ENVIRONMENTAL ASSESSMENT

MISSISSIPPI DELTA REGION
CAERNARVON FRESHWATER DIVERSION STRUCTURE
CHANGE IN STRUCTURE OPERATION
PLAQUEMINES AND ST. BERNARD PARISHES, LOUISIANA

EA # 392

INTRODUCTION

The U.S. Army Corps of Engineers (USACE), New Orleans District (CEMVN), has prepared this Environmental Assessment # 392 (EA #392) to evaluate a change in the operational plan for diverting Mississippi River water via the Caernarvon Freshwater Diversion Structure (CFDS). The proposed action is located near Caernarvon, Louisiana, at Mississippi River Mile 81.5 Above Head of Passes. The CFDS diverts Mississippi River water through an outflow channel, into the Breton Sound Basin (Figure 1). EA # 392 has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, Council on Environmental Quality's Regulations (40 CFR 1500-1508), and Corps procedures for implementing NEPA (33 CFR 230; Engineering Regulation, ER 200-2-2). The following sections include a discussion of the purpose and need for the proposed action, the authority for the proposed action, alternatives to the proposed action, significant resources that could be affected by the proposed action, and the proposed action's impacts, or lack of impacts.

This document is intended to complement the final Environmental Impact Statement (FEIS) "Louisiana Coastal Area, Louisiana; Freshwater Diversion to Barataria and Breton Sound Basins" filed with the U.S. Environmental Protection Agency on April 5, 1985, and a signed ROD on July 16, 1987, which is incorporated herein by reference. Numerous operational plans for the CFDS have been implemented since the project and its effects were described 1985 FEIS. The plans differ from the conceptual plan for operation described in the FEIS, and the variability between plans is indicative of the kinds of changes that are likely to continue in the future.

The State of Louisiana, as represented by the Louisiana Department of Natural Resources (LDNR), is obligated to operate and maintain the CFDS, pursuant to the "Agreement between the Department of the Army and the State of Louisiana for Local Cooperation" that was executed on June 10, 1987. The Caernarvon Interagency Advisory Committee (CIAC) was established by LDNR in furtherance of its local cooperation on the CFDS; and to advise the Secretary of LDNR relative to the operation of the CFDS. The CIAC meets annually to discuss the current and future studies from the agencies and academia, and votes on changes to the operational plan. The CIAC members include CEMVN, LDNR, U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), Environmental Protection Agency, Louisiana Department of Wildlife and Fisheries (LDWF), Louisiana Department of Environmental Quality (LDEQ), Louisiana Department of Health & Hospitals, local parish governments, landowner's representative, oyster fisheries representative, shrimp fisheries representative, and recreational fisheries representative.

The first operational plan for the CFDS was implemented in November 1990. The plan was based on monthly target salinity levels at three stations on the public oyster seed grounds. The salinity targets were

taken from a study of oysters in the Breton Sound Basin. The study resulted in development of an optimal salinity regime for oyster production (Figure 2). The second operational plan for the CFDS differed from the first by a change in the optimal salinity regime in the salinity targets for the months of May and June. This change was due to the fact that the steep climb in salinity from 7.0 parts per thousand (ppt) in May to 12.5 ppt in June would not likely be attainable because of residual freshwater in the system, and therefore the curve was smoothed as shown in Figure 3. Thus, the operational plan had a May target of 9.0 ppt, and a June target of 11.0 ppt.

In November 1991, the CFDS's operational plan was modified by reducing the salinity targets for December through February to the bottom of the range for those months in the optimal salinity regime. In addition, the May salinity target was decreased back to 7.0 ppt (Table 1). In April 1992, the May target salinity was changed back to 9.0 ppt, in response to concerns about the impacts of low May salinity on the brown shrimp harvest. In August 1993, a minimum flow of 700 cfs was instituted. In addition, a constant flow of 8,000 cfs was to be implemented for the months of December through February, unless salinities fell below 5 ppt at three stations on the public seed grounds (N. California Bay, Bay Gardene, and Black Bay), or below 3 ppt at the Bay Gardene station (Table 2).

