



A DELTA FOR ALL

The Baird Team

Framework Plan Summary Report
Changing Course Phase 1
February 2015

A NEW COURSE

Our concept is a Delta that can be sustained by the river and natural marsh building processes for the coming centuries. To sustain the Delta, we have to capture the full land-building potential of the great Mississippi River. We must strive to capture every grain.

*New river mouths are opened and managed over time to receive the river’s sediment, building land and wetlands where they have the best chance of success. The result will be a more compact, robust deltaic landscape from Vermilion Bay to Mississippi Sound for generations and centuries to come, a **Sustainable Delta**.*

Our approach delivers immediate gains by reducing flood risk and related uncertainty for the Delta’s people, opening huge opportunities for expanded and more efficient navigation and marine commerce, and helps maintain and expand its economies to provide new and stable jobs. Most of the immediate gains result from “taking the river out of the channel.”

A Sustainable Delta for Generations to Come

The changes we propose to save the Delta are ambitious and will make Louisiana a world leader in making coasts more resilient. Securing the future of the Delta through land building with the river will require changes in all aspects of the Delta – its economy, ecology, and culture. Many of the changes will be positive from the outset; others will require time and transition. We have begun outlining these transition strategies. We are confident that the proposed changes will ensure a more stable, productive, and sustainable delta for all for generations to come.

THE BAIRD TEAM: WHO WE ARE

Combining a fresh perspective with deep delta roots

The Baird Team is a collection of experts that combines international experience (The Fresh View Team) with deep delta roots and local knowledge (The Delta Team). Members of the Fresh View team bring independent, new perspectives based on a wealth of international experience. Most members have not been involved in previous CPRA or Corps efforts on coastal protection and restoration in Louisiana. The Delta Team features top local experts in the key areas associated with this challenge. Most members have spent years, if not decades, researching and understanding the science of the Delta and its processes.

The Baird Team is complemented by our Navigation Expert Advisory Panel with six top representatives of the Louisiana navigation community, including leaders of the two major ports and leaders of the pilots associations.

We believe that a successful solution must be derived from true teamwork, transparency, realism and innovation. Team members bring their technical expertise to the process and also importantly represent related stakeholder groups.

Fresh View Team

BAIRD & ASSOCIATES
(Engineering; Modeling & Analysis; Geomorphology & Geology)

Applied Ecological Services
(Environmental)

Research Planning, Inc. (Environmental; Geomorphology & Geology)

Sasaki Associates
(Planning & Socio-Economics)

Tetra Tech (Planning & Socio-Economics)

Delta Team

Karen O’Neill, Ph.D.
(Rutgers; Planning, Communities & Industries)

Vickerman & Associates
(Shipping & Navigation)

Don Hayes, Ph.D., P.E.
(University of Nevada Las Vegas; Dredging & Beneficial Use)

Don Resio, Ph. D.
(University of North Florida; Hurricane Risk)

Thomas Soniat, Ph.D.
(University of New Orleans; Oysters)

Martin O’Connell, Ph.D.
(University of New Orleans; Fish)

Teamwork
Transparency
Realism
Innovation

our team’s values

Tetra Tech (Planning & Socio-Economics)

Irv Mendelssohn, Ph.D.
(Louisiana State University; Wetlands & Nutrients)

Alex McCorquodale, Ph.D., P.E., P.Eng.
(University of New Orleans; Flow of Nutrients & Sediments)

Colin Thorne, Ph.D.
(University of Nottingham; Watershed & River)

Harry Roberts, Ph.D.
(Louisiana State University; Geomorphology & Geology)

Mark Kulp, Ph.D.
(University of New Orleans; Geomorphology & Geology)

Time for Change in the Face of Increasing Challenges

The case for action to preserve the delta

For most of the Delta's history, its residents adapted to life within the natural ebbs and flows of the dynamic Mississippi River delta. In the late 18th century, industrialization brought about a change of perspective. Dams, levees, and river structures were built; the South and Southwest Passes were tamed. For many years and in many ways, this system has served us well.

After almost one hundred and fifty years of adapting nature, we are at or near a point where this approach is no longer sustainable. Channelization of the river has forced its rich sediment to bypass the wetland landscapes it once replenished. The Delta, as a whole, has ceased to grow naturally. Valuable and protective wetlands are disappearing at alarming rates, putting the economy, ecology and cultures of the Delta at risk. Maintaining the course of a channelized river is not an option for those that rely on the Delta – locally, nationally and globally.

