000* (includes in-kind)
Community/Family	Partnership projects * (Includes in-kind)
Corporations	
Corporate Grants	\$50,000* (includes in-kind)
Donations/Sponsorships	\$50,000* (includes in-kind)
Other	
Court Penalties	\$100,000* (includes in-kind)
General Donations	\$25,000* (includes in-kind)

** Indicates that these are estimated revenue streams that vary from year to year.*

the cultural, economic, and ecological resources of the BTB. Formed in 1995, the Foundation is also the fundraising organization for the benefit of BTNEP.

The BTEF is a separately incorporated 501(c)3 organization responsible for identifying and nurturing relationships with potential donors and other friends of BTNEP; soliciting cash, securities, and other private resources for the support of BTNEP; and acknowledging and stewarding such gifts in accordance with donor intent and its fiduciary responsibilities.

The BTEF has played a key role in helping BTNEP with facilities and personnel matters as well as providing a fund raising vehicle for the organization. The BTEF renders invaluable support for BTNEP to achieve programmatic goals including but not limited to education, research, public service, and staff needs.

Major gifts from individual donors have not been a significant source of funds for BTEF and present an area for great potential growth. A personalized process of cultivation, solicitation, and recognition will need to be developed in order to build this



Funds are needed to support valuable estuarine research, protection, and restoration efforts. Image: Lane Lefort Photography

revenue category. As a part of the individual donor program, there needs to be a focus on identifying opportunities for BTNEP to acquire donor-advised funds, which represent the fastest growing technique in personal philanthropy.

External Foundations

In recent years, BTEF on behalf of BTNEP has received contributions from several local, regional, and national foundations, but these funds still only represent a small percentage of the overall annual revenue.

External foundations provide BTNEP an opportunity to seek support for specific projects/programs and, when possible, general operations support.

Opportunities exist to identify additional foundations whose funding priorities align with the mission and vision of the BTNEP (Table 6-2).

Corporations

Corporate donations and grants also present an opportunity for future funding growth. BTEF on behalf of BTNEP has historically received support from several corporate sponsors, but the number of contributors and the amount contributed has remained relatively constant over the last several years. There is an opportunity to identify additional corporate partners that would be willing to invest in the mission of BTNEP.

BTEF must carefully cultivate relationships with donors who make their gifts via donor-advised funds. BTEF should also explore the possibility of forming collaborative programs and alliances with other entities with a similar mission, so as to present a more appealing option for donor-advised funding. BTEF must also work to put the proper systems and procedures in place to allow for planned gifts from individuals. A planned gift is any major gift, made in lifetime or at death as part of a donor's overall financial and/or estate planning. Whether a donor uses cash, appreciated securities/stock, real

estate, partnership interests, personal property, life insurance, a retirement plan, etc., the benefits of funding a planned gift can make this type of charitable giving very attractive to both donors and non-profits. Establishing a planned giving program will provide significant revenue opportunities to the BTEF as it develops relationships with donors and supporters. Estate gifts will come to the BTEF when donors have confidence that their estate contribution will provide long-term conservation benefits to the community. That confidence will come through years of relationship building that will be important components of the major donor programs.

In order to guard against even the appearance of impropriety in their activities, the BTEF and BTNEP have documentation that clearly defines their relationship and respective responsibilities and authority. The BTEF continues to help BTNEP with its financial goals.

Developing New Funding Sources with Key Activities and Priorities

The following activities and priorities will be used to pursue new funding sources for BTNEP.

- Sustain and increase funding through the National Estuary Program, including funds from EPA and the State of Louisiana match. An important element of this strategy is continued outreach to federal and state legislators about BTNEP's work, results, and needs.
- Sustain, increase, and diversify funding from major federal, state, gulf coast, and foundation sources to support the projects and programs that implement the CCMP. BTNEP and BTEF have secured support from private foundations, companies, granting agencies, and individuals. BTNEP has tried to increase awareness about our program through a variety of means including:
 - ♦ maintaining active social media sites,
 - ♦ preparing public friendly fact sheets about projects,

- ♦ producing an annual BTNEP report,
 - ♦ hosting volunteer events for various group and
 - ♦ encouraging office and farm visits as well as field visits of policy makers and lead donors.
- Lead or participate in collaborative efforts to develop new and increased funding sources.

ADDITIONAL FUNDING STRATEGY

Historical support from federal, state, and local sources for BTNEP has led to the implementation of actions and projects that have resulted in ecosystem improvements and a more aware and engaged public. However, many of the priority issues identified 20 years ago remain and several new related issues

have arisen. Ongoing investment in the Barataria-Terrebonne area and the upstream watershed is essential to capitalize on yesterday's successes, sustain today's momentum, and lay the groundwork for a healthy future ecosystem. While some of the proposed actions in the CCMP could be accomplished through ongoing support of existing funding sources, the implementation of a broader suite of actions will require BTNEP to leverage both funding and partnerships.

As the BTNEP continues to evolve, it is critical for the organization to increase the diversity of its funding sources in order to support the current budget and account for additional growth over the coming years. BTNEP must build its capacity to address the areas of greatest potential fundraising



Beach cleanup, maintenance, and monitoring is funded through a number of sources. Image: Lane Lefort Photography

PROPOSED ACTIONS TO GARNER RESOURCES

BTNEP will use the following strategies to maintain its current resources and secure additional funding to implement the CCMP.

Ongoing

- Maintain budgets that properly support BTNEP's needs.
- Secure federal funding streams related to water quality improvements.
- Secure federal funding streams related to habitat restoration.
- Maintain emergency funding for possible storm related events.
- Encourage partnerships with other federal and state agencies and related entities.
- Advance public/private partnerships through BTEF that implement the CCMP.
- Maintain the work with BTEF for support of ongoing research projects.
- Increase the use of social media tools to recruit funds for BTNEP.

Short Term (0-1 year)

- Promote the use of EPA State Revolving Loan Funds for large water projects in the estuary.
- Secure EPA GOMP grants for water quality improvements.
- Secure LDEQ 319 water quality grant opportunities.

Medium Term (1-3 years)

- Increase knowledge of finance opportunities.
- Leverage appropriate finance streams.

Long Term (3+ years)

- Increase knowledge of finance opportunities.
- Leverage appropriate finance streams.

growth described above. The continued growth of BTNEP will depend on having the people with the necessary skills, connections, and demographics and implementing the proper cultivation strategies. This will require the active involvement and development of the BTNEP staff, members of the BTEF Board of Directors, existing partners, and volunteers. Below is a list of potential funding sources being considered as potential options for BTNEP's future fund development strategies (Table 6-2).

GOVERNMENT GRANTS & CONTRACTS

Government grants and contracts are currently a large source of funding for the BTNEP, and they will

continue to be important moving forward. BTNEP will continue to work with EPA and the State to ensure that funding for base operations continues. Grant proposals for specific projects/programs will also continue to be an important strategy moving forward and proposals will be directed both at the programmatic activities that are core to the mission of the organization, as well as organizational development activities that ensure growth and capacity-building of the BTNEP (Table 6-2).



Donors often volunteer with BTNEP. Image: BTNEP

BTNEP Financial Strategy

BTNEP works with
state & federal
agencies
on
partnership projects
that bring
additional funding
to the program.



EPA
allows for
matching funds
from state of
Louisiana

Currently, **BTNEP** uses
federal funding
source as the
primary source of income
for its work.



**BARATARIA-
TERREBONNE
ESTUARY
FOUNDATION**

BTEF
continues to help
BTNEP
with its
financial goals.



Image: Delaina LeBlanc, BTNEP

MONITORING PLANS TECHNICAL SUMMARY

Data collection, analysis, and uses

The 2019 revision to the BTNEP CCMP sets goals to restore and maintain the chemical, physical, and biological integrity of the BTES for its people and the people of the nation. BTNEP Action Plans, which are divided up into four categories including Coordinated Planning and Implementation, Ecological Management, Sustained Recognition and Citizen Involvement, and Economic Growth, contain detailed monitoring information.

Measuring the effectiveness of CCMP actions in bringing about environmental change is accomplished with the monitoring of a suite of indicators. This monitoring summary graphically organizes priorities, lead agencies, types of data gathered, timetable for gathering data, methods for sharing data, and other pertinent information.

The monitoring plan summary is provided as a technical supplement of the CCMP, and, as such, focuses on the technical aspects of monitoring data collection, analysis, and uses. Please refer to the CCMP Action Plans for full descriptions of developed management strategies to meet adopted goals and targets and the actions needed to accomplish those strategies.

This plan provides a framework that builds on existing monitoring programs within the BTNEP study area administered by organizations involved in the development and implementation of the CCMP. Actions addressed within the monitoring plans, responsible entities, the data they collect, data gaps, frequency of collecting and reporting the monitoring data, and how the data are shared, reported, and used can be found in complete Action Plans in Chapter 5.



Coordination, collaboration, and long-term support for monitoring are key elements to success of the monitoring plan. BTNEP will continue to work with multiple agencies and partners to obtain, share, and evaluate monitoring data and to communicate findings to the public, decision makers, and stakeholders. During this process, the methods used and data collected and analyzed are checked for current relevance, applicability to emerging needs, and potential changes for protocols as necessitated by improvements in technology.

This monitoring plan summary does not intend to be an integrated monitoring plan that pulls all of

the activities happening in the estuary together. BTNEP is neither in a position nor does it have the financial resources to develop and coordinate such a comprehensive unified plan for the entire estuary. Rather, this monitoring summary plan will help BTNEP and our partners monitor and measure the status and effectiveness of actions to evaluate the success of the CCMP.

The monitoring summary table on the following pages includes the efforts of federal, state, and local government agencies, NGOs, and all partners of BTNEP who are working to collectively implement the CCMP.



Bird researchers evaluate the health of a migratory bird as part of ongoing monitoring. Image: BTNEP

MONITORING SUMMARY TABLE

Category 1 Coordinated Planning and Implementation

PI-1 MANAGEMENT CONFERENCE

Lead Agency	BTNEP MC	Parties Responsible	BTNEP MC
Data Gathered	<ul style="list-style-type: none"> • BTNEP MC meeting agendas and presentations • annual reports to EPA and as required • annual reports to State as directed 		
Timetable for Gathering Data	quarterly, annually, and as requested	How Data is Shared	web

PI-2 PROGRAM OFFICE

Lead Agency	BTNEP MC	Parties Responsible	BTPO
Data Gathered	<ul style="list-style-type: none"> • BTNEP MC meeting agendas and presentations • annual reports to EPA and as required • annual reports to State as directed • annual work plan outputs 		
Timetable for Gathering Data	quarterly, annually, and as requested	How Data is Shared	web

PI-3 POINTS-OF-CONTACT

Lead Agency	BTPO and BTNEP MC	Parties Responsible	BTPO
Data Gathered	<ul style="list-style-type: none"> • BTNEP MC meeting agendas and presentations • annual reports to EPA and as required • annual reports to State as directed 		
Timetable for Gathering Data	quarterly, annually, and as requested	How Data is Shared	web

CP-1 GOVERNMENTAL AFFAIRS AND EDUCATION

Lead Agency	BTPO	Parties Responsible	BTPO
Data Gathered	<ul style="list-style-type: none"> • number of events • number of attendees at events • number of meetings held by the Governmental Affairs Workgroup 		
Timetable for Gathering Data	annually and as requested	How Data is Shared	web

Category 1 Coordinated Planning and Implementation (cont'd)

CP-2 EMERGENCY RESPONSE, RECOVERY, and RESILIENCE

Lead Agency	BTPO	Parties Responsible	BTPO
Data Gathered	<ul style="list-style-type: none"> • summary of activities 		
Timetable for Gathering Data	unknown	How Data is Shared	web
CP-3 COMMUNICATION OF RULES, REGULATIONS, AND GUIDELINES			
Lead Agency	BTNEP MC	Parties Responsible	BTPO
Data Gathered	<ul style="list-style-type: none"> • BTNEP MC meeting agendas • information sharing at any one of the four annual BTNEP MC meetings • quarterly updates on activities to the stakeholders at related BTNEP MC meetings • various reports to EPA about BTPO activities • reports to the State on Performance Indicators as required related to sharing public information about rules, regulations, and guidelines • BTNEP MC meeting presentation • EPA reports as required • annual reports to State as directed 		
Timetable for Gathering Data	quarterly, annually, and as requested	How Data is Shared	web

Category 2 Ecological Management

EM-1 HYDROLOGIC RESTORATION FOR MARSH/SWAMP MANAGEMENT

Lead Agency	CWPPRA and CPRA	Parties Responsible	CWPPRA and CPRA
Data Gathered	<p>Related CRMS sites:</p> <ul style="list-style-type: none"> • accretion data • feldspars • forested swamp vegetation • herbaceous marsh vegetation • hydrograph information • soil properties • surface elevation over time 		
Timetable for Gathering Data	CRMS collects data annually. Project specific data may also be provided as available.	How Data is Shared	agency websites

Category 2 Ecological Management (cont'd)

EM-2 RIVER REINTRODUCTIONS

Lead Agency	CPRA, USACE New Orleans District, LDNR, CWPPRA Task Force, and other Federal Agencies	Parties Responsible	CPRA, CWPPRA, LSU AgCenter, LA Sea Grant, and other state and federal resource agencies including EPA, NOAA/NMFS, USFWS, USDA/NRCS, USGS, LDWF, LDNR, LDEQ, LDH, etc.
Data Gathered	<ul style="list-style-type: none"> • metrics of diversion performance include water levels • sediment accretion/erosion • vegetative response • habitat change • land/water ratios • operational details of the diversion itself • soil quality metrics such as bulk density & organic versus mineral content • socioeconomic effects including changes in commercial fisheries • effects on other living resources such as fish and wildlife • migratory birds, marine mammals, and threatened & endangered species • impacts to navigation/boating access • many aspects of water quality including temperature, salinity, dissolved oxygen, nutrients, suspended sediment, and contaminants 		
Timetable for Gathering Data	Monitoring should include historical, real-time, and long-term data sets collected throughout the project life from planning through operations.	How Data is Shared	Data from the CRMS is shared via interactive website, and the development of the SWAMP promises to expand on data parameters covered by CRMS. Additional parameters should be shared on project-specific websites.

