WATER MARKS

Louisiana Coastal Wetlands Planning, Protection and Restoration News

August 2003 Number 23

FRESHWATER DIVERSIONS:
Revitalizing Louisiana's Coastal Wetlands

www.lacoast.gov

August 2003 Number 23

WaterMarks is published quarterly by the Louisiana Coastal Wetlands Conservation and Restoration Task Force to communicate news and issues of interest related to the Coastal Wetlands Planning, Protection and Restoration Act of 1990. This legislation funds wetlands enhancement projects nationwide, designating approximately $50 million annually for work in Louisiana. The state contributes 15 percent of the cost of project construction.

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ABOUT THIS ISSUE'S COVER . . .
Traditionally used to enhance oyster yields, freshwater diversions today are an essential tool for sustaining and restoring Louisiana's coastal wetlands.

Photograph, "Tonging Oysters, 1938" used by permission of Meriget W. Turner, curator, Fonville Winans Collection

Photograph of oyster shells by Rex Caffey, Louisiana State University Agricultural Center

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For more information about Louisiana's coastal wetlands and the efforts planned and under way to ensure their survival, check out these sites on the World Wide Web:

www.lacoast.gov
www.americaswetland.com
www.btnep.org
www.crcl.org

Correction: In the graph on page 9 of *WaterMarks* Number 22, the projections for precipitation by the Hadley and Canadian climate models were reversed. We apologize for this error.

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Restoring the Natural Flow: Diversions Rebuild Wetlands

SWOLLEN WITH waters drained from nearly half of the continental United States, the Mississippi River in flood stage embodies the terrifying and destructive force of nature. In its wake it can leave a trail of devastated fields, uprooted trees and ruined buildings.

To protect human life and property from the ravages of flood, a 1,600-mile system of levees and control structures now constrains the river and funnels its muddy waters into the Gulf of Mexico. But, while shielding cities and industry from disaster, these barriers of earth and concrete are starving the wetlands to death. Deprived of the floodwaters' rejuvenating nutrients and sediment, the coastal wetlands cannot combat the degrading effects of subsidence and saltwater intrusion and are vanishing. To restore the benefits of flooding without the risks of flood, wetland proponents advocate the strategic breaching of the levees, allowing river water to flow into selected marshes and bays. The hopes and challenges associated with this powerful technique are the subject of this issue of *Watermarks*: Revitalizing Louisiana's Coastal Wetlands.

River Water Builds Coastal Lands

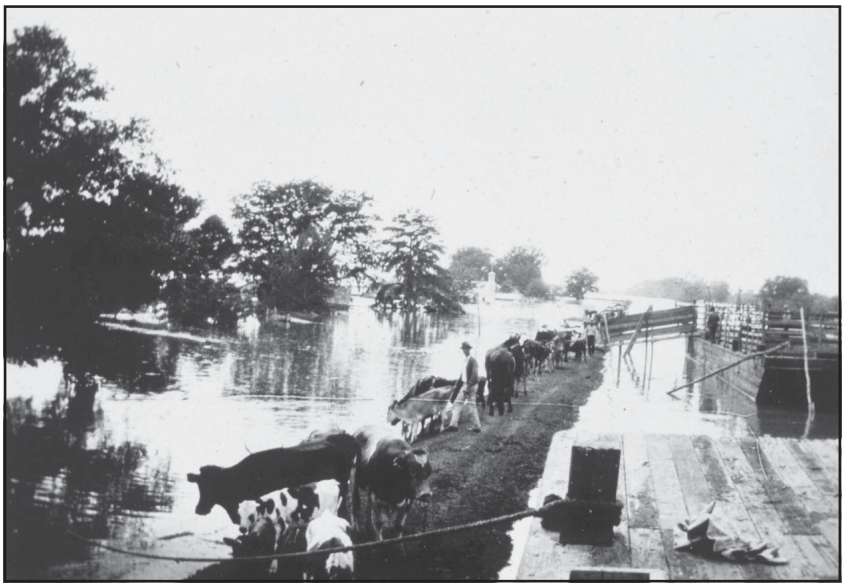
For eons the Mississippi River has shaped the coast of Louisiana through cycles of growth and decline. Jumping its natural banks and engulfing the delta, the river pushes back saline water driven toward land by wind and tide while depositing nutrients and sediment collected from upstream. Particle by particle, the sediment settles into the alluvial soil of bayous, swamps and marshes. Plants, nourished by river water, take root, trap more sediment, die and decay to create a biomass that traps yet more sediment. Incrementally, wetlands emerge, supporting marsh vegetation, providing habitat for fish and wildlife, and buffering the coast from storm surge and sea. As land accretes, the river inevitably seeks a shorter route to the Gulf, eventually carving out a new channel and abandoning the old wetlands. Deprived of an influx of nutrients and sediment, wetlands sink, succumb to salt water and disappear.

