CHAPTER 3

MEASURES FOR CURTAILING WETLAND LOSS

The possible options for curtailing wetland loss are numerous. They include diverting freshwater and sediment into the marshes; changing the course of the Mississippi River; modifying patterns of water and sediment flow to the marshes; maintaining wetlands artificially; restoring the barrier islands; and shifting away from the types of canals, channels, and levees that have destroyed wetlands to alternative transportation and flood protection strategies that have less adverse environmental impacts. This chapter briefly describes each of these measures.

Table 2 lists several of the options that have been proposed for curtailing wetland loss; Table 3 lists the measures that have been authorized by the Louisiana Legislature, planned by the Louisiana Geological Survey, or constructed by other organizations.

Table 2
Options for Curtailing Wetland Loss

<u>Barrier Island Restoration, Marsh Building and Restoration</u>
1. Restore diked, drained, dredged wetlands
2. Build marsh with materials from dredging projects instead of re-suspending dredged material in the lower river or creating spoil banks.
3. Require offsetting marsh creation for wetlands conversion due to development.
4. Raise the elevation, seal breaches, re-nourish beaches of barrier islands

<u>Marsh Management</u>
1. Construct tidal barriers and otherwise manage flow of water to and from marsh
2. Dike wetlands and manage artificially.
3. Thin layer deposition
4. Regulate marsh fires
5. Restore suitable marsh vegetation

<u>Regulatory</u>
1. Limit creation of new canals
2. Fill existing canals
3. Limit boat speeds in waterways
4. Restrict marsh buggies
5. Require mitigation for private wetland destruction
6. Subsidize new technologies

<u>Diversion</u>
1. Increase flow through the Atchafalaya River
2. Freshwater and/or sediment diversion to wetlands
3. Diversion to Mississippi River Gulf Outlet
4. Increase water flow to Bayou LaFourche
5. Separation of navigation from river flow using locks
6. Avoidance of additional levee construction in lower Atchafalaya

Table 3
Authorized, Planned, and Completed Projects for Curtailing Wetland Loss

Authorized by Louisiana Legislature (funded)

(1) Restore barrier islands and shorelines
- (a) Isles Dernieres
- (b) Fourchon Island
- (c) Shell Island
- (d) Timbalier/E. Timbalier Islands
- (e) Holly Beach
- (f) Grand Isle (Corps)

(2) Diversion
- (a) Caernarvon Diversion (joint state/federal project)
- (b) Pass a Loutre Marsh Creation (small diversion pilot project)

(3) Marsh Management
- (a) Montegut-Terrebonne
- (b) St. Bernard Parish
- (c) St. Charles Parish-LaBranche Wetlands

Planned by Louisiana Geological Survey (presently unfunded)

(1) Barrier Island/Shoreline Restoration and Nourishment
- (a) Plaquemines Parish Barrier Shorelines
- (b) Timbalier/E. Timbalier
- (c) Holly Beach-Cameron Parish
- (d) Caminada-Moreau shoreline

(2) Diversion (joint federal/state projects)
- (a) Davis Pond
- (b) Bonnet Carre

(3) Large Scale Wetland Protection Program (Outgrowth of this Study)

Completed by Other Agencies

(1) Barrier Island/Shoreline Restoration and Nourishment
- (a) Eastern Isles Dernieres Restoration (Terrebonne)
- (b) Timbalier Island Repair Project (Texaco, Inc.)
- (c) Grand Isle Hurricane Protection Levee (Corps)

(2) Marsh Management (numerous individual land owners)

Barrier Island Restoration

The measure with the highest priority has been the restoration of Louisiana's barrier islands--the first line of defense against the sea--by raising their surfaces and closing breaches. (See Figures 16-19.) Although storm protection has been the primary motivation, restoring these islands will also limit wave erosion of interior marshes. Furthermore, they will help to prevent additional increases in the salinity of the bays behind them by limiting tidal mixing with the high-salinity waters of the Gulf of Mexico.