EM-3 FRESHWATER REINTRODUCTION INTO BAYOU LAFOURCHE

Lead Agency	BLFWD, CPRA, USACE, EPA, USFWS, NRCS	Parties Responsible	BLFWD and CPRA
Data Gathered	<ul style="list-style-type: none"> • operational activities • proposed millages • cost estimates for upcoming work 		
Timetable for Gathering Data	monthly reports and as requested	How Data is Shared	web

Category 2 Ecological Management (cont'd)

EM-4 BENEFICIAL USE OF DREDGED MATERIAL AND DEDICATED DREDGING

Lead Agency	OCM, State of Louisiana, CWPPRA Task Force, CPRA, and USACE New Orleans District	Parties Responsible	State of Louisiana, CWPPRA Task Force, CPRA, and USACE New Orleans District
Data Gathered	<ul style="list-style-type: none"> • CWPPRA keeps track of acres created and maintained • list of the millions of cubic yards used • USACE completes BUDMAT reports • list of acres created • State of Louisiana keeps track of acres created or maintained • CPRA's Coastal Reference Monitoring Stations collect water quality and vegetation data on most restoration sites 		
Timetable for Gathering Data	annual report	How Data is Shared	agency websites

EM-5 PRESERVATION AND RESTORATION OF BARRIER ISLANDS

Lead Agency	CWPPRA Task Force, CPRA, State of Louisiana, and USACE, New Orleans District	Parties Responsible	CWPPRA, State of Louisiana, and USACE
Data Gathered	<ul style="list-style-type: none"> • development of a historical bathymetric database with up-to-date 2006 bathymetric analysis that provides a current seafloor change for the shoreline extending from Sandy Point to Raccoon Island and the northern Chandeleur Islands • compilation of videography and photography of the 2005 hurricane impacts • construction of a unified historic shoreline change database for the Louisiana coastal zone • LiDAR • surveys for the sandy shorelines of the coastal zone • BICM monitoring • USACE maintains completed reports on all BUDMAT activities • CWPPRA maintains public reporting to keep track of barrier island restoration projects completed • CWPPRA uses CRMS for gathering water quality and vegetative cover data • State of Louisiana through CPRA keeps track of acres created or maintained 		
Timetable for Gathering Data	annual report	How Data is Shared	agency websites

Category 2 Ecological Management (cont'd)

EM-6 SHORELINE STABILIZATION, INDUCED SEDIMENT DEPOSITION, AND LIVING SHORELINES

Lead Agency	BLFWD, CPRA, USACE, EPA, USFWS, NRCS	Parties Responsible	CPRA, USACE, and CWPPRA
Data Gathered	<ul style="list-style-type: none"> • design plans with project areas • expected benefits • results of geotechnical analyses • construction documents with as-built elevations and volumes of material • monitoring and maintenance reports • inspections to monitor the project and its effects 		
Timetable for Gathering Data	annual reports	How Data is Shared	agency websites

EM-7 FLOOD RISK REDUCTION AND COASTAL RESILIENCY

Lead Agency	USACE New Orleans District, CPRA, and TLCD	Parties Responsible	USACE, State of Louisiana, and TLCD
Data Gathered	<ul style="list-style-type: none"> • All responsible organizations maintain a list of ongoing and planned flood risk reduction projects and corresponding fact sheets. • The State and USACE maintain a list of acres restored/protected for HSDRRS mitigation projects. • TLCD maintains an up-to-date emergency contingency plan for operations of structural flood protection components during storms or flood events. • CWPPRA maintains acres created/restored for coastal restoration projects. 		
Timetable for Gathering Data	Annual Levee Inspection Reports	How Data is Shared	agency websites

EM-8 POLLUTANT IDENTIFICATION AND ASSESSMENT

Lead Agency	See Table EM-8.2	Parties Responsible	See Table EM-8.2
Data Gathered	<ul style="list-style-type: none"> • website links on BTNEP website to agency data websites • website links to GIS apps • refer to Table EM-8.2 		
Timetable for Gathering Data	reporting as required by agencies	How Data is Shared	agency websites and agency contact

Category 2 Ecological Management (cont'd)

EM-9 OIL AND PRODUCED WATER SPILL PREVENTION AND EARLY DETECTION

Lead Agency	LDEQ, USEPA, USCG, DPS/LOSCO, and LDNR/OC	Parties Responsible	LDEQ, NRC, USCG, USEPA, LOSCO, and LDNR
Data Gathered	<ul style="list-style-type: none"> • EM-9 establishes an accessible, comprehensive computerized spill database of petroleum and related fluids spills in the BTES. • Interpretive information from the database will be provided to agency and industry personnel and the public to keep them informed of the magnitude and impacts of oilfield related spills. The usefulness of the database and transfer of information will be evident in increased awareness of the impacts of such spills and eventually increased prevention of such spills in BTES. • Record number and volume of spills which should be reduced along with petroleum-related contaminants in the BTES. 		
Timetable for Gathering Data	A timeline developed jointly by the funding agency and the implementer will provide the basis for the monitor to assess plan implementation. Because of the multiple components, interactions of components, and involvement of many agencies, a more detailed timeline should be developed to track the progress of the development of the plan.	How Data is Shared	appropriate digital media and outreach venues

EM-10 IMPROVEMENT OF WATER QUALITY THROUGH REDUCTION OF SEWAGE POLLUTION

Lead Agency	LDEQ, LDH, LDWF, LDNR, USCG, local government, and SCPDC	Parties Responsible	LDEQ and LDH
Data Gathered	<ul style="list-style-type: none"> • LDEQ collects water samples associated with the Ambient Water Quality Network Program. • LDH maintains sewage system databases, beach monitoring, and molluscan shellfish data. • LDEQ conducts ecoregion surveys. • LDEQ conducts TMDLs Monitoring. 		

Category 2 Ecological Management (cont'd)

EM-10 IMPROVEMENT OF WATER QUALITY THROUGH REDUCTION OF SEWAGE POLLUTION (cont'd)

Data Gathered	<ul style="list-style-type: none"> • LDEQ conducts Special Watershed Project monitoring. • LDEQ conducts incident investigations. • LDEQ conducts compliance sampling projects. 		
Timetable for Gathering Data	daily, weekly, monthly, and five-year rotation	How Data is Shared	LDEQ public website and EPA website

EM-11 IMPROVEMENT OF WATER QUALITY THROUGH THE REDUCTION OF AGRICULTURAL POLLUTION

Lead Agency	LDAF, LDEQ, and USDA-NRCS	Parties Responsible	LDAF, LDEQ, and USDA-NRCS
Data Gathered	<ul style="list-style-type: none"> • types of conservation practices • acres of conservation practices • water quality data • watershed impairments 		
Timetable for Gathering Data	semi-annual, annual, and two-year reports	How Data is Shared	group meetings, agency websites, teleconferences, field days, and training workshops

EM-12 IMPROVEMENT OF WATER QUALITY THROUGH STORMWATER MANAGEMENT

Lead Agency	(See next BTNEP and local parish governments for Stormwater Redirection Projects; BTNEP, local city governments, and local parish governments for Stormwater Infiltration Basin Projects and Urban Stream Restoration Projects; and BTNEP for Urban Green Space page)	Parties Responsible	BTNEP, local parish, and city governments
Data Gathered	Stormwater Redirection Projects: <ul style="list-style-type: none"> • sediment elevation, water quality data, and vegetative cover Infiltration Basin: <ul style="list-style-type: none"> • total volume water retained Urban Stream Restoration: <ul style="list-style-type: none"> • pre- and post-data: water quality data, number of animal species, and number of plant species 		

Category 2 Ecological Management (cont'd)

EM-12 IMPROVEMENT OF WATER QUALITY THROUGH STORMWATER MANAGEMENT (cont'd)

Timetable for Gathering Data	pre- and post-project	How Data is Shared	BTNEP MC meetings, on-line through current online technologies where appropriate
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EM-13 URBAN GREEN SPACES

Lead Agency	BTNEP	Parties Responsible	BTNEP, EPA, individual communities, and LDEQ
Data Gathered	<ul style="list-style-type: none"> • visitor surveys • number of visitors • water quality samples 		
Timetable for Gathering Data	semi-annually and annually	How Data is Shared	educational outreach

EM-14 ASSESSMENT OF HARMFUL ALGAL BLOOMS (HABs)

Lead Agency	LDAF, LDEQ, NRCS, EPA, BTNEP, LDH, LDWF, USDA, FDA, LEEC, LUMCON, LDOE, Louisiana Sea Grant College Program, and EPA/National Environment Programs/Gulf of Mexico Program/Gulf of Mexico Alliance-Private	Parties Responsible	central host of materials and web page
Data Gathered	<p>Identify:</p> <ul style="list-style-type: none"> • taxonomic and toxin experts • number of experts engaged in an advisory capacity in the panel of experts • number of web pages developed and of times updated • number of fliers, brochures, and informational advisory outputs developed • number of community submissions/reports of potential HAB events <p>Employ:</p> <ul style="list-style-type: none"> • spatial analysis system • mapping reports of HABs, NOAA – National Estuarine Eutrophication Assessment • reporting events to the national HAB reporting system (LUMCON) 		
Timetable for Gathering Data	annual data summary	How Data is Shared	web page and public communications

Category 2 Ecological Management (cont'd)

EM-15 PROTECTION OF NATIVE PLANTS AND ANIMALS

Lead Agency	LDWF, LDNR, CPRA, LDAF, USDA, NRCS, USFWS, USGS, and NOAA's NMFS	Parties Responsible	BTNEP
Data Gathered	<ul style="list-style-type: none"> • existing datasets • CRMS vegetative surveys • agency lists of acres/square feet of pollinator habitat restored • specific assessments for T&E species 		
Timetable for Gathering Data	timelines vary	How Data is Shared	agency web sites, annual reports, and specific requests

EM-16 REDUCTION OF IMPACTS FROM INVASIVE SPECIES

Lead Agency	BTNEP	Parties Responsible	BTNEP and BTNEP MC
Data Gathered	<ul style="list-style-type: none"> • surveys to identify animal and plant species under various scopes of work that can be used to identify invasive species presence/absence 		
Timetable for Gathering Data	annual and special reports from state and federal agencies	How Data is Shared	quarterly report activity at BTNEP MC meetings, document meetings and activities of the ISAPT, and regularly report to EPA

EM-17 IMPROVEMENT OF WATER QUALITY THROUGH REDUCTION OF INSHORE AND MARINE DEBRIS

Lead Agency	BTPO with BTNEP MC, EPA, GOMP, Louisiana Sea Grant, LDWF, LDEQ, NOAA, KLB, KAB, LSU, and BTEF	Parties Responsible	BTNEP staff and its partners
Data Gathered	<ul style="list-style-type: none"> • document marine debris collected • document meetings and activities of the BTNEP staff • report regularly to BTMC and appropriate partners 		
Timetable for Gathering Data	as required by funding source entities	How Data is Shared	BTNEP website and/or partner websites

Category 2 Ecological Management (cont'd)

EM-18 PROTECTION OF DRINKING WATER SOURCES

Lead Agency	LDH, LDEQ, LDNR, USDA/NRCS, LDAF, local water districts and water providers, BTNEP MC, local citizens, and water advisories	Parties Responsible	LDEQ, LDH, local water districts, USDA NRCS, LDAF, BTNEP staff, and BTNEP MC
Data Gathered	<ul style="list-style-type: none"> • locations of wells • locations and sources of drinking water as a database • delineation of water protection areas • SPSOC locations including information that is associated with possible concerns • sewage survey data and associated GIS layers on maps • ambient water monitor • water intakes • groundwater wells • DNR layer • infrastructure for the water system as GIS layers • drinking water watch data • water systems CCR from individual water works • pump station data • treatment plant reports • results from Lower Mississippi River Waterworks Warning Network • local water districts' drinking water reports, consumer confidence reports, and local water district commission reports • mixing station reports • Farm/Nutrient and Management Plans • current BMPs • reports on opportunities to provide support to improvements of clean drinking water, water professionals, and water infrastructure ing data • aquifer water monitoring data 		
Timetable for Gathering Data	A time line for reporting data gathered is developed by the funding agency, and the implementer and will provide the basis for the monitor to assess plan implementation.	How Data is Shared	online at the various agencies and print materials distributed to the public

Category 3 Sustained Recognition & Citizen Involvement

SR-1 COMMUNITY ENGAGEMENT

Lead Agency	BTNEP staff	Parties Responsible	BTNEP MC and BTNEP staff
Data Gathered	<ul style="list-style-type: none"> • number of unique volunteers • number of volunteer hours recorded per year • number of volunteer events per year, per region of the BTES • number of waypoints identified and mapped 		
Timetable for Gathering Data	regularly for EPA and quarterly for BTNEP MC	How Data is Shared	media reports and BTNEP MC quarterly meetings

SR-2 CIVIC ENGAGEMENT

Lead Agency	BTPO and BTNEP MC	Parties Responsible	BTPO
Data Gathered	<ul style="list-style-type: none"> • most effective format for conveying the message of the BTES • number of materials given out at different events/locations • number of hits on specific web sites or social media posts 		
Timetable for Gathering Data	ongoing	How Data is Shared	quarterly social media report to BTNEP MC, track dissemination of materials, and quarterly Speakers Bureau report to BTNEP MC