This document outlines a carefully-crafted, bold, and strategic set of actions that aim to recapture the full sediment load of the river. We believe that nothing short of these actions can overcome the potential losses. Only bold action can create new land, protecting and expanding the incredibly rich heritage, ecologies, and economies of the Delta – one of the world's most productive places.

THE LANDSCAPE TODAY



Communities

For many people of the Delta, home is more than a house. Home is a way of life that is largely defined by the broader ecological context and a series of deep social networks. The ecological context includes the waterways and wetlands that provide diverse economic and recreational activities. The social networks are rich communities that make relocation, even in the face of repeated disaster, hard. Often, families of the Delta are sustained by vocational knowledge (i.e. fishing, oystering, and rigging) that is passed down.

Yet, generational change is happening. Inherited ways of life no longer always coincide with an increasingly global and technological context. The next generation struggles with reconciling years of tradition with new horizons. Families struggle with community identity: How can a way of life be preserved, yet adapted to new ways of working, thinking, and recreating? How can memory be passed down without being a limitation to an ever-expanding future?



Fisheries

Although the estuarine environments of the Delta continue to flourish today, most delta ecologists agree that a tipping point is coming where wetland loss will lead to a rapid decline in fish abundance. We don't know exactly when this tipping point will occur, but this shouldn't be a reason to delay action. We must soon restore the Delta's wetlands so fisheries can continue to flourish into the future.

Another important existing challenge to Delta fisheries is the Dead Zone in the Gulf of Mexico. Today, nutrient-loaded water from the river is directly discharged to the Gulf without passing through wetlands. This leads to large areas of hypoxia (low-oxygen) that negatively impact fish populations.

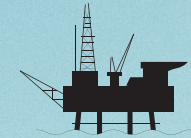
Today, many fishermen are still recovering from a difficult decade which strained finances and created much uncertainty. The future holds much uncertainty as well. Rising sea levels could impact existing fisheries by changing the salinity levels in the delta. Areas suitable for oysters and fish could change from where they are today.



Navigation and Shipping

Safe and efficient navigation on the Mississippi River is critical to the economy of the region and the nation. Today, navigation in the Delta faces challenges. Sedimentation of the river channel necessitates dredging the Lower Mississippi in order to ensure clear navigation depth, and dredging quantities and costs are increasing. The future of the system, particularly near its mouth and the Head of Passes, is uncertain in the face of sea level rise.

Yet, navigation also sees great future potential opportunities. The country stands at a watershed moment in terms of economic expansion related to the energy boom and increases in agricultural, natural resource, and manufactured exports. Much of the future economic growth is expected to be within the Delta itself, but it will also extend all the way up the Mississippi River to Chicago. Today, there is a need to plan for the long-term life of the river to allow for the increased capacity necessary to accommodate the growing role of marine commerce to the state and the nation.



The Energy Sector

Energy infrastructure in the Delta is a complex network of facilities, pipelines, and other infrastructure. The energy sector is critical to Louisiana's economy, providing hundreds of thousands of jobs and many billions in sales for Louisiana companies. Strategic assets, such as Port Fourchon, will continue to be central hubs for deepwater oil and gas services over the next decades.

The energy sector is already leading in adapting to the challenges of the dynamic Delta landscape. This includes moving facilities farther inland and elevating roads to provide access as land loss continues. This planning process can help strengthen the partnership with the energy sector and help align multi-benefit goals.

SUSTAINABLE DELTA

*We can stop additional land loss and sustain the delta, but
We must strive to capture every grain, and
We must start soon*

What is the delta and what are its boundaries?

The wild Mississippi River, before its channelization, once moved side to side like a loose garden hose snaking on the ground – albeit with much greater force and working over many hundreds of years. The sediment in its water dropped out as it reached Gulf of Mexico. The sediment created land – from as far west as Vermilion Bay to as far east as the Mississippi Sound. This territory is the natural delta of the river – and we would argue, the area of the river’s potential influence and a useful planning boundary today.