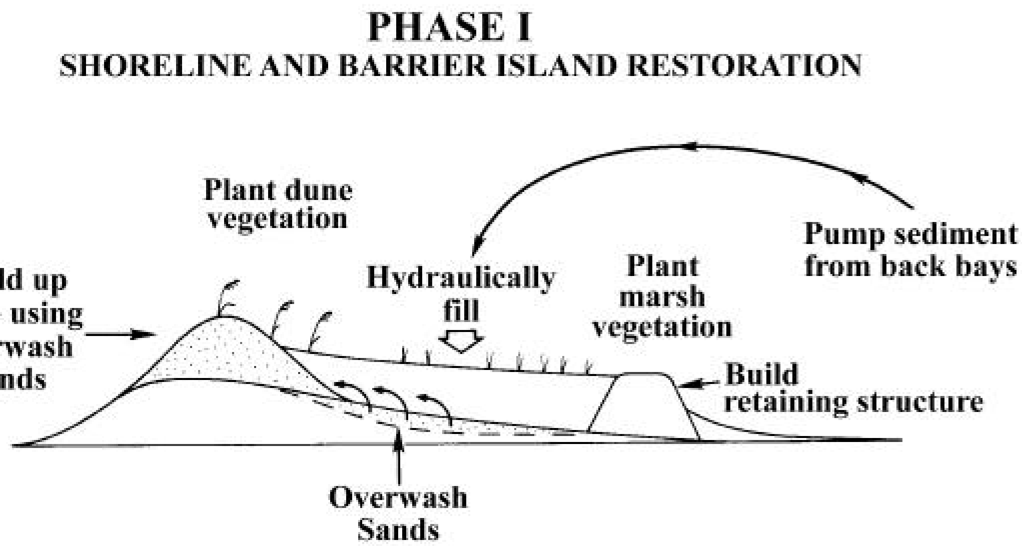

Figure 16. Cross-sectional view of shoreline and barrier island restoration plans (Phase I of the Louisiana Coastal Protection Master Plan).

Restoring barrier islands has the advantage of not interfering with existing social patterns and has thus faced little, if any, opposition. On the other hand, its ability to curtail wetland loss in the long run is limited. This measure does not prevent wetlands from being submerged as relative sea level rises, nor does it prevent marsh erosion along canals. The beneficial impacts on wetland salinity will generally be small compared with the salinity increases caused by other factors.

Wetland Restoration

A widely used wetland mitigation approach throughout the United States is to require those who destroy wetlands for a project to create wetlands nearby, either by lowering the surface of an upland or filling a channel or bay and planting marsh vegetation. The general procedure could be applied in Louisiana. For example, instead of resuspending material dredged from the Mississippi River, those who maintain shipping lanes could use this material to build marsh, which is currently done with some dredge spoil from Southwest Pass. Material dredged for canals could also be used to create marsh. Areas that have been diked or drained could be converted back to wetland. The Corps of Engineers (1984) has identified eight navigation channels where dredged material could support creation of 43,000 acres of marsh.

Although marsh creation has been a popular mitigation measure in the United States, its practical utility in solving the Louisiana wetland loss problem may be limited to cases where dredging of navigation channels provides material. The Corps of Engineers estimates the incremental cost of creating marsh at $700-4,100 per acre, given the existence of dredging projects that would require the disposal of dredged material. However, due to the lack of available sediment and other logistical problems likely to be encountered in creating fifty square miles of wetland per year, the cost per acre would almost certainly be an order of magnitude greater if this method were applied as a general solution to wetland loss. Accelerated sea level rise would further increase the amount of wetland creation required annually.