SR-3 MEDIA ENGAGEMENT

Lead Agency	BTNEP staff	Parties Responsible	BTNEP MC, BTNEP staff, and paid monitoring services
Data Gathered	<ul style="list-style-type: none"> • number of requests for interviews and information from news organizations • level of awareness and interest in BTNEP, its mission, and projects by local and national media • analytics from website and social media sites, number of inquiries, views, etc. 		
Timetable for Gathering Data	regularly for EPA, quarterly for BTNEP MC, and as events occur or projects progress	How Data is Shared	media reports, BTNEP MC quarterly meetings, and electronically

Category 3 Sustained Recognition & Citizen Involvement (cont'd)

SR-4 PUBLIC ENGAGEMENT

Lead Agency	BTNEP MC, BTPO, EPA, and consultants	Parties Responsible	BTNEP MC, BTNEP staff, and partners
Data Gathered	<ul style="list-style-type: none"> • number of materials given out at different events/locations • most effective format for conveying the message of the BTES • analytics on specific web sites or social media posts 		
Timetable for Gathering Data	regularly for EPA and quarterly for BTNEP MC	How Data is Shared	media reports and BTNEP MC quarterly meetings

SR-5 ESTUARINE CURRICULUM DEVELOPMENT

Lead Agency	BTNEP Education APT	Parties Responsible	BTNEP Education APT and BTNEP MC
Data Gathered	<ul style="list-style-type: none"> • quarterly report curriculum activity • document meetings and activities of the Education APT • document inventory of existing materials and its presentation to the BTNEP MC • regularly report to EPA 		
Timetable for Gathering Data	annually BTNEP Education APT and quarterly BTNEP MC	How Data is Shared	web

SR-6 CONTINUING EDUCATION PROGRAMS & INFORMAL EDUCATION PROGRAMS

Lead Agency	BTNEP Education APT and BTNEP MC	Parties Responsible	BTNEP MC and Education APT
Data Gathered	<ul style="list-style-type: none"> • document meetings and activities of the Education APT • quarterly report activities to the BTNEP MC • regularly report to EPA 		
Timetable for Gathering Data	quarterly to BTPO and BTEF	How Data is Shared	public meeting

Category 3 Sustained Recognition & Citizen Involvement (cont'd)

SR-7 FINANCIAL SUPPORT FOR EDUCATIONAL INITIATIVE

Lead Agency	BTEF, BTPO, BTNEP MC, and stakeholders	Parties Responsible	BTEF, BTPO, and BTNEP MC
Data Gathered	<ul style="list-style-type: none"> • BTEF quarterly report • quarterly reporting of activities to the BTNEP MC 		
Timetable for Gathering Data	quarterly to BTPO and BTEF	How Data is Shared	public meeting

SR-8 CULTURAL HERITAGE AND LIFEWAYS

Lead Agency	BTNEP MC and BTPO	Parties Responsible	BTNEP MC and BTPO
Data Gathered	<ul style="list-style-type: none"> • quarterly report activities to the BTNEP MC • document meetings and activities related to Cultural Heritage in the BTES • regularly report to EPA 		
Timetable for Gathering Data	quarterly BTNEP MC	How Data is Shared	web and social media

Category 4 Economic Growth

EG-1, EG-4 (PE-1) PLACE-BASED BENEFITS OF THE BARATARIA-TERREBONNE ESTUARY SYSTEM

Lead Agency	BTNEP, Lafourche Convention and Visitors Bureau, LDCRT, and Louisiana Travel Promotion Association	Parties Responsible	BTNEP
Data Gathered	<ul style="list-style-type: none"> • digital materials 		
Timetable for Gathering Data	pre- and post-surveys and annual reports	How Data is Shared	presentations, conversations, online, and archives

Category 4 Economic Growth (cont'd)

EG-1, EG-2 (PE-2) SCIENTIFIC LITERACY ON WATER

Lead Agency	BTNEP, Research Park Corporation/NexusLA, and Good Work Network	Parties Responsible	BTNEP and collaborative teams
Data Gathered	<ul style="list-style-type: none"> • digital recordings 		
Timetable for Gathering Data	pre- and post-surveys and annual reports	How Data is Shared	presentations, conversations, online, and archives

EG-1, EG-2, EG-4 (PE-3) SEAFOOD PROMOTION, TECHNOLOGY, AND MARKETING

Lead Agency	BTNEP	Parties Responsible	BTNEP, BTNEP MC, and collaborative partners
Data Gathered	<ul style="list-style-type: none"> • presentations • curricula developed 		
Timetable for Gathering Data	annual reports	How Data is Shared	presentations, conversations, online, and archives

EG-2, EG-3 (PE-4) DEVELOPMENT AT PORT FOURCHON

Lead Agency	GLPC, BTNEP MC, BTNEP, BTEF, WIG, NSU, LSU, Environmental NGOs and non-profits, CPRA, the energy industry, and media	Parties Responsible	GLPC, BTNEP, and other agency and NGO partners
Data Gathered	<ul style="list-style-type: none"> • acres of property developed and restored in the region • the number of volunteer events and hours • hours of staff time spent on outreach and technical assistance • media coverage and exposure • the number of outreach events and contacts generated 		
Timetable for Gathering Data	commencing in Fall 2017 with commencement of Slip D mitigation development	How Data is Shared	email, reporting tools (to be developed), social media, media, etc.

Category 4 Economic Growth (cont'd)

EG-1, EG-2, EG-4 (PE-5) CLIMATE CHANGE AS AN ECONOMIC DRIVER

Lead Agency	BTNEP	Parties Responsible	BTNEP, BTNEP MC, and collaborative partners
Data Gathered	<ul style="list-style-type: none"> • presentations • curricula developed 		
Timetable for Gathering Data	annual reports	How Data is Shared	presentations, conversations, online, and archives

EG-1, EG-2, EG-3, EG-4 (PE-6) BUSINESS FINANCIAL ASSISTANCE

Lead Agency	collaborative partners	Parties Responsible	SBDC, SCPDC, SLEC, TED, and TEDA
Data Gathered	<ul style="list-style-type: none"> • information on BTES and resource-based businesses 		
Timetable for Gathering Data	annually	How Data is Shared	web, BTNEP MC, and BTNEP's communication network

EG-1, EG-2, EG-3, EG-4 (PE-7) LIAISON ROLES OF BTNEP

Lead Agency	BTNEP, BTNEP MC, partners	Parties Responsible	BTNEP, BTNEP MC, partners
Data Gathered	<ul style="list-style-type: none"> • types and location of eco-tourism based business operations • best practices for eco-based operations • information specific to a pending problem of issue 		
Timetable for Gathering Data	continual	How Data is Shared	web and communication network

EG-1, EG-2, EG-3 (PE-8) BUSINESS EDUCATION AND TRAINING

Lead Agency	BTNEP and collaborative partners	Parties Responsible	BTNEP and collaborative partners
Data Gathered	<ul style="list-style-type: none"> • number of programs created • number of students completing the programs • percentage of students who receive jobs in the industry 		
Timetable for Gathering Data	continual	How Data is Shared	web and communication network

Category 4 Economic Growth (cont'd)

EG-4 (PE-9) MARKETING THE BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM

Lead Agency	BTNEP	Parties Responsible	BTNEP
Data Gathered	<ul style="list-style-type: none"> • number of marketing initiatives created 		
Timetable for Gathering Data	continual	How Data is Shared	web and communication network



BTNEP supports conservation efforts that monitor migratory birds such as the Red Knot. Image: Erik I. Johnson

DATA GAPS MONITORING TABLE

Below is a summary of the identified possible data gaps. It should be noted that at the time of this writing \$150,000 is needed to create an interactive map that would share data with public and scientific community. This is a much needed resource. An estimated \$15,000 would be needed annually to maintain the aforementioned database and continue to make it useful.

ACTION PLAN #	ACTION PLAN TITLE	POSSIBLE GAP
CATEGORY 1 - COORDINATED PLANNING & IMPLEMENTATION		
PI-1	Barataria Terrebonne Management Conference	The BTPO and/or the BTNEP MC will regularly evaluate data to determine any possible data gaps.
PI-2	Barataria Terrebonne Program Office	The BTPO and/or the BTNEP MC will regularly evaluate data to determine any possible data gaps.
PI-3	Maintain Points of Contact for the State of Louisiana	The BTPO and/or the BTNEP MC will regularly evaluate data to determine any possible data gaps.
CP-1	Governmental Affairs and Education	None identified at this time.
CP-2	Emergency Response, Recovery, and Resiliency	None identified at this time.
CP-3	Communication of Rules, Regulations and Guidelines	The BTPO and/or the BTNEP MC will regularly evaluate data to determine any possible data gaps.
CATEGORY 2 - ECOLOGICAL MANAGEMENT		
EM-1	Hydrologic Restoration and Management	None identified at this time.
EM-2	River Reintroductions	Monitoring should include historical, real-time and long term data sets collected throughout the life of the projects from planning through implementation.
EM-3	Freshwater Reintroduction into Bayou Lafourche	BLFWD meets regularly to evaluate data to determine any possible data gaps.
EM-4	Beneficial Use of Dredged Material and Dedicated Dredging	None identified at this time.
EM-5	Preservation and Restoration of Barrier Islands	None identified at this time.

DATA GAPS MONITORING TABLE (cont'd)

ACTION PLAN #	ACTION PLAN TITLE	POSSIBLE GAP
CATEGORY 2 - ECOLOGICAL MANAGEMENT (cont'd)		
EM-6	Shoreline Stabilization, Induced Sediment Deposition, and Living Shorelines	None identified at this time.
EM-7	Flood Risk Reduction and Coastal Resiliency	None identified at this time.
EM-8	Pollution Identification and Assessment	Sediment contaminant data is likely to be unavailable or dated due to lack of routine sediment monitoring. Data may be of limited value due to its age. Additional sampling or the creation of a quick response team from interested agencies may be needed.
EM-9	Oil and Produced Water Spill Prevention and Early Detection	Difficulty in detecting produced water spills during produced water disposal injection operations makes it nearly impossible to capture these events. The produced water spills have no telltale signs like oil spill sheens unless the produced water contains sufficient residual oil to create a sheen.
EM-10	Improvement of Water Quality through Reduction of Sewage Pollution	Whenever monitoring is not taking place data gaps exist.
EM-11	Reduction of Agricultural Pollution	Critical acres within impaired watershed need additional monitoring.
EM-12	Improvement of Water Quality through Stormwater Management	Data on how various vegetative communities respond and adapt is needed.
EM-13	Urban Green Spaces	It is not known if the collection of quantitative water quality data 12 months after the completion of such a project will show the intended improvements. A longer time period may be required.
EM-14	Assessment of Harmful Algal Blooms	Basic data on current occurrence and abundance of HAB species within BTES, environmental factors controlling toxicity of HAB species known to occur within BTES, predictions of possible future threat from HABs under increasing water temperature, increasing nutrient concentrations, and alterations to salinity with restoration actions.

DATA GAPS MONITORING TABLE (cont'd)

ACTION PLAN #	ACTION PLAN TITLE	POSSIBLE GAP
CATEGORY 2 - ECOLOGICAL MANAGEMENT (cont'd)		
EM-15	Protection and Enhancement of Native Biological Resources	See the LDWF Wildlife Action Plan and species recovery plans developed by USFWS and NOAA.
EM-16	Reduction of Impacts from Invasive Species	BTNEP relies on federal and state resource agencies to supply data to inform project development. Creation of a database to monitor and report effectiveness of eradication efforts in the BTES is needed.
EM-17	Improvement of Water Quality through the Reduction of Inshore and Marine Debris	BTNEP relies on federal and state resource agencies to supply data to inform project development. Creation of a database to monitor and report effectiveness of eradication efforts in the BTES is needed.
EM-18	Protection of Drinking Water Sources	It should be noted that data provide a snapshot of time with regards to drinking water. Additional surveys are needed to update the source water assessment for potential source survey.
CATEGORY 3 - SUSTAINED RECOGNITION & CITIZEN INVOLVEMENT		
SR-1	Community Engagement	None identified at this time.
SR-2	Civic Engagement	None identified at this time.
SR-3	Media Engagement	Rapidly changing technology demands continued research and funding in this area.
SR-4	Public Engagement	Rapidly changing technology demands require continued research and funding in this area.
SR-5	Estuarine Curriculum Development	The BTNEP Education APT and the BTNEP MC will determine possible data gaps.
SR-6	Continuing Education Programs and Informal Education Programs	The BTNEP Education APT and the BTNEP MC will determine possible data gaps
SR-7	Financial Support for Educational Initiatives	None identified at this time.
SR-8	Cultural Heritage and Lifeways	BTNEP MC will determine possible data gaps throughout implementation.

DATA GAPS MONITORING TABLE (cont'd)

ACTION PLAN #	ACTION PLAN TITLE	POSSIBLE GAP
CATEGORY 4 - ECONOMIC GROWTH		
EG-1	Economic Education	Data on individuals and segments of the community not reached is needed. Additional information on performance of other projects in the region is needed to develop future projects.
EG-2	Technology (R&D) and Marketing Development	Data on individuals and segments of the community not reached is needed. Additional information on performance of other projects in the region is needed to develop future projects.
EG-3	Business Assistance	Data on individuals and segments of the community not reached is needed. Additional information on performance of other projects in the region is needed to develop future projects.
EG-4	Marketing Sustainable Products and Practices	Data on individuals and segments of the community not reached is needed. Additional information on performance of other projects in the region is needed to develop future projects.

EPA Required Indicator Reports and Other Special Reports

EPA requires each NEP to create “Indicator Reports” that summarize the conditions in the estuary over time. BTNEP has created public reports over the history of the program that include 34 indicators based on 10 focus questions. These focus questions and indicators have been fully evaluated, researched, and accepted as important to the local community. Despite the difficulties and risks in reporting on any suite of indicators, BTNEP feels it is important to periodically check and report on these vital signs – and to use this information carefully and in the appropriate context to try to understand trends in key local environmental indicators. The indicator report idea is designed to help the general populace

and EPA to better understand how activities in the estuary directly influences the vitality of the regional economy, culture, and way of life. Should the BTNEP MC and/or stakeholders decide that a change is needed in identifying data gaps or needs, a committee will be formed to discuss how to better gather and/or report the dynamic statistics.