In November 1997, the operational plan was changed from a salinity-based plan to a plan with targeted flow ranges for each month combined with annual average salinity targets, and salinity minima for some months, and maxima for other months (Table 3). A modification in March 2000 raised the maximum flow from February 15 through April from 2,000 to 4,000 cfs (Table 4). In 2001, 2002, and 2003 high and low flow pulses were included as part of an LSU experiment between the months of January and April, and a high flow of 5,600 cfs was added in December when waterfowl season closed (Table 5). In January 2004, the pulses were added as part of the plan, and the flow range increased to 5,000 cfs; in February and March the flow range increased to 6,500 cfs; and in July through November the flow range increased to 4,000 cfs (Table 6). Snedden et al., (2006) found that "Together, these data show that diversions that coincide with river flood events tended to deliver more sediments to Breton Sound than those that occurred during relatively low discharges." This suggested that diversion pulses could potentially transport much needed sediments for marsh nourishment and still control salinities.

In 2005, the flow range was 6,500 cfs for all months (Table 7). The 2006 operational plan added pulses of 7,500 cfs up to 20 days in the months of December through June; otherwise the maximum flow range was 6,500 cfs (Table 8). The 2007 operational plan has a potential flow range from 0-8,000 cfs with a typical range shown in Table 9, with the following salinity parameters. The salinity at Bay Gardene will be monitored to stay above 3 ppt as a 4 week moving average. If the salinity at Bay Gardene station rises above 9 ppt, based on a 4 week moving average, Caernarvon discharge will be increased, to decrease the average to 8-9 ppt for oyster production. The CIAC will seek to maintain an annual average 5 ppt line, based on a yearly average, and monitor salinities as to promote enhancement of oyster production in the public seed grounds and to achieve other stated benefits of the project. The LDNR structure coordinator may modify the timing of pulses based on waterfowl or fisheries concerns, and in accordance with the March 1992 CEMVN Operation and Maintenance Manual. Every effort will be made to pulse during river rise for sediment delivery for marsh recovery. Pulses during frontal passage may be done at the discretion of the structure coordinator. The length of the pulse will depend on salinity conditions. The project area shown in Figure 1 is expected to remain the same with freshwater nourishing the marsh and flowing through the deeper canals and bayous into the bays and lakes.

PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the proposed action is to modify the operation of the CFDS from the originally proposed plan to one that achieves greater benefits to the environment of the Breton Sound Basin. The proposed action results from knowledge and experience gained from operating the project, and from scientific research studies, which indicates that changes to the originally conceived operation of the structure could improve the realization of the project goals.

AUTHORITY FOR THE PROPOSED ACTION

The CFDS is an element of the Mississippi Delta Region Project, which is a feature of the Mississippi River and Tributaries project, authorized by the Flood Control Act of 1928, PL 70-391, and modified by the Flood Control Act of 1965, PL 89-298 to include the Mississippi Delta Region Project as recommended by the Chief of Engineers in House Document No. 308, 88th Congress, 2nd Session, and further modified by the Water Resources Development Act of 1986, P.L. 99-662. The project provides for four salinity control structures; two on the east bank and two on the west bank of the Mississippi River, to introduce fresh water into the delta region.

PRIOR REPORTS

This document compliments the FEIS "Louisiana Coastal Area, Louisiana; Freshwater Diversion to Barataria and Breton Sound Basins" filed with the U.S. Environmental Protection Agency on April 5, 1985, and a signed ROD on 16 Jul 1987, which is incorporated herein by reference.

PUBLIC CONCERNS

The public is concerned with the rapid loss of coastal wetlands in Louisiana, which are being lost to subsidence and erosion at a rate of approximately 25 square miles per year. Various measures have been used to try to reduce the rate of loss, and it is widely recognized by the public and in the scientific community, that reintroduction of Mississippi River water, with its associated nutrients and sediments, could be an effective tool for reducing land loss. Historically, before the Mississippi River levees were constructed, the river would rise in the late winter and spring. The freshwater would overtop the banks and transport sediments and nutrients into the receiving marsh. Levees were constructed to protect the citizens and property from these flooding events, but in turn, negated the natural process of marsh nourishment. The CFDS mimics this natural process in the Breton Sound Basin by allowing freshwater from the Mississippi River back into the marsh.