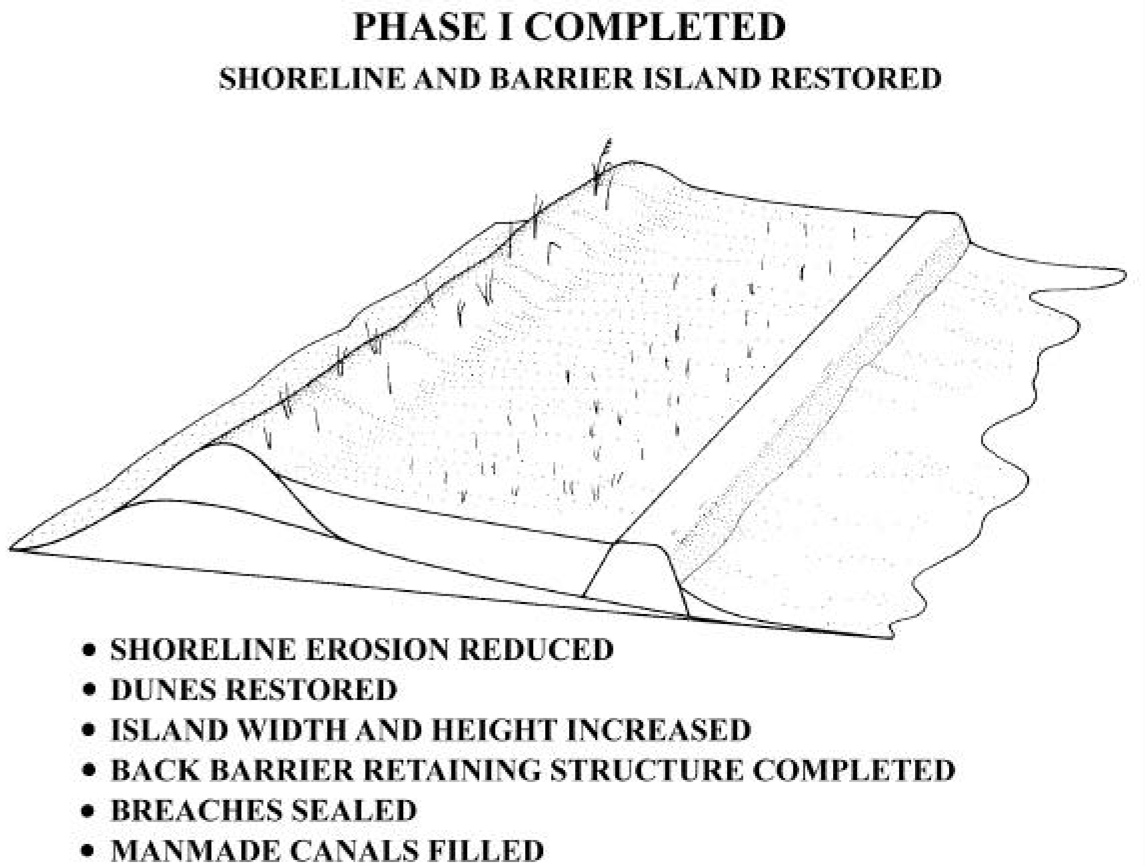

Figure 17. Oblique aerial schematic of restored barrier island (Phase I completed).

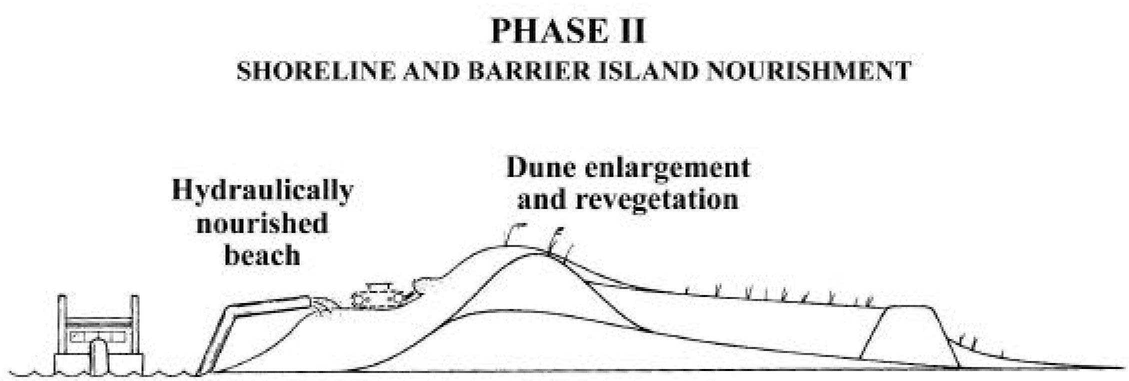

Figure 18. Cross-sectional view of shoreline and barrier island nourishment (Phase II of the Louisiana Coastal Protection Master Plan).