In the past, a series of ten focus questions that residents of the BTES commonly have posed to the BTNEP partnership has been used to organize the environmental indicators presented in these report. The indicators under each focus question represent some of the BTES’ vital signs. The topics tell us how the estuary is doing and establish an associational link to how the BTNEP partnership’s restoration efforts are working.

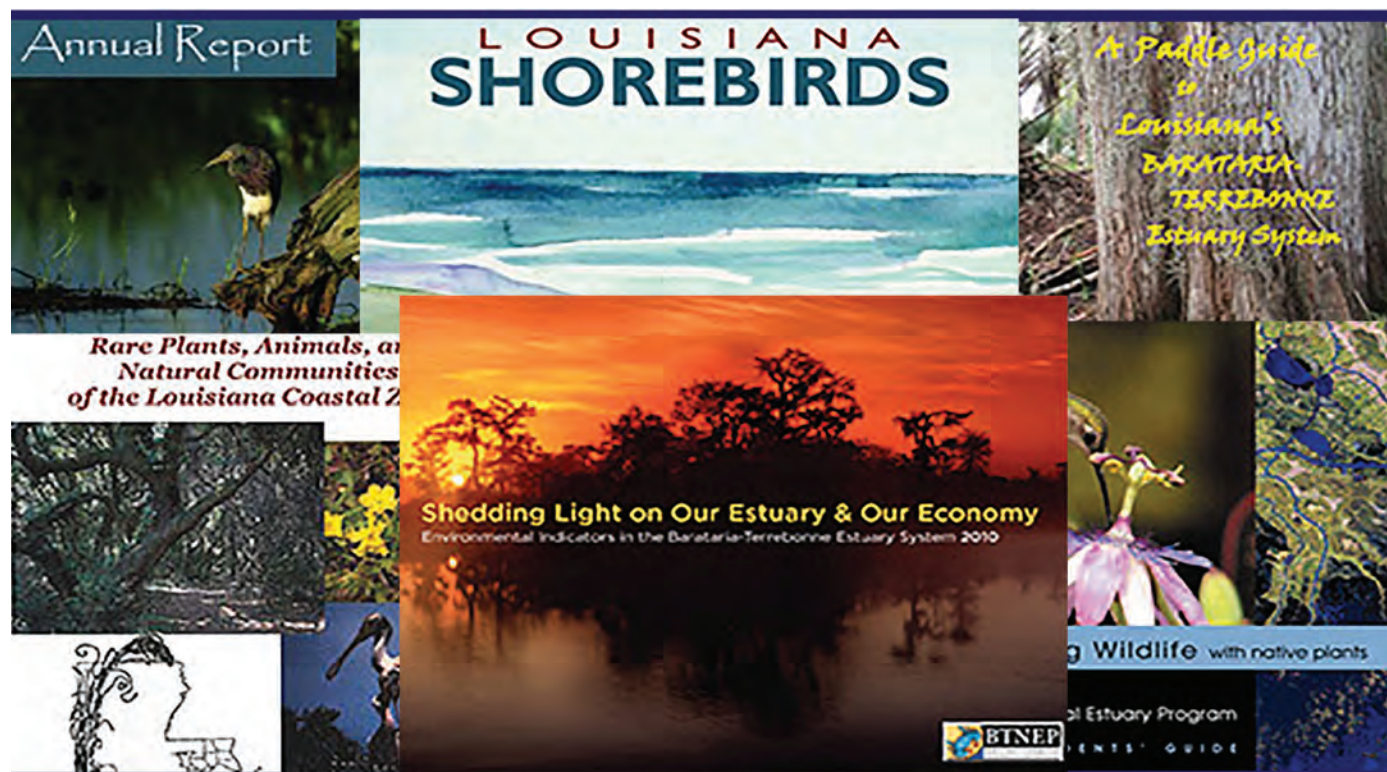
In 2010 BTNEP published “Shedding Light on Our Estuary and Our Economy” which was a compendium of indicators about the estuary system using the aforementioned process. It is important to periodically check and report on vital signs in the estuary. With EPA’s support of this effort to monitor the watershed conditions, BTNEP plans to continue to track and report to the stakeholders information about the environmental health of the BTES.

With the support of EPA, BTNEP plans to continue to provide this report both to our funding sources and the stakeholders on a regular basis of approximately every 10 years.

BTNEP has also created a host of special reports and documents for the public. These special reports such as the “Residents’ Guides” series that provide information on diverse topics such as improving water quality, managing invasive species, coastal restoration, and attracting wildlife with native plants are frequently produced and distributed by BTNEP.

Documents that cover the value of diverse habitats for migratory birds and the vanishing cheniere wood habitats provide the public with ongoing information about the value of this national estuary. BTNEP plans to continue to create similar documents. BTNEP ties these special publications to EPA annual workplan projects. Historically, BTNEP has provided the public with access to both print and digital copies. Traditionally BTNEP also creates over 15,000 printed tidal graph calendars that cover topics as diverse as the value of oysters to coastal protection and restoration techniques. These calendars are also made available on the BTNEP website as resource documents for the public.

BTNEP also creates annual reports that document project successes, partner activities, and general funding information to keep the public apprised of value of the program. BTNEP feels these special reports remain a valuable tool for sustained recognition of the program and citizen involvement.



A selection of covers from some of the many reports published by BTNEP.



Image: Keri Turner

HABITAT PROTECTION AND RESTORATION STRATEGY SUMMARY

Outline of goals, directions, and
projects

BTNEP has worked for more than 25 years with federal, state, and local government organizations, business leaders, environmental organizations, and various local stakeholder communities to identify and prioritize the problems in our estuary. This redeveloped CCMP contains specific actions that address the whole range of environmental problems facing the estuary, including habitat loss and degradation. Many of the issues in the estuary are directly related to land loss and climate change vulnerability. Each of the Action Plans related to the BTNEP priority problems is addressed earlier in this document. It should be noted that the BTES is changing not on a geologic time scale but right before the people who call this land home; the changes are occurring in human lifetimes. This fastest disappearing landmass on Earth requires extreme measures for restoration. The restoration and protection actions reflect an ongoing adaptation to subsidence, rapid land loss, and climate change vulnerability.

The restoration *strategy* outlines the overall goals for the restoration program and defines the major directions in which a program should proceed to meet these goals. Because ecosystem restoration projects can be very expensive to plan and implement in coastal Louisiana, and our EPA resources are currently limited, and project success is uncertain, substantial pressure exists to select projects that have the highest probability of meeting performance expectations. Details of these plans can be



found in the Action Plans of Chapter 5. Louisiana's coastal restoration projects typically cost tens of millions to hundreds of millions of dollars - well beyond BTNEP's budget capabilities. BTNEP must, therefore, rely on other partner entities to help to implement the CCMP habitat protection and restoration blueprint. The primary goal of land restoration in the estuary is to respond to the land loss by identifying a long-term blueprint of project construction, operations, maintenance, and adaptive management using science-based techniques and consensus-driven decision making. The major direction includes a multiple, pronged approach targeted at the varying habitat types and using the finest existing methods. The BTNEP MC members and their related organizations understand the fiscal commitment it takes for restoration and continue to engage in this ongoing effort to protect and preserve this unique ecosystem.

A wide range of habitat restoration efforts are occurring within the estuary. The level of involvement of the BTNEP MC members and BTNEP staff varies greatly, but the mission of implementation of the CCMP is a driving force in the estuary.

PRIORITY HABITATS AND KEY SPECIES FOR PROTECTION AND RESTORATION EFFORTS

The BTB provides habitat for a multitude of invertebrates, birds, finfish, shellfish, reptiles, amphibians, and mammals with all contributing to the living fabric of the BTB. It is estimated that the BTE's ecosystems provide habitat for approximately 735 species of native birds, finfish, shellfish, reptiles, amphibians, and mammals.

Key species of interest in the BTES have been fully identified in Action Plan EM-15 Protection

and Enhancement of Native Biological Resources. Discussion of plants and animals in EM-15 are separated into six categories to describe the BTB living resources which are of greatest interest. These include: (1) Plants, (2) Pollinators, (3) Fish and Shellfish, (4) Birds, (5) Wildlife, and (6) Threatened and Endangered Species.

The goals and/or objectives identified in EM-15 include the following.

- **Plants** - To support conservation efforts for ecological succession patterns of plant diversity from up-basin to down-basin within each of the habitat zones of the BTB delta ecosystem
- **Pollinators** - To build a framework that encourages landowners to manage their land in a way that maximizes its suitability as habitat for pollinators
- **Fish and Shellfish** - To support conservation efforts to maintain the diverse recreational and commercial invertebrate and vertebrate species harvested for pleasure and profit
- **Birds** - To support conservation measures that maximize available natural habitats that maintain healthy populations of migratory and resident birds across the BTB system
- **Wildlife** - To support conservation efforts to maintain the diverse amphibian, reptile, and mammal populations
- **Threatened and Endangered Species** - To support recovery and conservation

Full descriptions of the BTES priority habitats can be found in Chapter 2. See EM-15 Protection and Enhancement of Native Biological Resources for additional information about species. The Species



Bottomland hardwood forests are in the northernmost region of the estuary. Image: USFWS

of Concern identified in the subsequent pages are the LDWFs currently identified key species for protection and restoration efforts. In EM-16, the Reduction of Impacts from Invasive Species is fully investigated. The summary in the following pages helps readers understand the vast need for ongoing habitat restoration across the landscape.

Bottomland Hardwood Forests

Bottomland Hardwood Forests are forested, alluvial wetlands occupying broad floodplain areas that flank large river systems. These forested areas occasionally flood but are usually dry.

Key Plants Species include overcup oak, water hickory, sugarberry, swamp dogwood, privet, water elm, water oak, sweet gum, box elder, and winged elm, hawthorns, red mulberry, pecan, hackberry, honey locust, and elderberry.

Key Animal Species include a broad range of animals such as frogs, turtles, ducks, black bears, alligators, muskrats, mink, otters, egrets, herons, and hawks. These forests are also important for migratory songbirds including summer tanagers, red-eyed vireos, and great-crowned flycatchers.

Animal Species of Concern for Protection (as defined by LDWF)

AMPHIBIANS: southern dusky salamander, Louisiana slimy salamander, Strecker's chorus frog, eastern spadefoot, and southern crawfish frog

BIRDS: yellow-crowned night-heron, wood stork, swallow-tailed kite, bald eagle, American woodcock, yellow-billed cuckoo, wood thrush, yellow-throated vireo, northern parula, prothonotary warbler, Swainson's warbler, Louisiana waterthrush, Kentucky warbler, hooded warbler, field sparrow,

rusty blackbird, and orchard oriole

BUTTERFLIES: Celia's roadside skipper, falcate orangetip, 'Seminole' Texan crescent,

MAMMALS: southeastern shrew, southeastern myotis, Louisiana black bear, long-tailed weasel, and eastern spotted skunk

REPTILES: alligator snapping turtle, western worm snake, common rainbow snake, and timber rattlesnake

Detrimental Invasive Plant Species: Chinese tallow, camphor tree, chinaberry, privet, cat claw vine, air potato, Japanese honeysuckle, kudzu, Johnson grass, cogon grass, giant reed, Japanese climbing fern, and torpedo grass

Detrimental Invasive Animal Species: feral hogs, nutria, apple snails, emerald ash borer, Asian tiger mosquito, red imported fire ant, tawny crazy ant, Cuban tree frog, brown anole, and Formosan termite

Swamps

Swamps are densely stocked, often-flooded forested wetlands that develop in broad, shallow, braided drains or along margins of creeks. Trees and shrubs have evolved to tolerate prolonged flooding in swamps.

Key Plants Species include bald cypress and moss-draped water tupelo. The other dominate species include swamp red maple, black willow, pumpkin ash, green ash, water locust, and buttonbush.

Key Animal Species include most notably alligators, crawfish, bullfrog, and choupique. Swamps are also an ideal nesting habitat to herons, ibises, and egrets.

Animal Species of Concern for Protection (as defined by LDWF)

AMPHIBIANS: southern dusky salamander and Gulf Coast mud salamander



The alligator snapping turtle is largest freshwater turtle species in North America. Image: USFWS



Otters live on land and prefer to be near bodies of water with good water quality. Image: USFWS

BIRDS: American woodcock, yellow-billed cuckoo, wood thrush, yellow-throated vireo, northern parula, prothonotary warbler, Swainson's warbler, Kentucky warbler, hooded warbler, painted bunting, rusty blackbird, and orchard oriole

BUTTERFLIES: pepper and salt skipper and falcate orangetip harvester

MAMMALS: southeastern shrew and southeastern myotis

Detrimental Invasive Plant Species: Chinese tallow, camphor tree, chinaberry, privet, cat claw vine, air potato, Japanese honeysuckle, kudzu, Johnson grass, cogon grass, giant reed, Japanese climbing fern, torpedo grass, water hyacinth, common and giant salvinia, hydrilla, myriophyllum (parrot feather), alligator weed, Cuban sedge, wild taro, purple loosestrife, and Brazilian peppertree

Detrimental Invasive Animal Species: feral hog, nutria, apple snail, emerald ash borer, Asian tiger mosquito, red imported fire ant, tawny crazy ant, Formosan termite, Cuban tree frog, brown anole,

Asian clam, zebra mussel, snakehead, Rio Grande cichlid, Asian carp, Asian swamp eel, and tilapia

Freshwater Marsh

Freshwater Marsh is normally located adjacent to intermediate marsh along the northern most extent of the estuary's coastal marshes. As its name implies, it generally has salinities less than three ppt. This habitat supports the greatest plant diversity of all marsh habitats.