The public is also concerned about the effect of freshwater and sediments on estuarine fisheries of the receiving waters. There are concerns that productive oyster reefs could be rendered unproductive by over-freshening or from deposition of silt. Another concern is that the brown shrimp fishery could be impacted by the decrease in salinity in the spring months. Another concern is the potential formation of algal blooms triggered by the introduction of nutrient-rich river water.

DESCRIPTION OF THE PROPOSED ACTION

The proposed action consists of the implementation of a revised operational plan for diverting river water through the CFDS (Table 9), and the continued refinement of the operational plan to maximize project benefits. The 2007 operational plan has a potential flow range from 0-8,000 cubic feet per second (cfs). In addition, the CFDS would be used to maintain an annual average salinity of 5 ppt in the area of the "with-project 5 ppt line", as discussed in the 1985 FEIS (Figure 1). Future changes to this operational plan are expected, as monitoring data reflecting the effects of the diversions becomes available. This document allows for flexibility to cover these minor changes as long as they are within the 8,000 cfs flow range and are approved by the CIAC and the CEMVN. Possible changes could be made to monthly flow ranges, annual salinity targets, or minimum flows.

The proposed action has actually been in effect in some form since 1991. The operation of the CFDS over the last 15 years reflects the proposed action, not the No Action alternative, because past operation has not conformed to the FEIS. Deviations from the operation described in the FEIS have included diversions throughout the calendar year since the beginning of operation. Minimum flows were introduced in 1993 and pulses were added in 2001. Thus, project results to date reflect the impact of the proposed action.

The salinity targets of the proposed operational plan are similar to the salinity goal described in the FEIS. Maintenance of the position of the post-project 15 ppt line, also known as the Ford line, from April through September (a project goal in the FEIS) can be achieved while maintaining the average annual position of the 5 ppt line as shown on Table 2. Both measures are consistent with typical salinities observed in a low salinity year. However, managing for an annual or seasonal average salinity at the Ford line is extremely difficult, since daily salinities vary so widely in the open waters of the Breton Sound Basin in this area. Therefore, a goal of maintaining the position of the 5 ppt line was instituted because it is a more manageable goal. While the FEIS described a structure with a maximum capacity of 6,600 cfs, the CFDS was built with a maximum capacity of 8,000 cfs. The proposed change in operation would allow for flows up to this maximum capacity. The proposed change in operation would also be consistent with the March 1992 CEMVN Operation and Maintenance Manual for the CFDS, which states that flows through the structure should not exceed 8,000 cfs.

Short-term high flows, called "pulses", have been implemented for the past seven years. For example, flows of 7,500 cfs lasting for periods of 20 days each were implemented within the last year. Minor changes in operation based on environmental monitoring, such as pulses, would be recommended and implemented under the proposed change in operation. The impacts to important resources described in this EA would be similar to those that would occur, if other minor changes to the operational plan were to be implemented. The description of impacts below was prepared under the assumption that the proposed action would include continuing refinements to the operational plan in an effort to maximize project benefits.

ALTERNATIVES TO THE PROPOSED ACTION

Numerous alternatives to the proposed action were considered. The alternative operational plans were discussed in CIAC meetings, and various operational plans have already been implemented since the CFDS was completed in 1991. The impacts of the No Action alternative are also described in this EA.

No Action. Under the no-action alternative, the proposed action would not be implemented. The CFDS would be operated as described in the FEIS. With diversions from January through April, the project was expected to maintain the average position of the Ford line from April through September (Figure 1). The project is designed to maintain the optimal salinity regime in the Breton Sound Basin for the driest year that would occur in an average ten-year rainfall cycle. During this "10-percent drought" year, the peak flow of 6,600 cfs would be diverted. Three years out of ten, no diversion would be necessary at all, as rainfall in the area would be sufficient to achieve target salinity levels. During the remaining six years, the flows would range between 1,800 and 6,600 cfs.

ENVIRONMENTAL SETTING

GENERAL

The area affected by the CFDS is the Breton Sound Basin, located south of New Orleans, on the east bank of the Mississippi River. The area is bounded on the north by the non-federal Braithwaite/Scarsdale levee and Bayou La Loutre, on the southwest by the Mississippi River, on the northeast by the Mississippi River Gulf-Outlet, and on the southeast by the Gulf of Mexico. The dominant habitat types in the study area are fresh, intermediate, brackish, and saline marshes and associated fresh to saline water bodies. Barrier islands border the southern edges of the Breton Sound Basin.