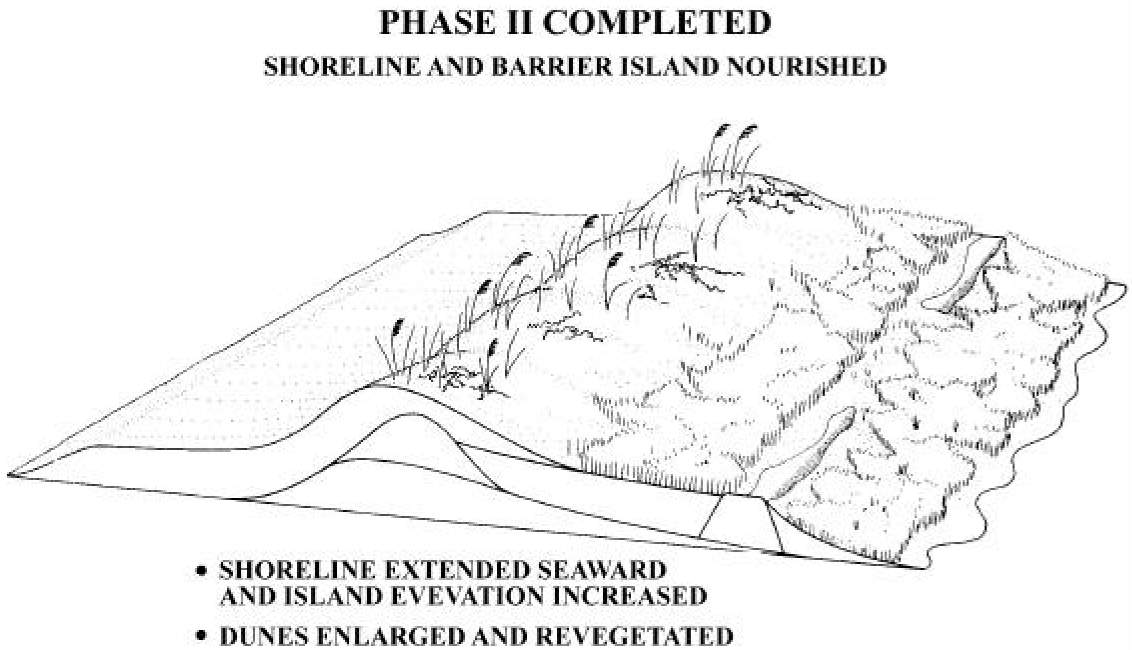

Figure 19. Oblique view of shoreline and barrier island nourishment (Phase II completed).

Marsh Management

The term "marsh management" refers to a variety of activities. The philosophy behind this approach is that human activities have so disrupted the natural wetland system that the best hope for maintaining these ecosystems is for society to step in and limit further damage. The most common form of marsh management in Louisiana is to regulate the flow of water in and out of the marsh, with the general goal of limiting salinity and controlling water levels, and to plant vegetation.

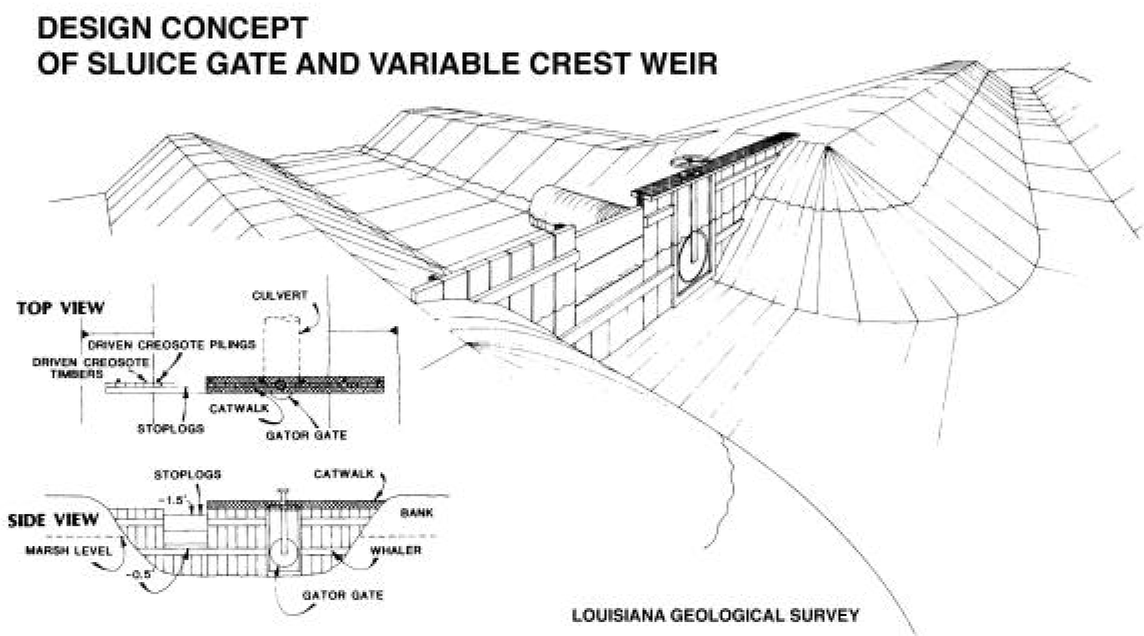

Figure 20. Design concepts for sluice gate and variable crest weir structures.