Key Plant Species include maidencane, spikeseed, bulltongue, alligatorweed, giant cutgrass, pickerelweed, pennywort, cattail, southern wildrice, coontail, common duckweed, waterlilies, irises, and bullwhip.

Key Animal Species include a wide range of animals such as frogs, turtles, ducks, muskrats, mink, otters, egrets, herons, and hawks.

Animal Species of Concern for Protection (as defined by LDWF)



The reddish egret is one of the rarest egrets in North America. Image: USFWS

BIRDS: American bittern, yellow-crowned night-heron, wood stork, mottled duck, northern pintail, canvasback, redhead, lesser scaup, bald eagle, northern harrier, yellow rail, black rail, clapper rail, king rail, sandhill crane, whooping crane, marbled godwit, dunlin, short-billed dowitcher, gull-billed tern, Caspian tern common tern, Forster's tern, short-eared owl, sedge wren, loggerhead shrike, and Nelson's sharp-tailed sparrow

BUTTERFLIES: Neamathla skipper, dion skipper, and great southern white

REPTILES: alligator snapping turtle

Detrimental Invasive Plant Species: Johnson grass, cogon grass, giant reed, Japanese climbing fern, torpedo grass, water hyacinth, common and giant salvinia, hydrilla, myriophyllum (parrot feather), alligator weed, Cuban sedge, wild taro, purple loosestrife, and Brazilian peppertree

Detrimental Invasive Animal Species: feral hog, nutria, apple snail, Asian tiger mosquito, Asian clam, zebra mussel, snakehead, Rio Grande cichlid, Asian carp, Asian swamp eel, and tilapia

A significant portion of freshwater marsh in the estuary is floating marsh locally known as "flotant." Flotant marsh is marsh which is buoyant during certain times of the year. Wildlife use the flotants frequently because they provide a "dry land" refuge in regions where flooding is frequent.

Intermediate Marsh

Intermediate Marsh is a unique habitat zone characteristic of delta regions that are influenced by freshwater and slight oceanic processes that produce a mixture of plants that can tolerate some osmotic tolerance to salinity. The salinity ranges of 3 to 10 ppt.

Key Plants Species include the two dominant plants that can tolerate salinity in the region which are wiregrass and widgeongrass alongside freshwater species such as cattails, bulltongue, giant bulrush, common threesquare, deer pea, switch grass, Walter's millet, alligator weed, and southern naiad.

Key Animal Species include waterfowl, wading birds, marsh hawks, and fur bearers, and nursery habitat for brown shrimp, blue crab, gulf menhaden,

and a variety of other commercially and recreationally valuable fishery resources.

Animal Species of Concern for Protection (as defined by LDWF)

BIRDS: brown pelican, American bittern, reddish egret, yellow-crowned night-heron, mottled duck, northern pintail, canvasback, redhead lesser scaup, bald eagle, northern harrier, black rail, clapper rail, king rail, sandhill crane, whooping crane, marbled godwit, dunlin, short-billed dowitcher, gull-billed tern, Caspian tern, common tern, Forster's tern, short-eared owl, sedge wren, and loggerhead shrike

BUTTERFLIES: Neamathla skipper, dion skipper, obscure skipper, great southern white, and western pygmy-blue

Detrimental Invasive Plant Species: giant reed, Japanese climbing fern, torpedo grass, water hyacinth, common and giant salvinia, hydrilla, myriophyllum (parrot feather), alligator weed, Cuban sedge, wild taro, purple loosestrife, and Brazilian peppertree

Detrimental Invasive Animal Species: feral hog,

nutria, apple snail, Asian tiger mosquito, snakehead, Rio Grande cichlid, Asian carp, Asian swamp eel, and tilapia

Brackish Marsh

Brackish Marsh is usually found between salt marsh and intermediate marsh although it may occasionally lie adjacent to the Gulf of Mexico. Salinity averages about eight ppt.

Key Plant Species include mostly wiregrass that thrive in this habitat; other species in this habitat are Onley bulrush, leafy threesquare, and widgeongrass.

Key Animal Species include oysters, speckled trout, redfish, muskrats, raccoons, mink, otters, and other mammals. Brackish marsh is also of very high value to estuarine larval forms of marine organisms such as shrimp, blue crab, and menhaden, known locally as pogey.

Animal Species of Concern for Protection (as defined by LDWF)

BIRDS: brown pelican, American bittern, reddish egret, yellow-crowned night-heron, mottled duck,



Menhaden (also locally called pogey) is a small filter feeding fish that is both economically and ecologically important. Photo: NOAA

northern pintail, canvasback, redhead, lesser scaup, bald eagle, northern harrier, yellow rail, black rail, clapper rail, king rail, whooping crane, marbled godwit, dunlin, short-billed dowitcher, gull-billed tern, Caspian tern, royal tern, sandwich tern, common tern, forster's tern, black skimmer, short-eared owl, loggerhead shrike, seaside sparrow, and Nelson's sharp-tailed sparrow

BUTTERFLIES: Neamathla skipper, palatka skipper, dion skipper, great southern white, and western pygmy-blue

REPTILES: Mississippi diamondback terrapin

Detrimental Invasive Plant Species: torpedo grass, water hyacinth, common and giant salvinia, purple loosestrife, and Brazilian peppertree

Detrimental Invasive Animal Species: feral hog, nutria, snakehead, Rio Grande cichlid, Asian carp, Asian swamp eel, and tilapia

Salt Marsh

Salt Marsh is the marsh area closest to the beach rim of the Gulf of Mexico; it varies from 1 to 15 miles

in width. Generally, vertebrate species population levels are higher in brackish marsh compared to salt marsh. The mean salinity of salt marsh is about 16 ppt.

Key Plant Species include smooth cordgrass (oystergrass) and black mangroves. Other minor species include saltgrass, black needlerush, and saltwort. Relatively few species can tolerate the salinity stress.

Key Animal Species include redfish, speckled trout, blue crabs, and shrimp. Many species must move in and out of the salt marsh at different stages in their life cycles. After these species spawn offshore, larval and juvenile fish and shellfish move through the passes into the estuary where they feed and grow.

Animal Species of Concern for Protection (as defined by LDWF)

BIRDS: reddish egret, yellow-crowned night-heron, northern harrier black rail, clapper rail, whooping crane, American oystercatcher, marbled godwit, dunlin, short-billed dowitcher, gull-billed tern, Caspian tern, royal tern, sandwich tern, common



Saltgrass helps to keep soils in place in the salt marsh. Image: NRCS



Painting buntings are easy to identify because of their beautiful plumage. Image: USFWS

tern, Forster's tern, black skimmer, short-eared owl, seaside sparrow, and Nelson's sharp-tailed sparrow

BUTTERFLIES: Neamathla skipper, dion skipper, obscure skipper, great southern white, and western pygmy-blue

REPTILES: Mississippi diamondback terrapin

Detrimental Invasive Plant Species: purple loosestrife and Brazilian peppertree

Detrimental Invasive Animal Species: feral hog, nutria, and Asian carp

Rivers, Bayous and Streams

Rivers, bayous, and streams carry water through all of the estuarine habitat types such as swamps and marshes. The key species of plants and animals and detrimental species are captured in those habitat types. Because of this interconnection, the estuary is dynamic by its very nature.

Maritime Ridges

Maritime Ridges are remnant natural levees of rivers, bayous, salt dome islands, or shell middens; natural stranded beach ridges ("Cheniere" – French for "place of oaks"); or anthropogenic to create elevation above the surrounding marsh. These ridges are mostly four to five feet above sea level.

Key Plant Species include live oak and hackberry as the dominant canopy species. Plant types that have been planted by BTNEP and have survived well include sand live oak, American beautyberry, honeylocust, persimmon, dogwood, yaupon, Hercules club, and salt matrimony vine.

Key Animal Species which use this habitat include migratory birds, reptiles, and mammals such as songbirds, rabbits, and coyote.

Animal Species of Concern for Protection (as defined by LDWF)

BIRDS: yellow-billed cuckoo, painted bunting, orchard oriole, and various migratory birds (continue efforts to support conservation of remaining habitat)

REPTILES: eastern glass lizard



*Barrier island restoration projects provide habitat for migratory shorebirds and colonial nesting water birds.
Image: NRCS*

Detrimental Invasive Plant Species: Chinese tallow, camphor tree, chinaberry, privet, cat claw vine, air potato, Japanese honeysuckle, kudzu, Johnson grass, cogon grass, giant reed, Japanese climbing fern, and torpedo grass

Detrimental Invasive Animal Species: feral hog and nutria

Bays

Bays are natural embayments, lakes, or ponds with fluctuating salinities and depths. Salinities range from 0.5 to 30 ppt. Most of the primary production of this community occurs in phytoplankton (diatoms, blue-greens, and green algae), nanoplankton, and ultraplankton.

Key Plant Species include various phytoplankton.

Key Animal Species are located at the bay/marsh interface which serves as a nursery ground area for fish, shrimp, and shellfish. Brown shrimp, white shrimp, oysters, blue crabs, menhaden, spotted sea trout, mosquito fish, killifish, sea catfish, silversides, anchovies, common loons, horned grebes, gulls, lesser scaup, and red-breasted mergansers are found in the estuary's bays.

Animal Species of Concern for Protection (as defined by LDWF)

MAMMAL: bottlenosed dolphin, manatee, and Gulf sturgeon

REPTILES: loggerhead sea turtle, Kemp's Ridley sea turtle, leatherback sea turtle, green sea turtle, hawksbill turtle, and Mississippi diamondback terrapin

Detrimental Invasive Plant Species: None identified in the estuary to date.

Detrimental Invasive Animal Species: Asian carp, lion fish, Asian tiger shrimp, and spotted jellyfish

Barrier Islands, Beach Dunes, Barrier Shorelines and Headlands

Barrier Islands, Beach Dunes, Barrier Shorelines and Headlands are long narrow islands or headlands, many with dunes, exposed to moderate to high amounts of salt spray. In addition, the areas have limited nutrient availability and substrate instability.

Key Plant Species include succulent species and vines found on the beach fronts, wiregrass on highest dunes, and black mangrove and smooth cordgrass on the sheltered bayside areas. Additionally, wiregrass, sea oats, beach panic, saltwort, morning glory, and seaside goldenrod are found in these areas. If dunes remain stable, allowing natural succession to progress, coastal dune shrub thickets are formed.

Key Animal Species use this habitat for important breeding and nesting of migratory shorebirds and colonial nesting water birds.

Animal Species of Concern for Protection (as defined by LDWF)

BIRDS: brown pelican, reddish egret, yellow-crowned night-heron, snowy plover, wilson's plover, piping plover, American oystercatcher, marbled godwit, dunlin, short-billed dowitcher, gull-billed tern, Caspian tern, royal tern, sandwich tern, common tern, Forster's tern, black skimmer, and red knot

BUTTERFLIES: obscure skipper and eastern pygmy blue

REPTILES: loggerhead sea turtle, Kemp's Ridley sea turtle, leatherback sea turtle, and Mississippi diamondback terrapin

Detrimental Invasive Plant Species: Chinese tallow, camphor tree, chinaberry, privet, cat claw vine, air

potato, Japanese honeysuckle, kudzu, Johnson grass, cogon grass, giant reed, Japanese climbing fern, and torpedo grass

Detrimental Invasive Animal Species: feral hog and nutria

PRIORITY HABITAT TYPES AND LAND RESTORATION ACTIONS OR TECHNIQUES

Much progress has been made to implement large-scale ecosystem restoration projects across coastal Louisiana by CWPPRA, CPRA, USACE, USDA NRCS, EPA, USFWS, and NOAA NMFS since the early 1990s. Smaller projects have also been implemented by BTNEP and its other BTNEP MC members and partners. The map on the following pages identifies the major projects completed prior to 2017. Partners' websites should be consulted for detailed lists and descriptions of past work.

The overarching goal of many land conservation plans is to focus conservation on those lands and waters that are most important for conserving living resources - native plants, animals, and natural and human communities - and water quality in the coastal watershed. This summary will share the state and local perspective on habitat protection and restoration strategies.

Projects Constructed in the BTES Prior to 2017

CPRA, USACE, and CWPPRA, the primary organizations that work on large scale coastal restoration and protection, have identified the following habitat types or categories and related restoration techniques in the estuary. Because climate change vulnerability is a way of life in coastal Louisiana, CPRA has made a resolute effort to incorporate the impacts of climate change in its plans to restore coastal landscapes in the estuary.

Coastal restoration in Louisiana is also an unapologetic political issue that has unprecedented bipartisan





support. In 2017, the Louisiana State Legislature passed, with a nearly unanimous approval, the 2017 Coastal Master Plan. (The Coastal Master Plan was approved unanimously in the House and by a 33 to 1 margin in the Senate.) In CPRA's Coastal Master Plan, which calls for spending \$50 billion for coastal restoration and protection during the next 50 years, estimates of sea level rise along Louisiana's coast caused by climate change may range between 1.4 to 2.7 feet during that time span. This makes the issue of prime importance to our residents.

This sea level rise estimate is consistent with recent scientific studies which forecast this change in our children's and grandchildren's lifetimes. This view is supported by a vast array of nonpartisan scientific associations, including the American Meteorological Society and the American Association for the Advancement of Science. Protecting coastal landscapes in the estuary is, therefore, very costly. These habitat types and the related restoration techniques are captured in detail in the CCMP under the Ecological Management Action Plans.

Categories and Priority Habitat Types for Restoration

Hydrologic Restoration and Management (EM-1) can be effectively used for marshes and swamps.