The history of these river processes – “deltaic processes” – remain visible today in how the landscape is used and inhabited. Where the river lingered, natural levees were created – high-and-dry ridgelines that proved more suitable to roadways and development (i.e. Plaquemines, St. Bernard, Lafourche, Teche). Between the levees, a series of bays developed, abounding with rich estuarine wetlands (i.e. Lakes Pontchartrain and Borgne, Barataria, Breton, Terrebonne). This structure of levees and bays continues to be meaningful today – providing a structure in the landscape (sometimes described as sub-deltas) that can help direct and control water.

Why is the Delta threatened?

The large-scale manipulation (via dams, levees, and channelization) of the river’s natural course has served our nation well over many decades. It has allowed for more stable navigation,

more suitable areas for habitation and somewhat more predictable flood risk. Yet, it has also had significant consequences, including an increasing and alarming rate of land loss in recent decades.

Land loss in the Mississippi River Delta is caused by three dominant factors. First, the river is carrying three to four times less sediment than it once did. Second, sea levels are rising and land is sinking. Third, the sediment in the river today is being sent out into the Gulf of Mexico, a by-product of channelization. Other factors contributing to land loss include dredged canals, oil and gas extraction, roads, and other landscape changes.

In the future, the challenges will be greater. With much of the land of the Delta less than three feet above sea level, the combination of increasing sea level rise (ten times the historic rate by some predictions) and continued land sinking (“subsidence”) threaten to submerge a large part of the Delta in the next 50 to 150 years.

Despite degrees of certainty about the predictions, it is clear: we can and must choose to change the future if we want to preserve the Delta.

A Smaller Delta is Reality

The Delta exists as a fine balance between the supply of sediment from the river, colonization by vegetation, erosion through storms, and submergence by sea level rise and subsidence. Historically the Delta grew by about 1,200 acres/year, while the last century has shown land loss

of 12,000 acres/year. More than 2,500 years of growth has been erased in less than 100 years.

The river carries less than one-third of the sediment than it did just 75 years ago. We know, in the face of sea level rise, we can sustain a delta approximately half the size of today’s Delta. We have defined one possible boundary of a smaller, sustainable Delta area.

We do not know exactly how much land we can or should build, so

management of the Delta will have to be adjusted as the years pass. What we do know is that the Delta has been losing land at a rate of at least 12,000 acres/year for the last 50 years. **To keep up, we must target the creation of 12,000 acres of land every year, year after year. Every year we fall short of the target, the area that can be sustained as the Delta becomes smaller.** The need to act has never been greater. And land building is a slow process. We must begin soon.



The river carries significantly less sediment today than it did historically, so we can only sustain a smaller delta. The more sediment that we capture and the quicker we begin, the larger the delta will be. Every year, an additional 12,000 acres are lost forever; there is only enough sediment to limit additional loss, not to rebuild land.

CAPTURING EVERY GRAIN

Taking advantage of the River's full land-building potential

THE PROVEN SUCCESS OF USING THE RIVER

The Wax Lake and Atchafalaya River deltas are living proof of the Mississippi River's power to build land, creating rich deltaic ecosystems with wetlands and trees that support fish, wildlife, and birds. In 50 years, the Wax Lake Delta footprint has grown to cover nearly 25,000 acres. Within a decade of land's first appearance in the Atchafalaya delta, tall stands of willow trees existed, providing protection from storm surges. We can learn from these examples of natural deltas within the region and apply the same principles to the river's main delta.

We have estimated the land building potential of the combined Atchafalaya and Mississippi Rivers. If delta building in the future is strategically planned, it will be possible to achieve the target of creating almost 12,000 acres each year. A key part of the strategy is to build land only within the boundary of the sustainable Delta area. **If we build outside the sustainable Delta area we over-stretch ourselves, resulting in greater and unplanned land losses in other parts of the Delta.**

What about dredging?

- Creating land/wetlands through dredging = \$25 - \$70 million/km2.
- To use dredging for half of our necessary land building = \$625 million to \$1.75 billion every year
- Land building using river's sediment = \$5-10 million/km2

Dredging will certainly have an important role in land-building as we phase in our plan, but the river must be the primary provider of sediment.