Water level at the Braithwaite/Scarsdale non-federal levee can be affected by water flow through the CFDS. The CEMVN is currently repairing sections of the levee that breached during Hurricane Kartina, and LDNR is restricting flows through the CFDS until repairs are complete. Plaquemines Parish Government will resume responsibility for the non-federal levee after repairs are completed. Plaquemines Parish has agreed that flow rates from the CFDS can safely be increased after grass cover on the levee is established, provided that the footnotes in the 2007 Operational Plan are complied with for maximum water levels adjacent to the Braithwaite/Scarsdale non-federal levee. The Plaquemines Parish Government Land Department, in association with the LDNR CFDS operator and CEMVN, will monitor water levels related to increased flows in accordance with the 2007 Operational Plan.

According to data used in a recent study of land loss by the National Wetland Research Center of the U.S. Geological Survey (USGS), there were approximately 69 square miles of net land area change between 1956 and 2004. Between the fall of 2004 and the fall of 2005, after Hurricanes Katrina and Rita, "the Breton Sound basin's water area increased by 40.9 square miles" (USGS 2006). The suggested land lost can be seen in the aerial photos dated November 7, 2004 and October 25, 2005 (Figure 4). Over 90 percent of the new water area appearing after the hurricanes in Breton Sound occurred within marshes that had been previously classified as fresh and intermediate (that is, between fresh and brackish in salinity) (USGS 2006). The 2007 CFDS operational plan could potentially combat these losses by introducing more sediment rich freshwater into the Breton Sound Basin. The increased flows would transport more sediments and nutrients and enhance marsh growth.

Agricultural crops grown in the area include citrus fruits and truck crops. Important terrestrial animals in the area include nutria, muskrat, raccoon, mink, and otter, which are harvested for their furs. White-tailed deer, rabbits, various small mammals, and a variety of birds, reptiles, and amphibians also occur in the study area. The American alligator is harvested throughout the area for its meat and hide, especially in the fresh/intermediate marshes. The marshes and shallow bays in the area function as nursery grounds for

valuable stocks of shrimp, oysters, crabs, and finfishes. These resources provide excellent opportunities for sport and commercial fishing. Popular recreational activities include fishing, hunting, and boating.

The petroleum, chemical, and related industries, the Port of New Orleans, and commercial fisheries form the economic base of the area. Major commodities moving through the port include grain, petroleum products, salt, and sulphur.

CLIMATE

Due to its proximity to the Gulf of Mexico, the area has a subtropical marine climate. The project area has two definite rainy periods; one from mid-June to mid-September, and the other from mid-December to mid-March. Annual normal precipitation is approximately 61.6 inches. Variations do occur with monthly totals sometimes exceeding 20 inches. Ground water surface varies in depth between 1 to 4 feet below the surface. Wind averages 7.8 mph in the project area with predominant directions being north-northeast from September through February and south-southeast from March through June. At least 10 major hurricanes or tropical storms have affected the project area since 1915 including Betsy (1965), Carmen (1974), Juan (1985), Andrew (1992), Georges (1998), Lili (2002), Ivan (2004), Dennis (2005), Katrina (2005), and Rita (2005). With the exception of Hurricane Katrina, these storms caused elevated water levels of 3 to 6 feet above normal in the project area. According to the National Oceanic and Atmospheric Administration, storm surges in eastern Louisiana from Hurricane Katrina generally ranged from 10 to19 feet. Storm surges and associated waves from these storms have significantly eroded marsh within the project area.

IMPORTANT RESOURCES

This section contains a description of important resources and the impacts of the proposed action on these resources. The important resources described in this section are those recognized by: laws, executive orders, regulations, and other standards of national, state, or regional agencies and organizations; technical or scientific agencies, groups, or individuals; and the general public. Important resources described in the 1985 FEIS, which would not be impacted by the proposed action, include bottomland hardwood forests, agricultural lands, the Mississippi River, Blue List Species, nesting colonies, swamps, barrier islands, minerals, state wildlife management areas, national parks, and the Louisiana Natural and Scenic Streams System. Important resources described in this section include marshes, water bodies, water quality, fisheries, wildlife, essential fish habitat, endangered or threatened species, cultural resources, recreational resources, and air quality.