Though today's levees and control structures successfully restrain floods, they also interrupt the age-old process of wetlands formation. The Mississippi, constrained within its banks, is forced to carry its

Courtesy of David Seawell

Fresh water flooding into the marshes delivers nutrients and sediment vital to a thriving wetlands ecology.

load of land-building sediment into the Gulf of Mexico, where it tumbles to the ocean floor and lies useless for restoring land. Without the rejuvenating sediment and nutrients of the river, existing wetlands decline. No new wetlands emerge. Salt water, advancing rapidly through navigation channels and pipeline canals, invades the estuaries. Vegetation recedes, marshes erode into the ocean, and coastal Louisiana vanishes at the rate of one acre every 35 minutes.



Courtesy of NOAA

While historically threatening to human life and property, river floods play an essential role in building and sustaining healthy wetlands.

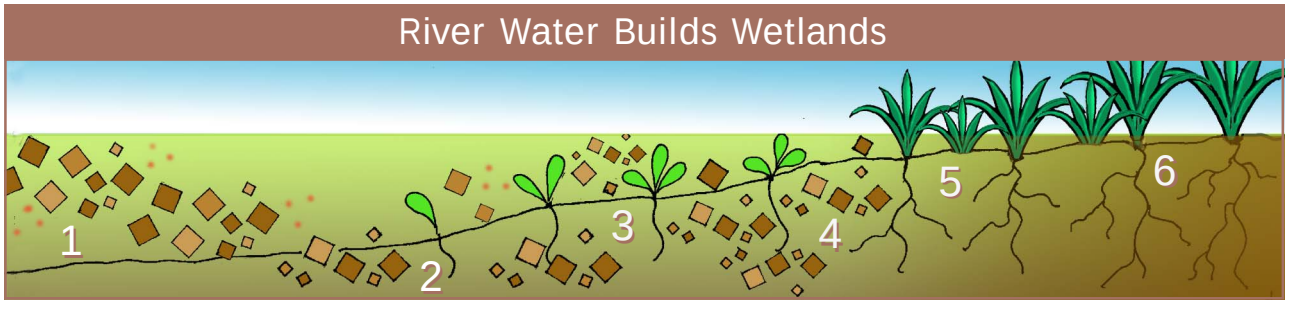
Reclaiming Benefits by Mimicking Nature

The best antidote for the decline of Louisiana wetlands may lie within the Mississippi River itself. Purposeful breaching of the levees, known as diversions or river reintroductions, can mimic the natural overflow of the river, routing fresh water, nutrients and sediments into marshes to nourish vegetation and to deposit the material needed to build emergent land.

Although diversions differ in construction and scale, the primary goals of all diversions are to supply marsh-building ingredients and to alter the saline content of the outflow area, boosting critical plant growth and providing a healthy habitat for fish and wildlife.

Expanded Purpose for an Old Practice

The first levees along the Mississippi River were built in the early 18th century. In the 1830s the first intentional breaching to enhance oyster yields was recorded, and diversions to irrigate crops and stimulate fish production became common. The idea of using diversions to restore wetlands emerged over half a century ago, and is now a leading strategy as agencies affiliated with the Coastal Wetlands Planning, Protection and Restoration Act recognize the Mississippi River as their most powerful ally in combating the current crisis of Louisiana's coastal land loss. WATER MARKS



1. Floodwater carries nutrients and sediment. **2.** Sediment settles. **3.** Plants take root. **4.** Plants trap more sediment. **5.** Biomass increases. **6.** Wetlands emerge.