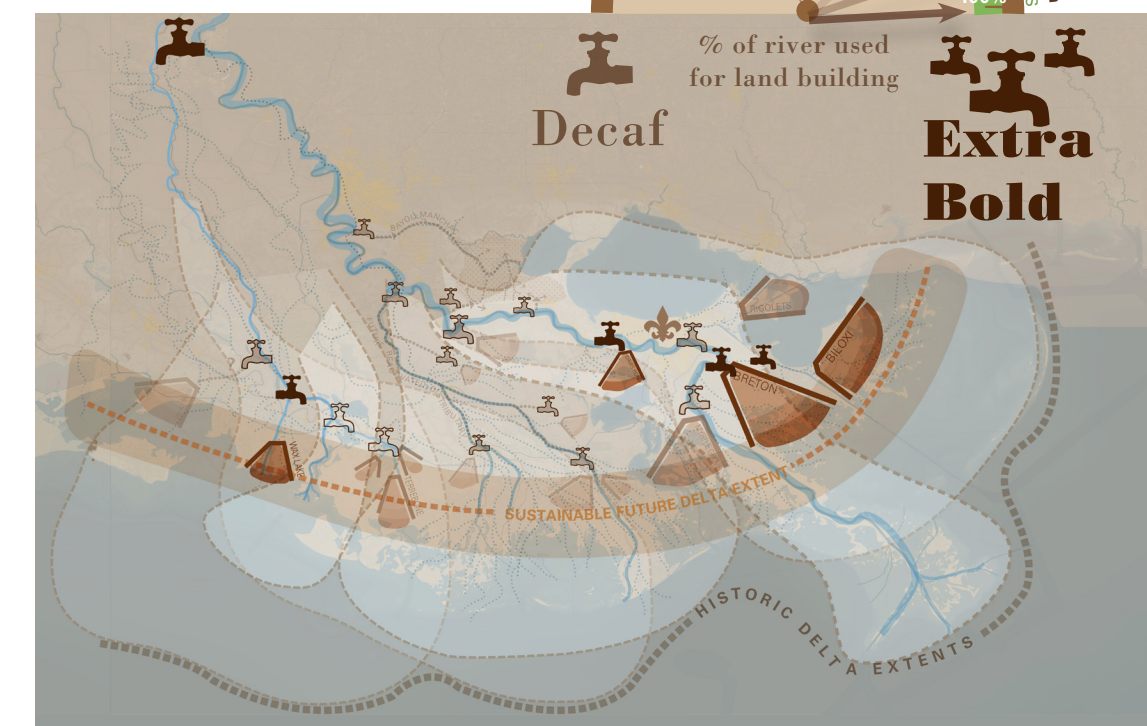
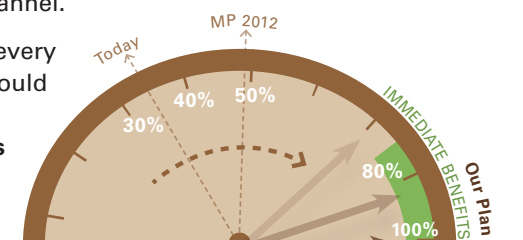
in land-building as we phase in our plan, but the river must be the primary provider of sediment.

BUILDING WITH THE RIVER

We aim to restore the land-building potential of the river. The Delta is an ecologically dynamic area that has helped to foster vibrant cultures and communities, but **its future existence depends on reestablishing long-term natural processes that have been disrupted**. Over the last several thousand years, the river mouth naturally switched locations – building land in different locations over time to create the Delta we live in today. Historic deltas included one or two active river mouths with areas of rapid growth and areas of rapid submergence/erosion. It was a continually changing landscape.

The foundation of our plan is a series of new river mouths or outlets strategically located throughout the Delta to build new sub-deltas with land and wetlands. Think of these as a series of faucets across the Delta that can be turned on or off (up or down) to deliver water and sediment in a strategic manner. Many of these “faucets” already exist. We want to build on existing infrastructure to help bring the Delta back to life, restoring natural processes that are proven to build the Delta. We are “taking the river out of the channel.”

To maximize land building by better capturing every grain, we propose that all new river mouths should be constructed upstream of English Turn. **By taking the river out of the channel, tremendous flood risk reduction and shipping advantages will also result.**



A FLEXIBLE, ADAPTIVE FRAMEWORK

*Minimizing short-term impacts,
maximizing long-term benefits*

A Flexible Strategy

To find an equitable balance between land building with the river and preservation of estuarine (saltier) areas **we propose to manage the new river mouths so that not all river mouths will be active at once**, cycling delta building between separate basins across the delta to mimic natural deltaic processes. It is likely that the river mouth or faucet to any individual basin will be turned on (or off) at 50 year intervals. Deltas grow most quickly in the first 50 years of their lifespan, so switching every 50 years helps maximize land building. Switching more frequently also maintains a more stable Delta, with less dramatic loss and growth than historic deltas.