MARSHES

Existing Conditions

The following federal laws recognize the national significance of marshes as a natural resource: the Clean Water Act of 1977, as amended; Executive Order 11990 of 1977, Protection of Wetlands; Coastal Zone Management Act of 1972, as amended; and the Estuary Protection Act of 1968. Marshes are ecologically important because they: 1) provide necessary habitat for various species of plants, fish, and wildlife; they serve as ground water recharge areas; 2) provide storage areas for storm and flood waters; 3) serve as natural water filtration areas; 4) provide protection from wave action, erosion, and storm damage; and 4) provide various consumptive and non-consumptive recreational opportunities. Marshes are significant to the public because of the high value the public places on the ecological functions and human benefits that marshes provide.

The Breton Sound Basin has extensive marshes, ranging from fresh to saline. Vegetation is dominated by wiregrass, with oyster grass, three cornered grass, needlegrass, and salt grass also prevalent. There has been a dramatic conversion of brackish and saline marsh to intermediate and fresh marsh since the CFDS began operating. Historically, these marshes flooded naturally in late winter and spring from the Mississippi River. The marshes also flood naturally from normal tidal events and seasonal weather conditions.

Recently, a study of land loss conducted by the USGS using aerial photographs, from the fall of 2004 to the fall of 2005, after Hurricanes Katrina and Rita, concluded "the Breton Sound basin's water area increased by 40.9 square miles" USGS (2006). The land change can be seen in the aerial photos dated Nov. 7, 2004 and Oct. 25, 2005 (Figure 4). However, the latest aerial photos dated March 2, 2006 and September 26, 2006 USGS (2006) (Figure 5) suggest that the marshes are recovering. The CFDS is helping to slow this rate of loss. Past studies have shown that plant biomass production has increased as a result of nutrient addition and lowering of salinity, and measured accretion rates were sufficient to keep pace with projected water level increases due to subsidence (Delaune and Patrick, 2002).

Future Conditions with No Action

Without implementation of the proposed action, marsh loss would continue in the Breton Sound Basin, although the rate of loss would be reduced by the Caernarvon project. Eventually, a delta-splay type of marsh is expected to develop in Big Mar, the nearest open water body to the CFDS, as sediment from the diversion is deposited. Because one of the factors contributing to marsh loss is saltwater intrusion, the Caernarvon project is expected to reduce marsh loss in the basin by approximately 16,000 acres over the 50-year project life. The projections above are based on achieving the salinity goals as described in the FEIS. However, with diversions occurring only in the months from January through April, those salinity goals are often unlikely to be achieved, and therefore less marsh would be preserved than the amount stated above.

Future Conditions with the Proposed Action

With the proposed action, a minimum flow of at least 6,500 cfs would typically be diverted during most of the year if the head in the river is available, except when there is a threat of coastal flooding, oil or chemical spill on the Mississippi River, or other emergency. This constant flow would maintain a freshwater head in the vicinity of the project, providing stable salinity conditions for marshes. Past surface elevation and vertical accretion data measured from 1996-2000 indicate that land elevation has increased. The Caernarvon study sites had wetland surface elevation change rates ranging from approximately 0.16 to 0.42 cm per year, vertical accretion ranged from 0.75 to 1.57 cm per year, and shallow subsidence ranged from 0.59 to 1.21 cm per year (Lane et al., 2006). The pulsing of water, or the diversion of high flows for short periods, results in an enhanced delivery of sediment into marshes nearest the structure.

According to a study conducted in the spring of 2002 and 2003, "sediment delivery during each pulse was highly variable (11,300-43,800 metric tons), and was greatest during rising limbs of the Mississippi River flood events" (Snedden et al., 2006). Pulses have been implemented for the past seven years, and increased sedimentation rates were observed on the marsh floor near the CFDS. The marshes in this area are not flooded by the diversion until flows reached approximately 4,000-5,000 cfs. A diversion flow of 8,000 cfs is expected to have a similar marsh inundation footprint with the majority of the water flowing down deeper canals, bayous, bays, and lakes including Bayou Mandeville, Lake Lery, and Black Bay. The higher flows allow nutrient-rich water to flood marshes that are generally above normal tides.