Diversions: Routing Water into Wetlands

ON AN AVERAGE DAY, the Mississippi River propels over half a million metric tons of nutrients and sediment into the Gulf of Mexico, while the wetlands just beyond its banks starve for lack of these very elements. To deliver the river's marsh-building ingredients where needed, four major kinds of diversions penetrate the levees and direct river water into the wetlands.

Crevasses, Old and Simple

The simplest type of diversion is a crevasse, a fissure in the natural levee where the river spills through. The earliest crevasses occurred at weak points in the embankment, but agencies managing the coastal region today are cutting new ones to assist in wetlands restoration. For example, the Delta-wide Crevasses Project in lower Plaquemines Parish proposes to make and maintain up to 30 breaches over 20 years' time, producing a net increase in the area and quality of fresh and intermediate marsh.

Siphons' Scale Adaptable to Location

"Siphons are like huge straws arching over the riverbank, sucking river water in at one end and spewing it out into the wetlands at the other," says Chuck Villarrubia, coastal scientist for the Louisiana Department of Natural Resources. "To establish suction you have to prime siphons, and ship traffic or low river levels can break the suction, making these diversions difficult to operate." They are relatively inexpensive to construct, however, and numerous small siphons can be used up and down the river to pinpoint delivery of fresh water.

Gated Structures Control Outflow

Larger-capacity gated structures employ box-like culverts that tunnel through the levee, diverting water into a receiving area or canal before it enters the estuary. Operators can open or shut gates fitted into the mouths of the culverts to control the timing, volume and velocity of the freshwater flow into the outflow area, and to seasonally moderate the salinity level.

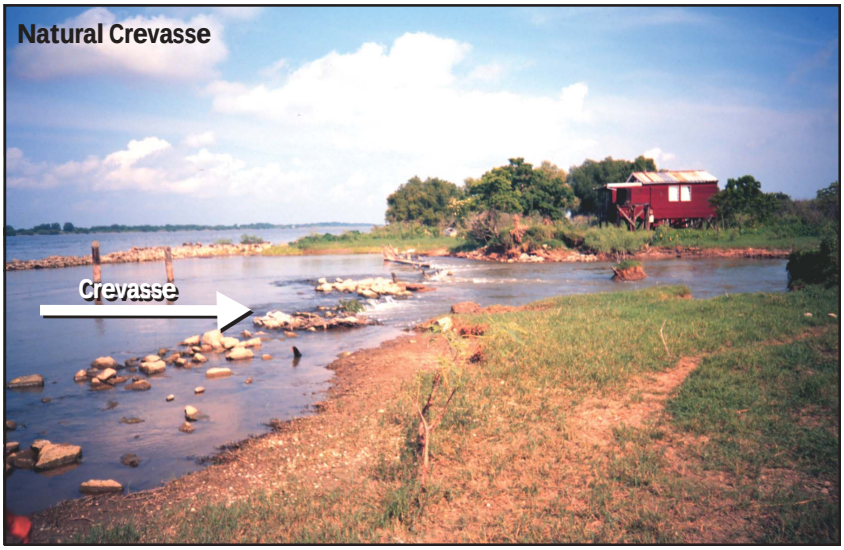
Results from the project at Caernarvon in Breton Sound demonstrate the advantages of a gated structure. In its 12

Courtesy of USACE New Orleans District

Gated structure at Caernarvon, Breton Sound

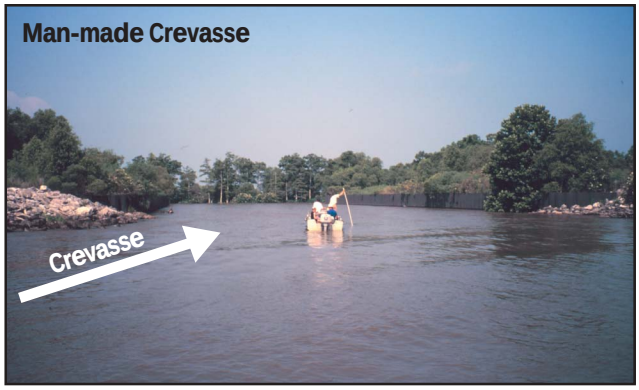
years of operation, Caernarvon has increased over seven-fold the size of freshwater plant communities, reduced the area of saltwater vegetation by over 50 percent, rejuvenated fish and wildlife populations, and stabilized the marshes. Built with funds from the Water Resources Development Act, Caernarvon is a model for other gated projects, guiding their response to changing weather conditions, growth cycles of shellfish, natural threats such as marsh-grass dieback, or requirements of commercial and recreational users of the wetlands.