Adaptive Management

Our framework of sub-delta faucets can be managed in many ways. Taps could be slowly turned up one-by-one, or we could begin by turning on one or two more fully. The tradeoff lies in land loss, adaptation, and how much of a delta we can ultimately sustain. **Starting more gradually allows for a slower transition, but it means we will lose more land and adapt to an even smaller delta.**

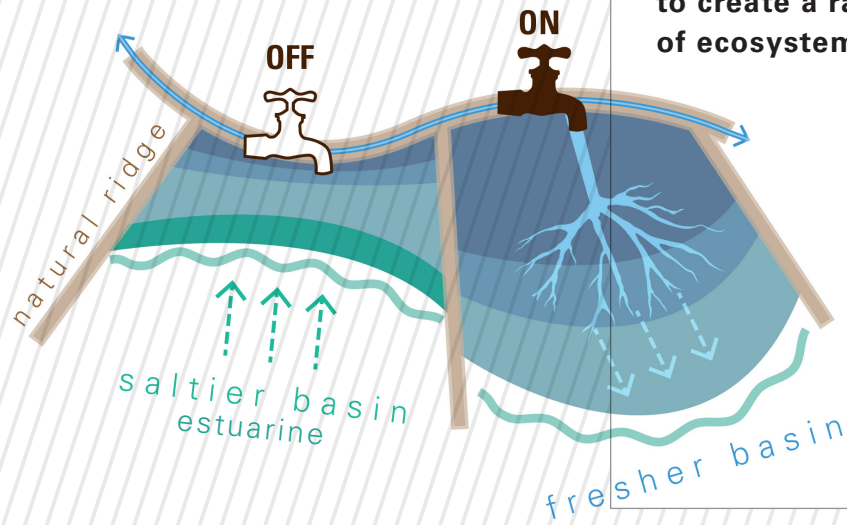
A Bold Plan Yields Immediate Gains and Catalysts

To realize tremendous immediate and future benefits to people’s lives and livelihoods, communities, industries, and the economy of Louisiana there is a need to go big and go bold. **By “bold” we mean using 100% of the river’s flow, taking the river out of the channel.** The benefits that we can achieve are further explained on the next page. When to turn up the bold dial depends on the future rate of land loss and the size of the sustainable Delta we can realistically hope for. But “going bold” can also seem daunting from many perspectives. We seek to provide a path to a Delta for all that provides options for transition and leaves no one behind.



Distributary Ecologies

Managing faucets to create a range of ecosystems



Distributary Ecologies: managing faucets to create a range of ecosystems

We propose to cycle between distributaries (faucets) to preserve a balance of estuarine and freshwater ecosystems. We must think of the delta as a whole in sustaining fish and wildlife.

Today:

- Rapid land-loss & minimal land growth
- Estuarine conditions across delta

Growth Stage (faucet on):

- Rapid land-building
- Freshening of water
- Freshwater wetlands, swamps, and forests

Submergence Stage (faucet off):

- Estuarine ecosystems created as salty water from the Gulf mixes with freshwater
- Submergence and erosion begin to occur

Estuarine zones with wetlands are an essential part of the ecosystem and to the recreational and commercial fishing community. We have grown accustomed to estuarine conditions across the Delta because most of the freshwater and the land-building sediment has been transported to the Gulf channelized by the levees of the Mississippi. Land building with the river therefore means less estuarine area – it is a difficult trade-off and it will be necessary to find an equitable balance.

The Master Plan Context

How does our plan compare?

Our plan may sound a lot like the diversion plans of the 2012 Master Plan. In fact, there are some fundamental differences:

- We plan for the fact that the future Delta will be smaller because the river delivers less sediment today and the sea is rising more quickly than in the past.
- Our new river mouths will capture 100% of the river and deploy it for land building; the proposed diversions of the Master Plan will capture no more than half of the river's land building potential.
- Fully taking the river out of the channel below English Turn provides the potential for tremendous immediate gains in flood risk reduction and expansion of shipping – advantages not gained by the Master Plan diversions, either individually or collectively.
- Our plan immediately reduces risk by reducing river flood levels in New Orleans and downstream.
- Our new sub-deltas will be strategically placed to maximize land building.
- We plan to rotate sediment distribution over time in the delta's sub-basins to ensure there is always a balance between fresh and estuarine environments, preserving the natural delta cycle and opportunities for commercial and recreational fisheries.