The area that is flooded depends upon winds and tides during high flows. Under typical conditions with the proposed action, the marshes would be flooded to the west and south of Big Mar and Lake Lery for a distance of a couple miles. The minimum flow of at least 6,500 cfs on a year-round basis is expected to provide a more stable salinity level for the freshwater marshes in the Caernarvon area. Peak salinities, which generally occur in the fall months, would be moderated by the constant flow of fresh water. The moderation of peak salinities could be important in reducing land loss in this area, and increased sediments should eventually create marsh providing much needed levee protection. Farther from the diversion project, salinities would be comparable to the Future Conditions with No Action.

Land loss/accretion trends observed in the upper basin since the CFDS was constructed are expected to continue in the future with the proposed action.

WATER BODIES

Existing Conditions

Fresh to saline water bodies of various sizes and depths are interspersed throughout the study area. According to the USGS, the Breton Sound Basin contains approximately 696 square miles of water bodies. The water bodies include ponds, lakes, streams, bayous, canals, bays, sounds, tidal passes, and pipeline canals. These water bodies are inhabited by a variety of finfish and shellfish, and provide valuable nursery habitat for many important species.

Future Conditions with No Action

Without implementation of the proposed action, no further impacts to water bodies are anticipated.

Future Conditions with the Proposed Action

With the proposed action, impacts to water bodies would be minimal. The proposed action would affect the approximately 696 square miles of water bodies in the Breton Sound Basin, but impacts would be very similar to the No-Action alternative. The primary difference in impacts would relate to seasonal freshening of the upper basin. Impacts related to salinity and concentrations of nutrients and sediments are discussed further in the Water Quality section.

WATER QUALITY

Existing Conditions

An assessment of the Mississippi River (within Louisiana's jurisdiction) by the Louisiana Department of Environmental Quality (LDEQ) cites the suspected causes of water quality impairment to be nutrients, including nitrogen and phosphorus and pathogens in the water. The suspected sources of impairment include municipal point source discharges and upstream sources. LDEQ lists the Mississippi River Basin Coastal Bays and Gulf Waters as impaired with the suspected cause of water quality impairment being mercury. The suspected source of impairment is atmospheric deposition. The LDEQ Section 305 (b) Report for 2004 lists the waterbodies in the Breton Sound Basin as fully supporting their respective designated uses, except that the waterbodies in the upper basin do not support shellfish propagation due to total fecal coliform exceedances. The potential sources of impairment are listed as wildlife other than waterfowl and on-site treatment systems. The Louisiana Department of Health and Hospitals determines, on a seasonal basis, areas closed to oyster harvest based on sampling for fecal coliform.

Water quality data were collected for the CFDS from 8 sampling locations from 1988-1994. The frequency of violations of the 1986 USEPA saltwater aquatic life chronic criteria were reviewed for the preconstruction period (1988-1990) and compared to that of the post-construction period (1991-1994). Violations for copper, cadmium, mercury, pH, fecal coliform, pesticides and dissolved oxygen increased in the postconstruction period, while violations for nickel, lead, and turbidity decreased. Such comparisons can be misleading, however. For example, turbidity is significantly increased in the receiving area during diversions, but this effect may not be well captured by monthly samples from stations 11 miles or more away.

There were 15 instances in which the frequency of criteria violations was at least twice as great in the preconstruction period as in the postconstruction period, and there were 16 instances where the opposite was true. An analysis of the patterns of the violation data showed no definite correlation between freshwater diversion and degradation of water quality in the receiving area (CEMVN, 1995). For example, many of the increases in violations were at stations farthest from the diversion structure, and in other cases, concentrations were greater in the receiving area than in the Mississippi River. However, the report did conclude that increases in fecal coliform levels did appear to be related to freshwater diversion.