Experiments indicate that pulsing — releasing a large quantity of water over a relatively short period of time — may best simulate natural floods. According to John Day, professor of oceanography and coastal sciences at Louisiana State University, pulsing pushes fresh water and nutrients over a wide expanse without overfreshening the outfall area. As demonstrated when Caernarvon operated for brief periods at its full capacity, pulsing may also prove useful for land-building purposes.



Courtesy of NOAA

Crevasses occur naturally as the river breaks through weak points in the bank and floods the adjacent marshes.



Courtesy of NOAA

Man-made crevasses direct waterborne nutrients and sediment into specific areas of the wetlands.

Sediment Diversions Build Land

Larger particles of sediment are carried deep in the river's channel. To claim them for land-building purposes, sediment diversions would make large cuts down into the river bank to allow tens of thousands of cubic feet of sediment-laden water to pass into the marsh every second. Slated for construction in 2003, the first diversion of this kind, West Bay, is expected to create almost 10,000 acres of marsh. The U.S. Army Corps of Engineers suggests that more such diversions, placed downriver from populated areas, can effectively combat the problem of coastal land loss.

Coastal restoration requires a variety of techniques, including the use of diversions of various scales, to achieve the age-old accomplishments of nature. Diversions combine science and engineering to benefit the natural world and the human population that so depends on it. WATER MARKS

Diversion Critics Question Impact on Economy, Environment

TO THE MODERN mind accustomed to highway speeds, time in the Louisiana wetlands may appear as fixed and eternal as the unblinking eye of an alligator. But the rate of change is quickly accelerating as levees, canals and other man-made structures contribute to the wetlands' rapid decline.

To counteract their detrimental impact, advocates of coastal restoration strongly urge using diversions to replicate natural processes and rejuvenate the wetlands. However, when humans impose control over nature, disputes inevitably erupt over how to exercise that control and whom to hold responsible for the consequences. Debates over using diversions concentrate on four issues: fisheries, water quality, flooding and navigation.

Fisheries

Historically, oystermen have been proponents of river diversions, citing as benefits the reversal of saltwater intrusion, the increase in areas of optimal salinity for oyster production, and the decrease of predators found in high-salinity areas. Lately, however, oystermen have voiced concern that modern large-scale diversions damage present-day fisheries by changing the salinity of estuarine waters, resulting in the displacement of aquatic populations and the reduction of catch. "Restoring normal and healthy salinity levels throughout an estuary is an important goal of diversions," confirms Allen Bolotte, district conservationist for the Natural Resources Conservation Service. "We'd like to return marshes to the graduated levels of an earlier time, when the interface of fresh water and salt was optimal. This would promote vegetative growth, marsh development, and a greater diversity of plants, animals and fisheries throughout the coastal zone."

Courtesy of LA Dept. of Tourism

Oyster fisheries benefit in the long run as diversions enhance and sustain Louisiana's coastal ecosystem.

For Bolotte, and many others studying the issue, a key question is how to ensure the sustainability of coastal Louisiana while protecting the livelihoods of people who depend on the wetlands today. "In the long run, diversions enhance habitat and increase productivity," Bolotte says, "but in the short term, in the life of coastal fishermen relying on a daily catch, their effect can be costly and disruptive."

Because oysters grow in stationary beds, unable to move when salinity levels change, oystermen are especially vulnerable to the effects of diversions. Acknowledging that people who suffer economic damage are justified in seeking reasonable compensation, the state of Louisiana and other concerned parties have devised