In evaluating a one-hundred year horizon, we uncovered potentials that were not apparent in the short-term master planning context. We believe, with further refinement, these initiatives can be aligned to ensure that both short and long term benefits to the region are maximized.

SIGNIFICANT & IMMEDIATE FLOOD RISK REDUCTION BENEFITS

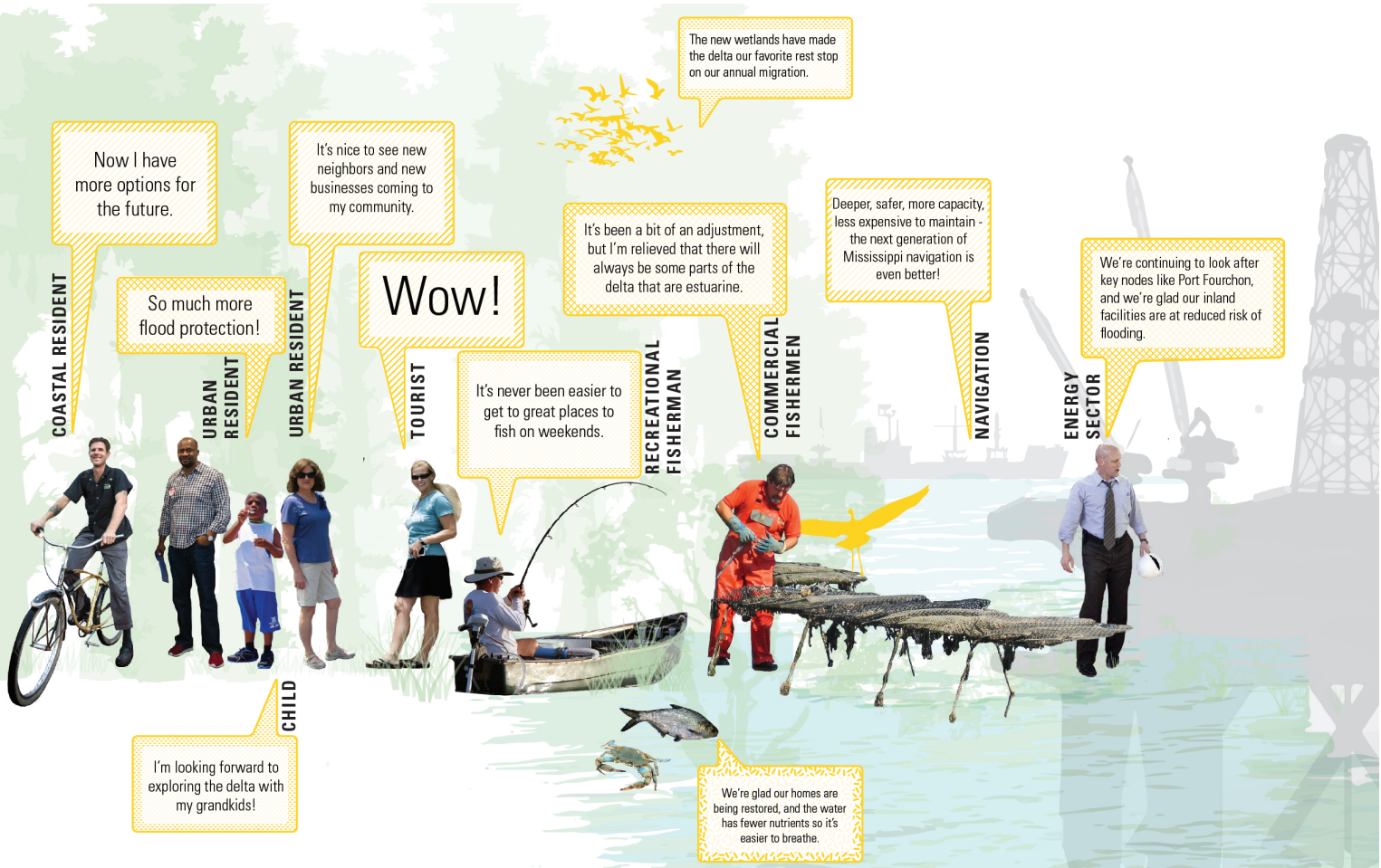
Our plan yields immediate gains. By redistributing 100% of the existing river flow to new river mouths at and upstream of English Turn, we are taking the river out of the existing channel above that point.