The temperature of Mississippi River water is lower than the temperature of the receiving area. Mississippi River water averages 5° C to 8° C cooler than the receiving area from January through April, with temperature differentials of 10° C to 12° C not being uncommon. Differentials in excess of 20° C have been recorded. The Mississippi River has relatively high concentrations of nutrients, which raises a concern about eutrophication in receiving waters near freshwater diversions. High levels of nutrients in the water can cause excessive algal growth, or "blooms." Some species of algae produce toxins, and blooms can lead to hypoxic conditions as bacteria decomposes dead algae. These conditions can lead to fish kills. Water quality sampling undertaken for the CFDS from 1988 through 1994, shows that nutrient levels increased in the upper basin during the postconstruction period. Means for total phosphorous, nitrate, and nitrite increased over preconstruction means. This is not unexpected, since, much of the water in the upper basin is river water during diversions.

While noxious algal blooms have not been a problem in the waters near the CFDS, some indicators of eutrophic conditions have been observed in the upper basin. During the summer of 2001, elevated chlorophyll levels as high as 60 parts per billion were observed in Grand Lake (R. Lane, unpublished data). This was during a period of low or no discharge from the CFDS and was most likely due to (1) increased benthic regeneration of nutrients during the warm summer months, and (2) increased water residence time due to drought conditions (R. Lane, Louisiana State University, personal communication). Preliminary analysis of the phytoplankton community structure, both during high diversion events and later in the summer, showed a diverse community dominated by diatoms, without the strong occurrence of potentially harmful algal species (I. Ciugulea, University of Bucharest, Romania, personal communication).

Saltwater intrusion is also a concern for the Breton Sound Basin. The Mississippi River levees have prevented the annual overflows of freshwater, sediments, and nutrients that nourish the estuaries. The ongoing processes of subsidence, relative sea-level rise and erosion, as well as the network of natural and man-made channels, have further contributed to the saltwater intrusion and marsh deterioration of the Breton Sound Basin. The CFDS has partially reversed the impacts of saltwater intrusion.

Future Conditions with No Action

Without implementation of the proposed action, the CFDS would be operated under the original operational plan as outlined in the 1985 FEIS. Diverting fresh water under the original operational plan would differ from existing conditions in that no water would be diverted from May through December. The salinity goals defined in the FEIS would often not be achieved with this limitation, and salinities would be higher in the Breton Sound Basin during some years. Slightly less total volume would probably be diverted over the long-term because flows would be limited to only four months of the year with a maximum flow of 6,600 cfs.

The extent of water quality impacts with the No Action alternative would be greatest in the receiving area in years when the maximum or near maximum design discharge is diverted and most localized in the vicinity of the diversion structure in years when only small quantities of freshwater are diverted. Pollutant loading would be directly related to the total volume of water diverted. Cooler river water would lower the temperature of water bodies in the receiving area from January through April. Water quality impacts would be concentrated into four months of the year, when river water would replace most of the ambient water in the upper basin. Nutrient input through the structure would not occur in the summer months when algae blooms tend to occur. Nutrients may not be assimilated as efficiently as they would be if the same volume of water were diverted over a longer period, but greater flushing rates would tend to decrease the occurrence of blooms.

Future Conditions with the Proposed Action

With the proposed action, the potential impacts and benefits to water quality within the Breton Sound Basin are similar to those projected in the FEIS. However, with the additional 7 months of operation (May to December) at flows of 6,500 cfs or more, the potential for introduction of pollutants or other forms of impaired water from the Mississippi River would increase. Impacts related to potential long–term increases in mean trace metals concentrations, bioaccumulation, temperature gradients, alteration of existing hydraulic regimes, sedimentation patterns, turbidity, and eutrophication would be similar to the impacts observed over the last 15 years. Loading rates would generally be slower than with the No Action alternative, except during periods of high flow. Assimilation of nutrients and other constituents may be enhanced by the relatively lower flow rates of the proposed action. Temperature changes would be less abrupt due to the constant minimum flow, and more abrupt at the start of pulses of high flow. Conversely, constant flow of river water through the structure could saturate the assimilation capacity of the marsh and water bodies in the area. Tendencies toward accelerated eutrophication as a result of nutrient influxes to water bodies would probably be moderated by improved circulation and assimilation of nutrients in the receiving area. Pulses would tend to result in less assimilation of nutrients with greater flushing rates and lower temperatures during the pulse. Salinity levels would continue to be reduced in areas that have experienced saltwater intrusion positively impacting habitat for desired species of shellfish and finfish in turn maintaing commercial fisheries and wildlife production.