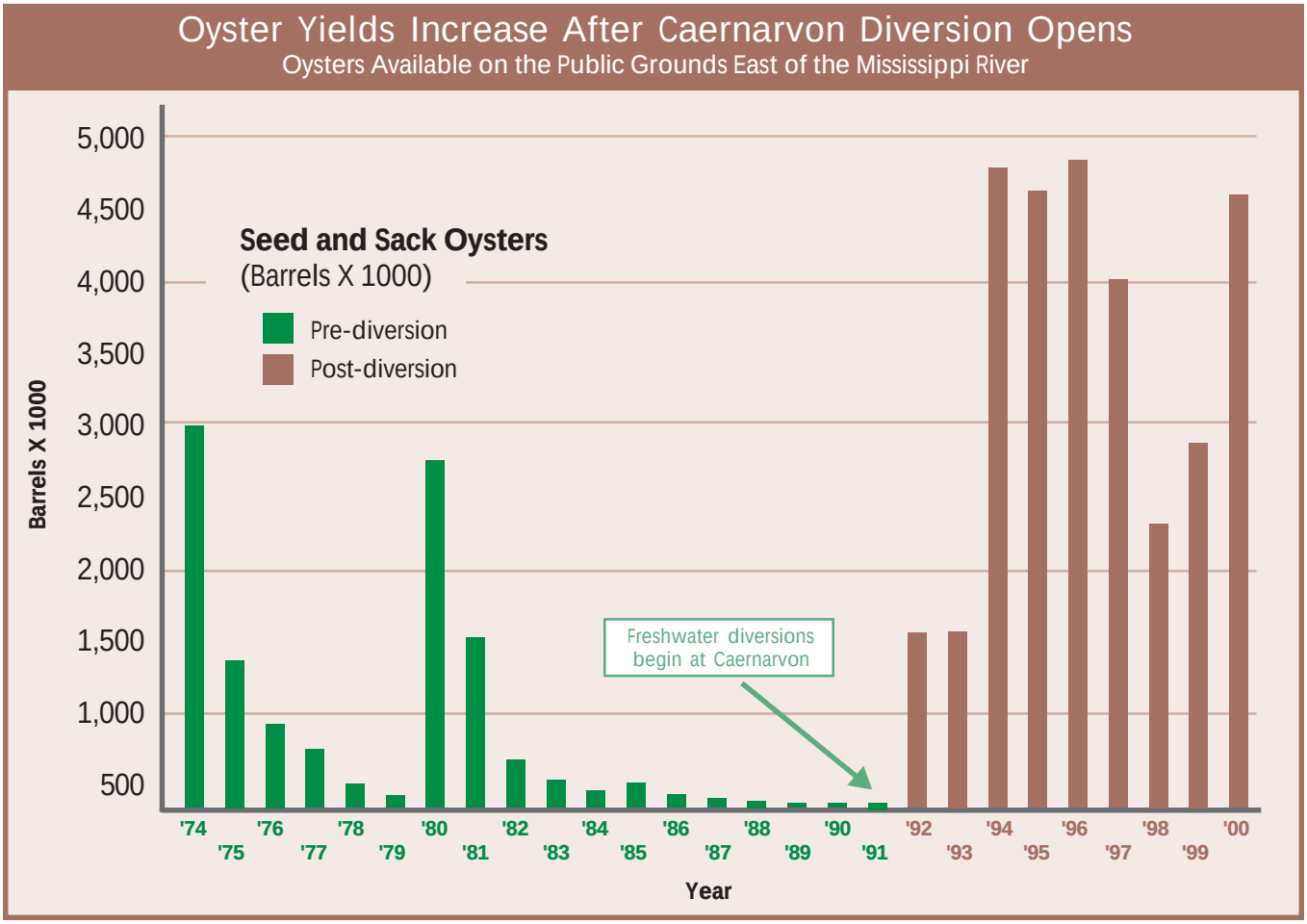
a method for calculating losses incurred by oyster leaseholders that considers the value of both the oyster beds themselves and the crops they support.

Water Quality

By mid-20th century, pollution pouring into the Mississippi from agricultural run-off, municipal sewage systems and industrial wastes earned the river a reputation as a dirty toxic soup. Although the quality of river water began to improve after the passage of the Clean Water Act in 1972, fears about contaminants such as insecticides, herbicides and fertilizers persist.

Scientific studies over the past decade document the health of the river. Tests for 100 toxic chemicals revealed the presence of only five, and these in low concentrations. Trace minerals detected in fish are well within safe limits for edibility, and concentrations of modern pesticides fall below EPA standards for drinking water. Throughout the watershed, improvements to waste treatment facilities have dramatically reduced bacterial levels in the river.