Such schemes typically involve regulating water flow in or out of wetland management units ranging in size from several acres to about five thousand acres. Wetland tracts larger than this are difficult to manage and are often partitioned into smaller units. Water flow is regulated by a system of retaining levees or dikes and some form of water control structure. Commonlyused structures include fixed- and variable-crest weirs, single- and double-flapgated culverts, and sluice gates. (See Figure 20 These structures can be operated to allow juvenile marine organisms some access to internally managed wetlands for use as nursery and feeding areas. Other management schemes involving forced drainage (mechanical pumping) to regulate water levels may prevent marine organisms from using managed areas. Currently, forced drainage is limited to populated areas.

Though goals of individual marsh management plans may vary widely, most plans usually incorporate features that enable control of water levels and salinity by preventing inflow of excess saltwater and by regulating freshwater output or inputs (rainfall, runoff, or introduced freshwater) until the desired water level or salinity is reached.

Examples of wetland areas utilizing passive (gravity-operated) marsh management schemes include much of the state-owned Department of Wildlife and Fisheries refuges and numerous privately maintained marsh tracts. These areas are often managed to optimize vegetation growth and to maintain water level conditions best suited for waterfowl that winter in these wetlands. Management of commercial crawfish ponds and other aquacultural efforts typically involves active pumping to achieve desired water levels.

An important advantage of this approach (as well as wetland restoration) is that major landowners can implement these measures themselves. Since conversion of land to open water can deprive them of income from mineral extraction, fishing, hunting, and trapping, landowners often have an incentive to manage their marshes without help from the public sector. However, because federal activities that have benefited all of society have contributed to much of the wetland loss, an argument can be advanced for public subsidies of these activities. This may be particularly advantageous if such subsidies would result in more wetland protection than equivalent expenditures for federal, state, and local wetland protection projects. Although the recent reform of the federal tax code suggests that new federal tax incentives are unlikely, the current code permits deduction of contributions to conservation groups that restore or protect wetlands.

The restoration potential of these measures is also limited. Most important, as relative sea level rises, passive management of water flow will become increasingly difficult. While tidal gates and gravity may be sufficient to adequately drain wetlands today, if sea level rises a few more feet, it will be necessary to actively pump the water out.

Terrebonne Parish is considering a plan for long-term marsh management. A tidal surge levee through the interior of the parish would be built, and marsh inland of that levee would be actively managed by forced and gravity drainage, even after the sea has risen a few feet above the marsh. The parish estimates the cost at over $100 million. This plan, however, would only be a partial solution. Although birds, animals, and some fish would benefit from the protected vegetation, active pumping systems currently do not allow shrimp and other marine organisms to pass from one side of the levee to the other. Until cross-levee migration becomes possible, this approach would do less to benefit commercial fisheries than other methods of protecting an equivalent number of acres. Nevertheless, it might be more practical than increasing sediment supplies in places that are far from active distributaries such as eastern Terrebonne Parish, particularly if sea level rise accelerates.

A final marsh management technique involves periodic spraying of sediment on the marsh to increase its rate of vertical accretion. Technologies to accomplish this goal have only recently emerged, and have some of the same logistical and cost problems as marsh creation. In spite of these difficulties, this technique may prove useful in certain areas that are just barely being submerged due to a sediment deficit. Clearly, it would be far cheaper to supply sediment to an existing, living marsh than to fill a bay to the level necessary to create a new marsh; it would also disrupt ecosystems less. (This practice is being applied to a limited extent to marsh adjacent to new canals in Terrebonne Parish.)

Canals and Land Use

Thus far, we have examined specific technical solutions without regard to how they might be implemented. Barrier island restoration will almost certainly be a public program, while marsh building and marsh management can be undertaken either as public or private efforts. By contrast, decreased speeds for boat traffic, a cutback in marsh buggy traffic, and less conversion of wetlands to dry land would generally involve public regulation of private activities. Curtailing the adverse impacts of canals could involve regulatory programs or public works.