The **goals** include:

- To improve wetland habitats negatively impacted by local hydrologic modifications
- To improve hydrology through the effectual use of the freshwater, sediments, and/or nutrients that already reach the basins
- To stabilize water levels and salinity to provide conditions conducive to the establishment and growth of emergent and submergent marsh plants

Actions or Techniques

Earthen and rock plugs prevent unnatural tidal flow through abandoned canals, and water-control



Hydrologic restoration projects often use water control structures to improve hydrology. Image: CWPPRA

structures help regulate water and salinity levels. In some cases, large culverts are installed under roads, levees, or other obstructions that have impounded wetlands. (See EM-1 for additional information.)

River Reintroductions (EM-2) including the Freshwater Reintroduction into Bayou Lafourche (EM-3) can also be effectively used for restoring marshes, swamps, and drinking water quality.

The **goals** include:

- To use riverine resources of freshwater and sediment from the Mississippi and Atchafalaya Rivers in order to decrease salinities and preserve and/or create marshes
- To support and encourage reintroduction of Mississippi River flows into Bayou Lafourche in order to bring freshwater and sediments to the BTB marshes to help address coastal land loss and to ensure adequate consumptive freshwater supplies by combating saltwater intrusion

Actions or Techniques

The river presents a great opportunity for rebuilding land but also the greatest challenges, as competing needs are inevitable. Controlled sediment diversions

route river water through strategic locations in the levees to feed starving marshes. Crevasses, or cuts, are constructed through levees to allow passive creation of smaller deltas. (See EM-2 and EM-3 for additional information.)

Marsh Creation (EM-5) projects that beneficially use dredged material are important for saving vanishing marshes.

The **goal** is:

- To make use of material when dredging activities or dedicated dredging occurs within or adjacent to the BTES in order to create, maintain, and/or restore marsh, coastal ridges, and islands

Actions or Techniques

Open water is reclaimed into new or preexisting land. A pipeline dredge that removes sediment from a “borrow site” by using a specialized vessel outfitted with a drill, suction pump, and pipe moves sediment. As the drill, or cutterhead, spins, it agitates sediment at the bottom of the borrow site. This sediment is then pumped with water into a pipe that carries the resultant slurry to the restoration site. Once the slurry is in place, the water runs off as the sediment settles to form new land. Native vegetation is then installed

to jump-start wetland productivity. Marsh creation projects result in restored wetlands in areas that were open water just weeks before. This process uses dredged material for ecosystem restoration. (See EM-5 for additional information.)

Barrier Islands and Shorelines

Barrier islands and shorelines (EM-5 and EM-6) require a host of methods to properly restore because these areas are exposed to moderate to high amounts of salt spray and abut the Gulf of Mexico. In addition, limited nutrient availability, substrate instability, and island evolution also affect restoration strategies.

The **goal** is:

- To preserve and restore barrier islands in order to protect environmental and economic resources

Actions or Techniques

Sediment is dredged and pumped to the project site which is then vegetated with native dune and marsh plants. Sand fencing is used when needed or as funding is available.

Shorelines may also be protected by rock revetments, oyster reefs, concrete panels, and other fabricated materials have been constructed along otherwise

unstable shorelines to abate wave energy and reduce erosion. (See EM-5 and EM-6 for additional information.)

Ridge Restoration

Ridge Restoration (EM-4) is important as it recreates habitat similar to what was once natural stranded beach ridges (“Cheniere” – French for “place of oaks”). These anthropogenic ridges create elevation above the surrounding marsh. These ridges are mostly four to five feet above sea level.

The **goal** is:

- To preserve and restore ridges in order to protect environmental and economic resources

Actions or Techniques

Ridge restoration takes place when dredged sediment is used to reconstruct elevated ridges where trees can grow. The sediment is piled up into tall, linear features rather than spread out. The “crown” of the ridge is planted with native woody tree species selected for their hardiness and habitat value. A marsh “apron” is then constructed alongside the ridge to protect it and to provide additional wetland habitat. This, in general, is done by beneficially using dredged material (See EM-4 for additional information.)



Barrier island restoration projects resemble construction sites. Image: CPRA

Terracing

Terracing (EM-7) can be used in shallow water areas near marshes.

The **goals** include:

- To trap or induce sediment deposits in order to maintain and restore existing marshes
- To create a landform that would act as a sediment trap to help build new land, reducing wave fetch and erosion on adjacent marsh shorelines, creating habitat for fish and waterfowl, and improving water quality to promote the growth of aquatic vegetation

Actions or Techniques

Terraces are long, earthen berms that are built by mechanically dredging material and piling and shaping the material to a desired height. Most terraces average around three feet tall, with shallow side slopes and a wide base. This size and shape optimize the amount of terrace that falls in the intertidal zone and will support wetland vegetation. This process uses dredged material for ecosystem restoration. (See EM-6 for additional information.)

Levees

Levees (EM-7) or man-made structures designed for flood protection are used to protect communities and other populated areas.

The **goal** is:

- To provide flood risk reduction measures for property, population centers, and ecosystems

Actions or Techniques

Ecosystem restoration projects may be used in tandem with structural flood protection systems, such as levees. Levees provide a man-made engineered structure to provide storm protection for important infrastructure and people. (See EM-7 for additional information.)

Flood Gates

Flood Gates (EM-7) protect communities and other populated areas by using adjustable gates to control water flow along rivers.

The **goal** is:

- To provide flood risk reduction measures for property, population centers, and ecosystems



Levees provide flood risk reduction measures for property, population centers, and ecosystems. Photo: USACE

Morganza to the Gulf

Levee Alignment and Structures

Interim Flood Risk Reduction Project



Flood gates are an important part of levee systems. Image: TLCD

Actions or Techniques

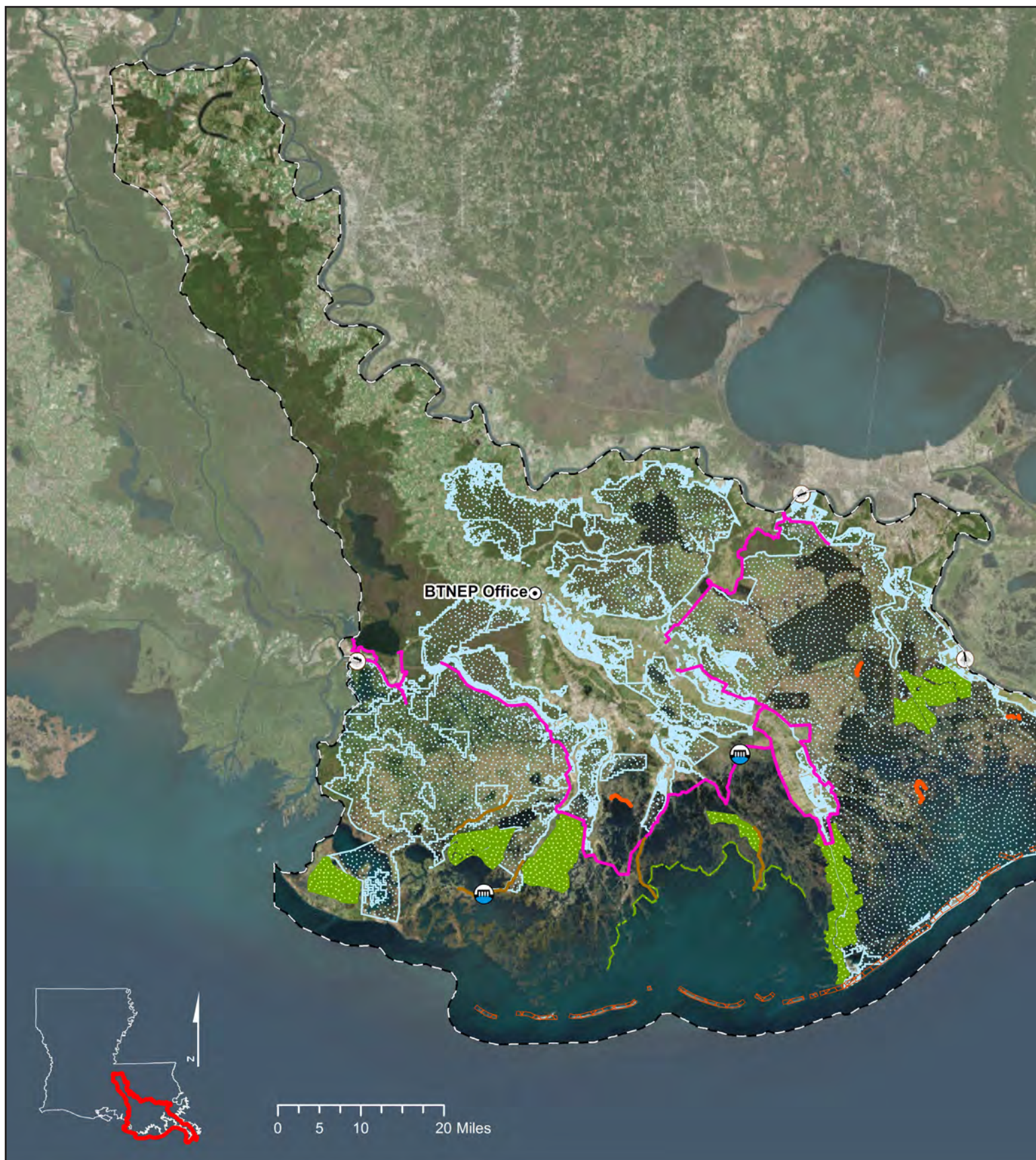
Flood gates engineered in conjunction with levees and ecosystem restoration provide protection to people in the event of hurricanes or spills. (See EM-7 for additional information.)

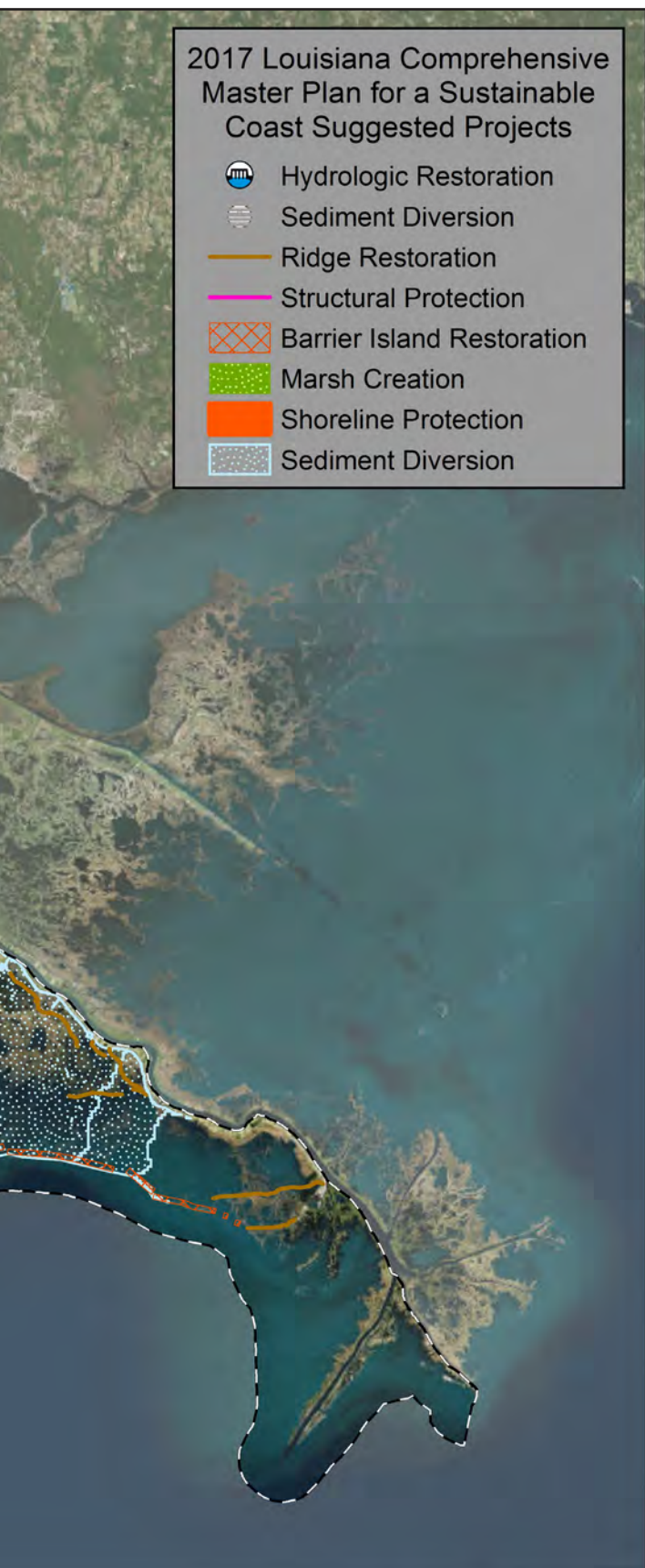
CPRA's 50-year plan for coastal restoration covers the entire coast of Louisiana. Fourteen of the sixteen BTES parishes are included in the plan; only Pointe Coupee and West Baton Rouge parishes are not in the plan. Ascension, Assumption, Iberia, Iberville, Jefferson, Lafourche, Orleans, Plaquemines, St. Charles, St. James, St. John the Baptist, St. Martin,

St. Mary, and Terrebonne parishes are all included in the plan. For more detailed information visit <http://coastal.la.gov>.

A general map of the proposed 50-year plan of projects in the CPRA 2017 Coastal Master Plan is provided on the following pages. These proposed projects are taken in the context of what might be created in the long term future should CPRA be able to secure funds.

Additionally, nonstructural measures are being encouraged by CPRA. These offer a flood mitigation alternative to structural measures by accommodating





floodwaters and either removing structures from harm's way or reducing risk to existing buildings and infrastructure by elevating them above flood waters. Nonstructural projects include flood-proofing commercial structures, elevating residential structures, and voluntary residential acquisition.