Overabundance of nitrogen and phosphorus could cause excessive algal growth harmful to the marsh ecosystem, but, as Bolotte points out, "At their present scale, diversions simply do not convey enough water into the wetlands to make algal blooms a threat." Wetlands have been able not only to absorb river-borne nutrients but actually to benefit from

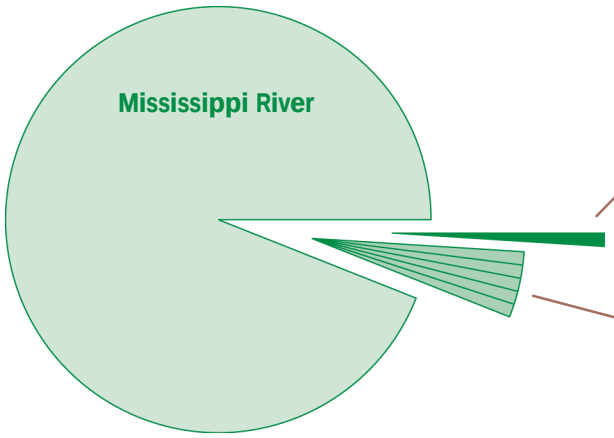


Courtesy of LaDNR CRD

One Percent of River Currently Flows Through Diversions

Percentages based on average flow and rounded

Capacity based on all diversions currently operational



1% of river's volume flows through diversions operating at current levels

6% of river's volume could flow through diversions operating at full capacity

them. Furthermore, preliminary research at Louisiana State University indicates that filtering river water through the marshes decreases the nutrient load carried by the Mississippi, thereby reducing the size of the hypoxic area, or "dead zone," in the Gulf of Mexico.

Flooding

A unified system of levees along the Mississippi River allows millions of people from Baton Rouge to the Gulf to enjoy safety from floods. To them, purposefully breaching the levees may appear to be folly.

The major diversions can control the release of water, however, adjusting the timing and volume to local conditions and to meet specific needs. For instance, increasing flow might counter saline-borne threats such as brown marsh and red tide, or restraining it could accommodate the needs of fisheries or seasonal sportsmen. Channel banks and physical barriers in the receiving basins regulate outflow speed and direction, further diminishing the threat of flood and preventing unintentional erosion.

Navigation

Reducing water levels in a navigation channel that cuts through the wetlands could restrict ship traffic and require more frequent dredging, or force the relocation of the channel. Presently, however, diversions do not draw enough water from the river to threaten navigation. Implementing a huge diversion such as the Third Delta at Donaldsonville would certainly increase federal navigation maintenance costs. Shipping might also have to adapt by utilizing new channels if large diversions cause changes in the geography of the coastal region.

Balancing Needs for Sustainability

Diversions attempt to replicate the natural processes that build healthy wetlands while limiting potential damage to the people and economy of coastal Louisiana. Inevitably there are conflicting opinions over setting priorities and managing change. "For the benefit of the entire region," says Bolotte, "we need to develop consensus among the various concerned parties and make wise choices that assure the vigor and sustainability of the wetlands." WATER MARKS

Diversions Build Hope for Wetlands

The expense of constructing and operating diversions is a fraction of the estimated cost should the nation fail to protect and restore the Louisiana wetlands. Over the next 20 years, these diversion projects are expected to stabilize or create over a million acres of wetlands. WATER MARKS