Several researchers have proposed that the use of canals be replaced with less damaging alternative forms of transportation, such as hovercraft, which are used by oil companies in Alaska but not Louisiana. A halt to the dredging of canals would decrease the loss of wetlands. However, existing canals would continue to convey saltwater into freshwater wetlands, and would continue to convert marsh to open water as they widened.

For this reason, some have suggested that a portion of existing canals be filled or plugged. Such a strategy might be accomplished either as a regulatory program or as a public work. A regulatory program might, for example, require that for every mile of new canal, two miles of old canals must be filled or plugged. Such a policy could gradually reduce the damage caused by canals. However, it might also make the use of canals economically less attractive than alternative forms of transportation such as hovercraft, in which case the dredging of new canals would end and no canals would be sealed off.

Although reducing canalization of Louisiana's wetlands would have environmental benefits, the cost of doing so would be very great. Moreover, even a complete restoration of the original marsh would not prevent wetlands from being submerged, which could destroy a large fraction of Louisiana's wetlands in the next century if the present confinement of the Mississippi River continues.

Diversion

A class of options collectively called "diversion" would enable at least a fraction of Louisiana's wetlands to keep pace with even an accelerated rise in sea level. These options have the greatest chance of permitting the long-term survival of Louisiana's wetlands because they imitate the natural processes that have created and sustained these wetlands for the last several thousand years. Unfortunately, these measures would also impose higher costs than the shorter-term solutions discussed above.

The most imminent diversion strategy is the construction of freshwater diversion structures. (See Figure 21.) Such projects would partly offset the freshwater starvation caused by the river levees, decreasing marsh salinities and thereby slowing the rate of marsh loss. Although some sediment would also be supplied to the marsh, the amounts would not be sufficient to enable extensive areas to keep pace with current or projected rates of subsidence and sea level rise. Moreover, as long as there is a need for a self-scouring main channel of the Mississippi, there will be a limit to how much water can be diverted before the flow of the river slows more than navigation policy makers will accept. Nevertheless, freshwater diversion structures could provide important protection of wetlands as part of a short-term strategy to buy time while a long-term strategy is put into place.

Figure 21. Freshwater diversion structure at Bayou LaMoque in Plaquemines Parish, LA.

Table 4 illustrates estimates by the Corps of Engineers (1984b) of the potential for two proposed freshwater diversion structures in Barataria Basin and Breton Sound. The projected wetland loss of close to one half million acres in these two basins by 2035 could be reduced by almost one hundred thousand acres. These projections illustrate both the potential and the limitations of diversion structures.

Table 4
Potential Wetland Acreage Saved by Two Proposed Freshwater Diversion Structures
(thousands of acres)

	Barataria	Breton Sound
Current (1985) Acreage	430.5	182.9
Remaining Wetland by 2035*		
Without Diversion	245.1	131.4
With Diversion	327.8	147.8

*Assuming current rates of sea level rise.

Planned structures would reduce to 23 percent the expected 39 percent wetland loss in the next fifty years. This would represent a 20 percent reduction in the rate of statewide wetland loss.

Source: U.S. Army Corps of Engineers (1984b).

A widely advocated diversion scheme that might have a greater long-term impact would be to allow the Mississippi River to change its course to the Atchafalaya River. If this happened, the sediment flowing down the river into the shallow waters of Atchafalaya Bay would create new wetlands, rather than be carried off the edge of the continental shelf, provided that the Atchafalaya River was not subsequently modified in the fashion that has occurred with the main channel of the Mississippi River.

This latter qualification is important because the river levees being built and planned along the Atchafalaya would prevent sediment and freshwater from reaching western Terrebonne Parish. We are not certain whether the Atchafalaya will be engineered to deliberately convey all sediment off the continental shelf, or whether there will be the same need for a deep draft (50-foot) self-scouring channel.