All of these efforts are carried out through partnerships between federal, state, and local agencies with assistance from private and nonprofit sectors and citizens.

In addition to these large scale restoration activities, BTNEP, working with BTEF and a host of BTNEP MC partners, performs a variety of smaller habitat restoration projects including but not limited to ridge restoration, species specific restoration, and water quality restoration activities. Water quality restoration plans are outlined in great detail in EM-8, EM-14, EM-17, and EM-18. These actions reflect an ongoing adaptation to land loss and climate change vulnerability.

Large scale ecosystem restoration projects proposed for the 50-year 2017 Coastal Master Plan

Habitat enhancement projects in the estuary generally involve working with both protection and restoration and can take place across multiple habitat types and numerous species. Many BTNEP MC members and partners work cooperatively to coordinate efforts to maximize benefits.



Image: Lane Lefort Photography

THE PATH AHEAD

Moving Forward

BTNEP is always a work in progress. The CCMP revision is a testament to the willingness of the entire association of people who care about the estuary to become and remain engaged. A primary reason for this ongoing interest may well be the science-based, consensus-driven approach to ecosystem restoration that NEPs use. The process continues to be relevant in an ever-changing landscape. It has taken great teamwork for this NEP to truly evaluate where it has been as an organization and where it wants to go in the future.

This CCMP revision looks forward to engaging new people and asking long-time supporters to continue to participate in actively benefiting and defending the estuary. As the land washes away, the ecological, economic, and cultural values that remain and what we hold so dear will increase. The message in the title of the BTNEP Characterization Report, first published in 1995, “Saving Our Good Earth – A Call to Action” continues to accurately reflect our status and our commitment. We need and we have people who are willing to join together to work and protect this enormously valuable national resource.

The Action Plans identified in Chapter 5 are wide-ranging and considered significant and essential. The Action Plans recommend implementable activities to improve the local ecosystem as a resource for all, as we all benefit from its bounty. This CCMP is reflective of the natural processes and human activities that have changed the landscape and seek to address our basic human desire to get better. As we move forward, we want to be good stewards of the natural resources that remain and guard this abundant environment for future generations.

This estuary is treasured by visitors and residents alike. The nation depends on this estuary for things as widely varying as oysters for their tables, gasoline for their cars, and music for their souls. The people who live, work, and play in the estuary have a strong willingness to protect it. BTNEP, through the goals set forth in the first CCMP and with this revision, provides people with a place to learn more about what they appreciate in the estuary and also provides people a place to share in the action of restoration.

The founders of BTNEP have established a path to protect and preserve the estuary. They are the visionaries for the model we are working hard to implement. They have helped us reshape our approach to restoration by setting the accepted standard to be one that is inclusive in nature and requires us to reach agreement through compromise and consensus. With more than a 50-member BTNEP MC representing a host of stakeholders, we have learned to understand the value of our neighbors’ needs. This document calls the next generation of diverse stakeholders such as representatives from industry and business, fisheries, agriculture, oil and gas, government agencies, individual citizens, landowners, civic organizations, hunters, scientists, engineers, environmentalists, economists, urban planners,

educators, and the like to roll up their sleeves, get involved, and work together to forge solutions that benefit all.

While it continues to be true that no other place on Earth is disappearing as quickly as the Barataria-Terrebonne estuarine system, citizens are tackling difficult problems with respect for what is at stake. People in this estuary have been working together effectively because the problems here threaten our very existence. Varying expertise supports goals to help, to improve, and to restore this fragile estuary. This cooperative characteristic of BTNEP and its

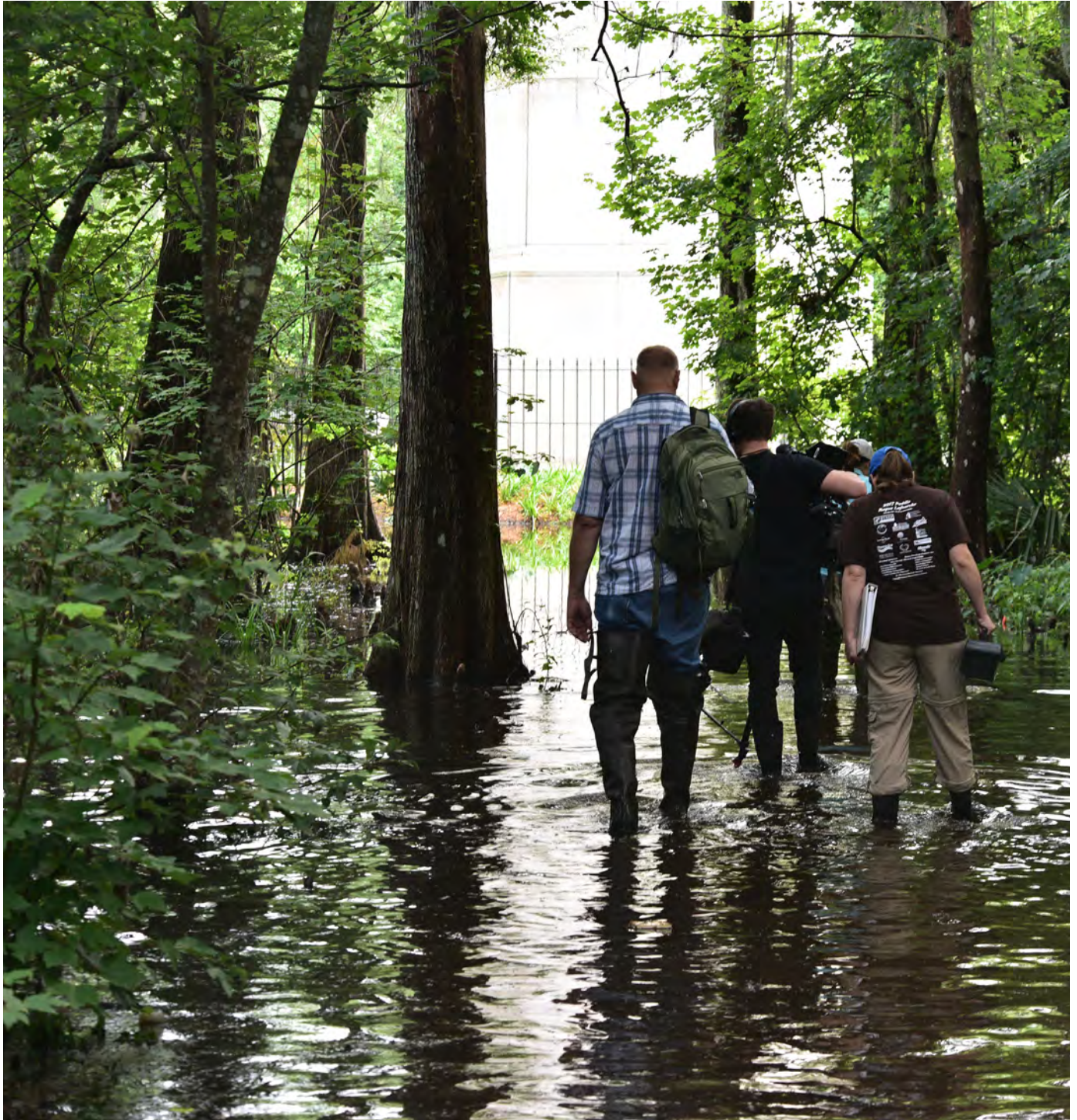
stakeholders positions us to move onward with diligence and respect.

Our success will ultimately be determined by the way we use the tools we have to move forward. Our character, strength, and courage will be required to continue to face the ongoing challenges. We must continue to take steps to preserve some of the most diverse and fertile habitats in the world.

We are ready; we have a path before us here in our CCMP. Once again, we invite you to join us in our ongoing efforts to preserve the past and protect the future together.



BTNEP works with youth through its volunteer program to encourage the next generation to work together to create ecological solutions to complex problems. Image: BTNEP



WEBPAGE ADDRESSES

Acronym	Full Name	Webpage
AFWA	Association of Fish and Wildlife Agencies	http://www.fishwildlife.org/
APHIS	Animal and Plant Health Inspection Service	https://www.aphis.usda.gov/aphis/home/
ARMI	Amphibian Research and Monitoring Initiative	https://armi.usgs.gov/
ARS	USDA Agricultural Research Service	https://www.ars.usda.gov/
ASSET	Aquifer Sampling and Assessment Program	http://deq.louisiana.gov/page/aquifer-sampling-and-assessment-program
ATTAINS	Assessment and Total Maximum Daily Load Tracking and Implementation System	https://www.epa.gov/tmdl
BEACH	Beaches Environmental Assessment and Coastal Health	https://www.epa.gov/beach-tech
BICM	Barrier Island Comprehensive Monitoring	https://pubs.usgs.gov/of/2013/1083/
BLFWD	Bayou Lafourche Fresh Water District	http://www.blfwd.org/
BLM	Bureau of Land Management	https://www.blm.gov/
BMP	Best Management Practice	https://www3.epa.gov/npdes/pubs/owm0274.pdf
BoR	Louisiana Board of Regents	http://regents.state.la.us/
BoR/ LUMCON	Board of Regents' Louisiana Universities Marine Consortium	http://regents.state.la.us/
BTB	Barataria and Terrebonne Basins	https://btnep.org/about-btnep/what-is-an-estuary/
BTE	Barataria-Terrebonne Estuary	https://btnep.org/about-btnep/what-is-an-estuary/
BTEF	Barataria-Terrebonne Estuary Foundation	https://www.supportbtnep.org/
BTES	Barataria-Terrebonne Estuary System	https://www.supportbtnep.org/btnep-and-the-estuary/the-barataria-terrebonne-national-estuary/

Acronym	Full Name	Webpage
BTNE	Barataria-Terrebonne National Estuary	https://btnep.org/
BTNEP	Barataria-Terrebonne National Estuary Program	https://btnep.org/
BTNEP MC	Barataria-Terrebonne Management Conference	https://btnep.org/about-btnep/management-conference/
BTPO	Barataria-Terrebonne Program Office	https://btnep.org/
BUDMAT	Beneficial Use of Dredged Material	https://www.epa.gov/cwa-404/beneficial-use-dredged-material
CCMP	Comprehensive Conservation and Management Plan	https://nepis.epa.gov/Exe/ZyNET.exe/20004XHU.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1991+Thru+1994&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C91thru94%5CTxt%5C00000003%5C20004XHU.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL
CCR	Consumer Confidence Reports	https://www.epa.gov/ccr
CELCP	Coastal and Estuarine Land Conservation Program	https://coast.noaa.gov/czm/landconservation/
CFR	Code of Federal Regulations	https://www.ecfr.gov/cgi-bin/ECFR?page=browse
CHRIS	Chemical Hazards Response Information System	https://hero.epa.gov/hero/index.cfm/reference/details/reference_id/3827365
CIAP	Coastal Impact Assistance Program	https://wsfrprograms.fws.gov/subpages/grantprograms/ciap/ciap.htm
CLIWS	Center for Louisiana Inland Water Studies (University of Southwestern Louisiana)	https://cls.louisiana.edu/
CPRA	Coastal Protection and Restoration Authority	http://coastal.la.gov/
CRC&D	Capital Resource Conservation & Development Council	https://www.nrcs.usda.gov/wps/portal/nrcs/detail/la/people/partners/?cid=nrcs141p2_015723

Acronym	Full Name	Webpage
CRCL	Coalition to Restore Coastal Louisiana	http://www.crcl.org/
CRMS	Coastwide Reference Monitoring System	https://www.lacoast.gov/crms2/home.aspx
CUP	Coastal Use Permit	http://www.dnr.louisiana.gov/index.cfm/page/90
CWA	Clean Water Act	https://www.epa.gov/laws-regulations/history-clean-water-act
CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act	https://lacoast.gov/new/About/
CWSRF	Clean Water State Revolving Fund	https://www.epa.gov/cwsrf
DODT	Louisiana Department of Transportation	http://wwwsp.dotd.la.gov/Pages/default.aspx
DPS	Department of Public Safety and Corrections	http://www.dps.louisiana.gov/
EBI	Environmental Baseline Inventory	http://www.losco.state.la.us/product_publications.html
EDA	Economic Development Administration	https://www.eda.gov/
EDMS	Electronic Document Management System	http://www.edms.net/
EMAP	Environmental Monitoring & Assessment Program	https://archive.epa.gov/emap/archive-emap/web/html/
EMS	Emergency Management Information System	https://en.wikipedia.org/wiki/Emergency_Management_Information_System
EPA	US Environmental Protection Agency	https://www.epa.gov/
EQIP	Environmental Quality Incentives Program	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/
EROS	Earth Resources Observation and Science	https://eros.usgs.gov/
ESA	Endangered Species Act	https://www.fws.gov/endangered/laws-policies/