Diversion Projects in Louisiana's Coastal Wetlands

Diversion Project	Project #	Description of Project Work	Lead Agency	Location	Project Status	Acres Benefited
Avoca Island Diversion & Land Building	TE-49	Sediment diversion	COE	Terrebonne Basin	Planning phase	143
Benney's Bay Sediment Diversion	MR-13	Construction of conveyance channel, sediment retention devices, dikes, weirs; 50,000 cfs	COE	Mississippi River Delta Basin	Construction scheduled March 2004	5,828
Caernarvon Freshwater Diversion*	N/A	Construction of five culverts and inflow and outflow channels	COE; State of Louisiana	Breton Sound Basin	Construction completed 1991	77,000
Caernarvon Diversion Outfall Management	BS-03a	Construction of flow-through culverts with water controls at eight sites, three plug closures with armor; restoration of 13,000 feet of spoil bank	NRCS	Breton Sound Basin	Construction completed 2002	1,132
Channel Armor Gap Crevasse	MR-06	Enlargement of existing crevasse to allow additional flow and sediment deposition	COE	Mississippi River Delta Basin	Construction completed 1997	936
Davis Pond Freshwater Diversion	N/A	Construction of four gated culverts, inflow and outflow channels, guide levees and rock weir	COE; State of Louisiana	Barataria Basin	Construction completed 2002	777,000
Delta-Building Diversion at Myrtle Grove	BA-33	Installation of five gated box culverts and a conveyance channel; construction of a pump station	COE	Barataria Basin	Engineering and design phase	8,891
Delta-Building Diversion North of Fort St. Philip	BS-10	Construction of new conveyance channel with cuts allowing fresh water to divert into adjacent open waters	COE	Breton Sound Basin	Construction scheduled March 2004	2,473
Delta-wide Crevasses	MR-09	Construction of five new crevasses; dredging of existing crevasses; installation of plug in Raphael Pass crevasse to force more water through splays	NMFS	Mississippi River Delta Basin	In construction (1st dredging cycle completed; three more dredging cycles scheduled)	2,386
Freshwater Introduction South of Highway 82	ME-16	Installation of water control structures; plug removal, structure modification; canal enlargement	FWS	Mermentau Basin	Construction scheduled spring 2004	296
Grand Bayou/GIWW Freshwater Diversion	TE-10	Deepening existing channel and installation of weir to reduce saltwater intrusion and retain fresh water	FWS	Terrebonne Basin	Construction scheduled April 2005	1,808
Lake Boudreaux Basin Freshwater Intro & Hydrologic Mgmt	TE-32	Dredging and installation of sluice gates and outfall management structures for fresh water introduction	FWS	Terrebonne Basin	Construction scheduled May 2004	619
Mississippi River Water Reintroduction into Bayou Lafourche	BA-256	Installation of receiving intake structure/siphon system; 1,000 cfs	EPA	Barataria Basin	Engineering and design phase	104,399
Central and East Terrebonne Basin Freshwater Delivery Enhancement*	TE-42	Improve distribution of fresh water from the GIWW	FWS	Terrebonne Basin	Proposed complex project	To be determined
Myrtle Grove Siphon	BA-24	Installation of six siphon pipes; construction of leveed outfall channel to facilitate distribution of fresh water and sediments; 2,100 cfs	NMFS	Barataria Basin	Not scheduled	1,119
Naomi Siphon*	BA-03	Installation of eight siphons	State of Louisiana/ Plaquemines Parish	Barataria Basin	Construction completed 1993	Not measured
Naomi Outfall Management	BA-3c	Installation of two weirs to maximize sediment retention and nutrient uptake	NRCS	Barataria Basin	Construction completed 2002	633
Opportunistic Use of the Bonnet Carre Spillway	PO-26	Raising spillway pins to allow flow and reduce salinities	COE	Pontchartrain Basin	Not scheduled	117
River Reintroduction into Maurepas Swamp	PO-29	Installation of two culverts; construction of receiving pond; 1,500 cfs	EPA	Pontchartrain Basin	Construction scheduled January 2005	36,121**
Small Freshwater Diversion to the Northwestern Barataria Basin	BA-34	Installation of siphons; gapping of spoil banks and culverts	EPA	Barataria Basin	Construction scheduled May 2005	5,134**
Small Sediment Diversions	MR-01b	Construction of conveyance channels	State of Louisiana	Mississippi River Delta Basin	Construction completed 1993	6,719
South Lake DeCade Freshwater Introduction	TE-39	Installation of water control structures on south shore and enlargement of canal	NRCS	Terrebonne Basin	Construction scheduled September 2004	201
West Bay Sediment Diversion	MR-03	Construction of a conveyance channel; 20,000 to 50,000 cfs	COE	Mississippi River Delta Basin	Construction scheduled September 2003	9,831
West Point-a-la-Hache Siphon*	BA-04	Installation of eight 27-inch tubes to siphon water	State of Louisiana	Barataria Basin	Construction completed 1991	Not measured
West Point-a-la-Hache Outfall Management	BA-4c	Installation of three earthen plugs and three weirs; restoration of channel banks to enhance distribution and reduce saltwater intrusion	NRCS	Barataria Basin	Hydrologic modeling phase	1,087

*Non-CWPPRA project
**Acres of swamp

WaterMarks Interview ... continued from back cover

really a kind of toxic soup that will kill off our wetlands rather than restore them, but water quality testing has shown that the river is remarkably free of toxins.