Taking the river out of the channel above English Turn reduces peak river flood levels through New Orleans and further downstream by 10 to 15 feet. This reduction is essentially the equivalent of making the existing Mississippi River levees through New Orleans levees 10 to 15 feet higher. As a result, Mississippi River levees through New Orleans would not need to be raised for river flood protection for many decades to come, and the replacement of the 85-year-old Bonnet Carre spillway (estimated to cost \$500M) would not be needed.

Another element of our plan that is made possible by taking the river out of the channel is the creation of several storm

surge relief channels through the Mississippi River levees below English Turn. These channels will be strategically located, lined with levees, and crossed by causeways. These channels would reduce hurricane surge levels on the southeast side of New Orleans and in east Plaquemines and St. Bernard Parishes by at least 5 feet during Katrina-like events, further reducing flood risk and deferring future levee upgrade costs.

These two flood risk reduction components of our plan immediately increase the degree of protection to New Orleans and areas downstream from 1 in 100 years to more than 1 in 1,000 years. This would reduce the chance of major flooding in the next 50 years from 40% to less than 5%. On top of this, flood risk will be further reduced in the next 15 to 30 years, as trees which will buffer storm surges begin to mature on newly created sub-delta lands.



STAKEHOLDER BENEFITS

The Delta in Transition



Communities

- Greater certainty about where it is safe to live and work in the future, allowing for a more planned transition to safer areas
- 2 Home Program provides a means for groups to transition together, maintaining existing homes while also transitioning to safer locations
- A new delta will become “A New Wonder of the World” – ecotourism and delta management sectors skyrocket
- A more accessible Delta - for tourists, fishermen, and residents
- Economic development generated by our plan will increase local tax bases
- Restoration of the wetland landscape and associated ecosystems preserves cultural ties to delta landscape



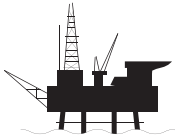
The Fishing Industry

- Stability for future fisheries (vs. living through the approaching tipping point and subsequent dramatic decline)
- A smaller delta will be more accessible to recreational and commercial fishers
- Delta Discovery Center and the 2 Home Program provide more options for adapting as the Delta transitions to a balance of freshwater and estuarine areas
- Regional planning efforts allow for new mechanisms for support and assistance as local conditions change
- Reduction of the Gulf Dead Zone



Navigation & Shipping

- Expands the capacity of the Lower Mississippi River
- Substantially reduces or eliminates dredging in Lower Mississippi
- Improves feasibility of a deeper channel (at least 50’ deep)
- Improves safety (little or no flow speed)
- Provides possibility of shorter channel to Gulf
- Allows for widening of the river for more anchorage, ports, and transshipment areas
- Saves money by eliminating operational costs for IHNC, Harvey, and Algiers, and removing the need to replace the IHNC and Harvey locks



The Energy Sector

- Flood risk reduction for facilities within existing levees
- Provides more certainty about where land will be in the future
- Preserves existing transportation corridors
- Protects and expands the Mississippi River capacity for marine commerce
- Improved flood protection for facilities along the River



Fiscal Case for our Plan

Direct Savings & Avoided Costs

- Avoided dredging costs: nearly \$50M/yr (current 45ft channel) or \$140M/yr (deeper, 50ft channel)
- Avoided replacement costs of two locks: \$1.6 to \$2B total
- Avoided replacement cost of Bonnet Carre Spillway: \$500M
- Economic advantage of a 50 ft channel: \$11.5B nationally; \$50 million/year to the State
- **River flood benefits are similar to what would be experienced with a 10 to 15 ft increase in levee height through and downstream of New Orleans, saving billions of dollars in flood damage**
- **Surge flood benefits are similar to what would be experienced with a 5 ft increase in levee height for New Orleans, St. Bernard, and east Plaquemines**

Estimated Costs for some of our Key Components

- Distributary Structure & Channel: \$3 to 4B
- Distributary Cutoff Channel (for preserving estuarine conditions): \$1.3 to \$1.7B;
- We plan to make distributary infrastructure moveable and re-usable to reduce future costs
- Infrastructure for surge relief channels: \$400M total