Acronym	Full Name	Webpage
FDA	U.S. Food and Drug Administration	https://www.fda.gov/
FRP	Facility Response Plan	https://www.epa.gov/oil-spills-prevention-and-preparedness-regulations/facility-response-plan-frp-overview
GDP	Gross Domestic Product	https://en.wikipedia.org/wiki/Gross_domestic_product
GIS	Geographic Information System	https://www.nationalgeographic.org/encyclopedia/geographic-information-system-gis/
GIWW	Gulf Intracoastal Waterway	http://www.txdot.gov/inside-txdot/division/transportation-planning/waterway.html
GLPC	Greater Lafourche Port Commission	http://portfourchon.com/
GOMA	Gulf of Mexico Alliance	http://www.gulfofmexicoalliance.org/
GOMP	Gulf of Mexico Program	https://www.epa.gov/aboutepa/about-gulf-mexico-program-gmp
GOMRI	Gulf of Mexico Research Initiative	http://gulfresearchinitiative.org/
GPS	Global Positioning Unit	http://www.gps.gov/
GU	Groundwater UDI Surface Water	https://www.dnr.mo.gov/DWW/Help/html_Source_Water_Type.htm
GUISW	Ground Water Under the Influence of Surface Water	https://www.dnr.mo.gov/DWW/Help/html_Source_Water_Type.htm
GUP	Purchased Groundwater UDI Surface Water	https://www.dnr.mo.gov/DWW/Help/html_Source_Water_Type.htm
GW	Groundwater	https://www.dnr.mo.gov/DWW/Help/html_Source_Water_Type.htm
GWP	Purchased Groundwater	https://www.dnr.mo.gov/DWW/Help/html_Source_Water_Type.htm
HAB	Harmful Algal Bloom	https://www.epa.gov/nutrientpollution/harmful-algal-blooms
HNC	Houma Navigational Canal	https://waterdata.usgs.gov/la/nwis/nwismap/?site_no=07381328&agency_cd=USGS
HSDRRS	Hurricane Storm Damage and Risk Reduction System	http://www.mvn.usace.army.mil/Missions/HSDRRS/

Acronym	Full Name	Webpage
HUD	Louisiana Department of Housing and Urban Development	https://www.hud.gov/states/louisiana
IAP2	International Association for Public Participation	https://www.iap2.org/
IR	2016 Water Quality Integrated Report	http://deg.louisiana.gov/page/water-quality-integrated-report-305b303d
ISAPT	Invasive Species Action Plan Team	https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5182307.pdf
KAB	Keep America Beautiful	https://www.kab.org/
KLB	Keep Louisiana Beautiful	https://keeplouisianabeautiful.org/
LA SAFE	Louisiana Strategic Adaptations for Future Environments	http://lasafe.la.gov/
LaSTEP	Louisiana Small Town Environmental Program	http://www.doa.la.gov/Pages/ocd/CDBG/lcdbg_programs.aspx
LAWEN	Louisiana Water Economy Network	http://www.louisianawater.net/
LCA	Louisiana Coastal Area	https://www.lca.gov/
LCES	Louisiana Cooperative Extension Service	http://www.lsuagcenter.com/
LCRP	Louisiana Coastal Resources Program	http://www.dnr.louisiana.gov/
LDAF	Louisiana Department of Agriculture and Forestry	http://www.ldaf.state.la.us/
LDCRT	Louisiana Department of Culture, Recreation, and Tourism	http://www.crt.state.la.us/
LDEQ	Louisiana Department of Environmental Quality	http://deg.louisiana.gov/
LDHH	Louisiana Department of Health and Hospitals	http://www.dhh.louisiana.gov/
LDNR	Louisiana Department of Natural Resources	http://www.dnr.louisiana.gov/

Acronym	Full Name	Webpage
LDNR OC	Louisiana Department of Natural Resources Office of Conservation	http://www.dnr.louisiana.gov/index.cfm/page/46
LDOE	Louisiana Department of Education	https://www.louisianabelieves.com/
LDWF	Louisiana Department of Wildlife and Fisheries	http://www.wlf.louisiana.gov/
LEEC	Louisiana Environmental Education Commission	http://www.wlf.louisiana.gov/environmental-education-commission
LEH	Louisiana Endowment for the Humanities	https://www.leh.org/
LiDAR	Light Detection and Ranging	https://oceanservice.noaa.gov/facts/lidar.html
LOSCO	Louisiana Oil Spill Coordinators Office	http://www.losco.state.la.us/
LOSPRA	Louisiana Oil Spill Prevention and Response Act	http://www.losco.state.la.us/pdf_docs/OSPRA_2003.pdf
LPB	Louisiana Public Broadcasting	http://www.lpb.org/
LPBF	Lake Pontchartrain Basin Foundation	http://saveourlake.org/
LPCCP	Louisiana Pollinator Cooperative Conservation Program	http://louisianacrops.com/2014/10/07/louisiana-pollinator-cooperative-conservation-program/
LSPMB	Louisiana Seafood Promotion and Marketing Board	http://www.louisianaseafood.com/
LSTA	LA Science Teacher's Association	http://www.lsta.info/
LSU	Louisiana State University	http://www.lsu.edu/
LUMCON	Louisiana Universities Marine Consortium	https://lumcon.edu/
MMPA	Marine Mammal Protection Act	http://www.nmfs.noaa.gov/pr/laws/mmpa/
MRBI	Mississippi River Basin Healthy Watersheds Initiative	https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/home/?cid=stelprdb1048200
MR&T	Mississippi River and Tributaries Project	http://www.mvd.usace.army.mil/About/Mississippi-River-Commission-MRC/Mississippi-River-Tributaries-Project-MR-T/

Acronym	Full Name	Webpage
NBS	National Biological Service	https://www.federalregister.gov/agencies/national-biological-service
NDRC	National Disaster Resilience Competition	https://www.hudexchange.info/programs/cdbg-dr/resilient-recovery/
NEP	National Estuary Program	https://www.epa.gov/nep
NEPA	National Environmental Policy Act	https://www.epa.gov/nepa/what-national-environmental-policy-act
NGO	Non-governmental Organization	https://www.usaid.gov/partnership-opportunities/ngo
NMFS	National Marine Fisheries Service	http://www.nmfs.noaa.gov/
NOAA	National Oceanographic and Atmospheric Administration	http://www.noaa.gov/
NPS	Nonpoint Source	https://www.epa.gov/nps/what-nonpoint-source
NRC	National Response Center	http://www.nrc.uscg.mil/
NRCS	Natural Resources Conservation Service	https://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/
NRDA	Natural Resource Damage Assessment and Restoration Program	https://www.doi.gov/restoration
NSSP	National Shellfish Sanitation Program	https://www.fda.gov/food/guidanceregulation/federalstatefoodprograms/ucm2006754.htm
NWF	National Wildlife Federation	http://www.nwf.org/
NWIS	National Water Information System	https://waterdata.usgs.gov/nwis
NWQI	National Water Quality Initiative	https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/water/?cid=stelprdb1047761
NWRC	National Wildlife Research Center	https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/programs/nwrc
O&M	Operations and Maintenance Program	https://www.epa.gov/asbestos/what-operations-and-maintenance-om-program

Acronym	Full Name	Webpage
OCM	Office of Coastal Management	http://www.dnr.louisiana.gov/index.cfm/page/85
OPA'90	Oil Pollution Act of 1990	https://www.epa.gov/laws-regulations/summary-oil-pollution-act
OSDS	Onsite Sewage Disposal System	https://www.epa.gov/septic/onsite-wastewater-treatment-and-disposal-systems
PITs	Priority Issue Team	https://gulfofmexicoalliance.org/our-priorities/
QA/QC	Quality Assurance/Quality Control	https://www.epa.gov/e-enterprise/rd-project-scope-quality-assurance-quality-control-qaqc
RCPP	Regional Conservation Partnership Program	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/farmbill/rcpp/
RESTORE Act	Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economies of the Gulf Coast States Act	https://www.congress.gov/bill/112th-congress/senate-bill/1400
SBDC	Small Business Development Center	https://www.sba.gov/offices/headquarters/osbdc/resources/11409
SCPDC	South Central Planning & Development Commission	http://www.scpdc.org/
SLEC	South Louisiana Economic Council	http://bayouregion.com/
SLWDC	South Louisiana Wetlands Discovery Center	http://slwdc.org/
SONRIS	Strategic Online Natural Resources Information System	http://sonris.com/
SPCC	Spill Prevention, Control and Countermeasures	https://www.epa.gov/oil-spills-prevention-and-preparedness-regulations
SPSOC	Significant Potential Sources of Contamination	https://www.epa.gov/sites/production/files/2015-08/documents/mgwc-gwc1.pdf
STORET	STOrage and RETrieval and Water Quality eXchange	https://www.epa.gov/waterdata/water-quality-data-wqx
SW	Surface Water	https://www.dnr.mo.gov/DWW/Help/html_Source_Water_Type.htm
SWAP	Source Water Assessment Program	https://www.dnr.mo.gov/DWW/Help/html_Source_Water_Type.htm

Acronym	Full Name	Webpage
SWAMP	System Wide Assessment and Monitoring Program	https://thewaterinstitute.org/reports/swamp-version-iii
SWCD	Soil and Water Conservation Districts	https://en.wikipedia.org/wiki/Conservation_district
SWP	Purchased Surface Water	https://www.dnr.mo.gov/DWW/Help/html_Source_Water_Type.htm
TEDA	Terrebonne Economic Development Authority	http://www.tpeda.org/
TLCD	Terrebonne Levee and Conservation District	http://www.tlcd.org/
TMDL	Total Maximum Daily Load	https://www.epa.gov/tmdl
TNC	The Nature Conservancy	https://www.nature.org/
TPCG	Terrebonne Parish Consolidated Government	http://www.tpcg.org/
UDI	Under the Direct Influence	https://www.dnr.mo.gov/DWW/Help/html_Source_Water_Type.htm
USACE	U.S. Army Corps of Engineers	http://www.usace.army.mil/
USCG	U.S. Coast Guard	https://www.uscg.mil/
USDA	U.S. Department of Agriculture	https://www.usda.gov/
USEPA	U.S. Environmental Protection Agency	https://www.epa.gov/
USFWS	U.S. Fish and Wildlife Service	https://www.fws.gov/
USGS	U.S. Geological Survey	https://www.usgs.gov/
USNPS	U.S. National Park Service	https://www.nps.gov/index.htm
WATERS	Watershed Assessment, Tracking and Environmental Results System	https://www.epa.gov/waterdata/waters-watershed-assessment-tracking-environmental-results-system

Acronym	Full Name	Webpage
WIG	Water Institute of the Gulf	http://thewaterinstitute.org/
WIPS	Watershed Implementation Plans	https://www.epa.gov/chesapeake-bay-tmdl/epa-oversight-watershed-implementation-plans-wips-and-milestones-chesapeake-bay
WQX	Water Quality Exchange	https://www.epa.gov/waterdata/water-quality-data-wqx
WRDA	Water Resources Development Act	https://www.congress.gov/bill/114th-congress/senate-bill/2848
WSFR	Wildlife & Sport Fish Restoration	https://wsfrprograms.fws.gov/subpages/aboutus/aboutus1.htm



Hummingbird. Image: Keri Turner

New BTNEP CCMP Action Plans 2019



2019 CCMP		ACTION PLANS	Relationship to 1996 CCMP Action Plans	
Plan #	Page #	CATEGORY 1 Coordinated Planning and Implementation	Updated or New	Combined
PI-1	51	Barataria-Terrebonne Management Conference	Updated	
PI-2	54	Barataria-Terrebonne Program Office	Updated	Formerly PI-3
PI-3	57	Maintain Points of Contact for the State of Louisiana	Updated	Formerly PI-2
CP-1	59	Government Affairs and Education	Updated	Formerly CP-3 and SR-8
CP-2	62	Emergency Response, Recovery, and Resilience	NEW	
CP-3	65	Communication of Rules	Updated: Formerly Public Involvement in the Development of State Rules, Regulations, and Guidelines	
Plan #	Page #	CATEGORY 2 Ecological Management	Updated or New	Combined
EM-1	71	Hydrologic Restoration and Management	Updated	
EM-2	78	River Reintroductions	Updated	
EM-3	87	Freshwater Reintroduction into Bayou Lafourche	Updated	
EM-4	90	Beneficial Use of Dredged Material and Dedicated Dredging	Updated	
EM-5	95	Preservation and Restoration of Barrier Islands	Updated	
EM-6	98	Shoreline Stabilization, Induced Sediment Deposition, and Living Shorelines	Updated	
EM-7	103	Flood Risk Reduction and Coastal Resiliency	NEW	
EM-8	108	Pollutant Identification and Assessment	Updated	Combined with former EM-13
EM-9	118	Oil and Produced Water Spill Prevention and Early Detection	Updated	
EM-10	131	Improvement of Water Quality through the Reduction of Sewage Pollution	Updated	
EM-11	135	Improvement of Water Quality through the Reduction of Agricultural Pollution	Updated	

2019 CCMP		ACTION PLANS	Relationship to 1996 CCMP Action Plans	
EM-12	140	Improvement of Water Quality through Storm Water Management	Updated	
EM-13	144	Urban Green Spaces	NEW	
EM-14	147	Assessment of Harmful Algal Blooms	Updated	
EM-15	152	Protection and Enhancement of Native Biological Resources	Updated	
EM-16	168	Reduction of Impacts from Invasive Species	Updated	
EM-17	175	Improvement of Water Quality through the Reduction of Inshore and Marine Debris	NEW	
EM-18	178	Protection of Drinking Water Sources	NEW	
Plan #	Page #	CATEGORY 3 Sustained Recognition and Citizen Involvement	Updated or New	Combined
SR-1	194	Community Engagement	NEW	includes SR-1, SR-3, SR-4, SR-7
SR-2	195	Civic Engagement	NEW	includes SR-2
SR-3	197	Media Engagement	NEW	includes SR-9
SR-4	200	Public Engagement	NEW	includes SR-10, SR-11, SR-12, SR-13
SR-5	203	Estuarine Curriculum and Development	Updated	Formerly SR-14
SR-6	206	Continuing and Informal Education Programs	Updated	Formerly SR-15
SR-7	208	Financial Support for Educational Initiatives	Updated	Formerly SR-16
SR-8	210	Cultural Heritage and Lifeways	Updated	Formerly SR-5
Plan #	Page #	CATEGORY 4 Economic Growth	Updated or New	Combined
EG-1	222	Economic Education	NEW	includes EG-8
EG-2	222	Technology (R&D) and Market Development	NEW	includes EG-4, EG-6
EG-3	223	Business Assistance	NEW	includes EG-1, EG-3, EG-7
EG-4	224	Marketing Sustainable Products and Practices	NEW	includes EG-2, EG-5