WaterMarks: So you're not worried about toxicity at all?

Schexnayder: Not at all. The real concern has been about excessive nutrients, and that's not been a problem to date. Nutrients themselves aren't toxic. Coastal wetlands assimilate nutrients rapidly — in fact they respond by actually increasing their capacity to utilize them. Additional nutrients eventually express themselves further up the food chain as more shrimp, more fish, more birds and so forth. Even the so-called "toxic" blue-green algae are an important food to many estuarine organisms.

WaterMarks: What about diversions' effects on fisheries? Don't oyster fishermen oppose diversions?

Schexnayder: The short answer is no. Oystermen have long recognized that fresh water improves oyster production. If we can return to more traditional salinity levels it'll be a big positive for oystermen in the long term. It'll eliminate the cost of improving oyster beds higher in the estuaries and reduce the dangers from pollution. And most importantly, oyster production will increase significantly.

WaterMarks: Isn't there a "Yeah, but ..." here?

Schexmayder: The problem is that we are talking long term. The data we have show that the first two years after a diversion becomes operational can be the most disruptive. After that the bands of fresh and brackish water expand and oyster production begins to increase well beyond what it was before the diversion. We need a bridge for the fishing industry that will take us over the short-term problems and get us to the long-term advantages. It's critical that some form of reasonable compensation for losses, in addition to the oyster-lease relocation program, be included in our thinking about diversions.

Courtesy of LA Dept. of Tourism

Every link in the food chain depends on nutrients in the ecosystem.

We need to reach out and involve user groups like oystermen, commercial and sport fishermen — not blame them. They could become a powerful force in the effort to save coastal wetlands.

WaterMarks: You emphasize the difficulty and complexity of really addressing the problem of coastal wetlands loss in Louisiana. How hopeful are you about the future?

Schexnayder: I'm concerned that coastal wetlands loss will always be a Louisiana problem — that it won't ever become a priority for this nation and we won't ever have the dollars to seriously address the issues. But I'm also very concerned that if coastal wetlands loss does become a national priority, it will be because Louisiana has suffered a catastrophe — one costing significant loss of life and billions of dollars in damage. My hope is that we have the foresight as a nation to act now rather than react to a disaster later. WATER MARKS

The WATER MARKS Interview

Mark Schexnayder

Mark Schexnayder serves as a regional coastal advisor for fisheries in the Louisiana Sea Grant College program and the Louisiana State University Agricultural Center. He has also worked as director of the Marine Biological Lab on Grand Terre and as manager of the state crustacean program. He is shown in the photograph with his daughter Ava Eugenie, fishing in New Orleans City Park.

WaterMarks: Many planners argue that diversions are the only option available to save Louisiana's coastal wetlands. Are diversions really the answer?

Schexnayder: While we would all like to find a silver bullet, there just isn't one out there. And as powerful as they are, diversions are only one tool in the toolbox. Protecting what's left of Louisiana's coastal wetlands is going to require multiple, complex and expensive solutions.

WaterMarks: So diversions have their limitations.

Schexnayder: We tend to talk about diversions as if they were all the same. But diversions range from small siphons moving water at 250 cubic feet per second to proposed structures with the capacity of 200,000 cfs. So it's not so much a case of limitations as a matter of matching the right diversion to the project. In some cases, a series of small siphons might be a better fit than one large structure.

WaterMarks: I've heard you use the term reintroductions instead of diversions. Why?

Schexnayder: Diversions imply that we're changing a natural process, taking something away from the river. The facts are just the opposite. Breaching a levee restores a natural process of flooding that has always been part of the river. We're re-introducing water to wetlands in a way that replicates what happened before the levee system was built.

WaterMarks: But isn't the river is full of chemicals and fertilizers that will damage the wetlands?

Schexnayder: Some people worry that the Mississippi is

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