While permitting the formation of a major new delta, diversion to the Atchafalaya would cause problems for many people. Substantial sedimentation would occur in the part of the Mississippi River immediately below the Old River Control Structure. Fortunately, the need for increased dredging in this area would not be prohibitive, because ocean-going vessels do not venture this far upstream. Another important consequence is that saltwater would be able to move farther up the Mississippi, perhaps reaching the drinking water intakes for New Orleans. (Although a shift to alternate supplies would be costly, such costs might prove to be a "blessing in disguise." The current water supply is of such low quality that one-third of the city's residents drink bottled water; Houma is currently making such a shift.) Increased Mississippi River salinity would also force some industrial users to install corrosion-resistant pipes.

An increased flow down the Atchafalaya would require the federal government to change its policy of maintaining the present flow ratio, in which it has invested billions of dollars. Finally, a new course for the river would require Morgan City and other communities along the Atchafalaya River to be either abandoned or protected with ring levees. Although abandoning a few communities voluntarily on a planned basis may be preferable to a subsequent eventual involuntary (unplanned) abandonment of the entire coastal zone, our political system might tend to avoid wrestling with difficult short-term problems by gravitating toward the latter no-action alternative.

Another diversion option that would permit wetlands to keep pace with an accelerated rate of sea level rise would be to separate navigation from the flow of the river. The rationale for such a measure is that navigation's need for a rapidly flowing self-scouring channel and the wetlands' need for freshwater and sediment are mutually exclusive.

Several measures for separating navigation from stream flow have been investigated. The New Orleans Dock Board considered diversion of shipping to a set of parallel canals along the Mississippi River Gulf Outlet, and the Corps has investigated a new channel to replace Southwest Pass. If ships used locks instead of the main channel, it would not matter if the flow of the river were slowed by freshwater diversion structures or breaches in river banks south of Venice, and new wetlands could form in substantial numbers.

The major disadvantage of this approach is the initial construction costs. In addition, shellfish production in some areas would decline, although the long-term reductions in production throughout the state would be far greater if no measures were taken. Other options, such as a new, deep water port, might also be feasible, but would have greater initial costs.

Other diversion schemes may also be worth investigating. Bayou Lafourche was an active Mississippi River distributary until it was sealed off by the Atchafalaya and Lafourche Levee Boards under the authority of the River and Harbor Act of 1902. Although the substantial development that subsequently took place (and still exists) along Louisiana's original "main street" would make a complete reactivation costly, the bayou might be used to convey a limited amount of freshwater to Terrebonne and Lafourche Parishes. The Corps has also investigated schemes to divert freshwater down the Violet Canal; however, much of the water could be lost down the Mississippi River Gulf Outlet, bypassing most of the marsh.

Although diversion of the Mississippi River to the Atchafalaya or separation of navigation from streamflow would be likely to achieve the maximum degree of wetland protection and creation, we have serious reservations about whether they would be politically feasible. Nevertheless, assessments of technically viable options should consider these measures and allow the political process--not this panel--to accept or reject options due to political feasibility.

SUMMARY

Although the loss of wetlands in Louisiana is becoming increasingly serious, it is not for a lack of options to control that loss. The problem is that the conditions that have created wetland loss are intertwined with such indispensable activities as flood prevention, shipping, and petroleum extraction. Projects have been authorized--though not funded--which would significantly slow the rate of wetland loss due to saltwater intrusion. But restoring the sediment supply necessary for the wetlands to keep pace with current subsidence (as well as projected sea level rise) would require an end to the current situation in which most of the sediment of the Mississippi River flows into the Gulf instead of the wetlands.

Given the practical realities of today, many of the panel members doubt that this will ever happen. Diversion of the Mississippi River to the Atchafalaya would require a reversal of a major long-standing policy and separation of navigation from streamflow would increase the cost of shipping. Both measures would cost billions of dollars, and no other methods have been identified to completely restore sediment supply. Nevertheless, the panel has concluded that if no politically feasible means of stopping 50 to 100 percent of the wetland loss can be identified, it is more prudent to consider measures that do not appear to be politically feasible today than to limit a long-term evaluation to measures that can only delay the inevitable.

However, it would be wrong to conclude that long-term evaluations warrant delay or reconsideration of authorized projects. If costly long-term programs of diversion or canal filling must ultimately be implemented, the planned freshwater diversion and barrier island restoration projects will still be necessary. Whether or not sea level rise accelerates, these short-term measures complement development of a long-term strategy and will help buy time for its eventual implementation.

The next chapter discusses the currently authorized projects in moredetail, while the following chapter lays out a plan for assessing the long-term options.