Lane et al. (1999) studied water quality impacts in the Breton Sound Basin associated with CFDS diversions between 0 cfs to approximately 7,500 cfs, depending on the month of the year. The authors concluded that, "There was no significant impact of the diversion at all on the water quality monitoring stations for $NO_2 + NO_3$" (nitrite plus nitrate). Specifically, they stated that rapid reduction of $NO_2 + NO_3$ seemed to occur indicating that, "...the Breton Sound wetlands and shallow waters were acting as a strong sink for $NO_2 + NO_3$." The study also concluded that the diversion did not have a significant impact on total nitrogen and total phosphorus levels.

In contrast, Rabalais et al. (1995) found that, "The sediment record (from the Barataria and Terrebonne salt marshes) indicates that the wetlands (adjacent to the estuarine system) incompletely buffer the effects of increased nutrient loading on water quality and that the ability of the wetlands to absorb additional amounts of nutrients is much less than 100%." This suggests that additional nutrient loading could result in algae blooms.

The structure is designed to adequately freshen the basin for the 10 percent drought year, or the driest in 10 years. Therefore, there is a less than 10% probability that the structure will not be able to reduce salinities to the target level in any given year. It is also likely that during some years, ambient salinity in the basin will be low, and annual salinity will be lower than the 5 ppt target salinity at the "with-project 5 ppt line" (Figure 1). This line is the same line as in the FEIS, and therefore salinities will be similar to those observed with the No Action alternative.

In an e-mail dated March 9, 2007, the LDEQ stated a new water quality certification is not required for the change in operation.

FISHERIES

Existing Conditions

The national significance of freshwater and tidal fisheries is recognized by the Fish and Wildlife Coordination Act of 1958, as amended. Fisheries resources are ecologically and economically significant because: they are a critical element of many valuable freshwater and marine habitats; they are an indicator of the health of various freshwater and marine habitats; and many species are important commercial resources. Fisheries resources are publicly important because of the high priority that the public places on their esthetic, recreational, and commercial benefits.

The commercial fishery resources in the Breton Sound Basin are primarily estuarine and marine in nature. Commercially important species include the American oyster, brown and white shrimp, blue crab, Gulf menhaden, and striped mullet. Finfish harvest in the area has been severely reduced since the Louisiana Marine Resources Conservation Act of 1995 restricted gillnet use in Louisiana. The study area supports rich populations of phytoplankton, zooplankton, benthos, macro-invertebrates, and numerous small fishes. These organisms constitute vital components of the aquatic food chain. White shrimp, brown shrimp, red drum, Spanish mackerel, and sharks are likely to be present in the Breton Sound Basin. Louisiana adopted a trip-ticket system of tracking landings by sub-basins, and data became available in 2000. The combined data from two sub-basins (one covering the marsh from the CFDS out to the open waters of Breton Sound, the other covering the open waters of both Breton and Chandeleur Sounds) was reviewed for the years 2000 through 2006. An average of approximately 3.8 million pounds of brown shrimp, with a value of $5.4 million, were landed from these two sub-basins each year. Approximately 2.0 million pounds of white shrimp, valued at $3.3 million, were landed annually. Blue crab annual landings of 6.3 million pounds were valued at $4.0 million. Oysters harvested in these two sub-basins totaled approximately 6.5 million pounds annually, with a value of $14.0 million. (LDWF, unpublished data).

Sport fishing in the study area is diverse and substantial, including both fresh and saltwater fishing. Sport trawlers take both brown shrimp and white shrimp, with blue crab as a popular bycatch. Saltwater sport finfishes commonly harvested include spotted seatrout, red drum, sand seatrout, Atlantic croaker, spot, black drum, sheepshead, southern flounder, southern kingfish, and Spanish mackerel. The top two species targeted and caught by recreational anglers are spotted seatrout and red drum.

Freshwater sport fishing occurs in the fresh to slightly brackish waters in the upper portion of the area. Species commonly taken include largemouth bass, warmouth, bluegill, redear sunfish, channel catfish, and blue catfish. The largemouth bass population has expanded in the years since the CFDS became operational, and the recreational fishery has expanded in response. The LDWF has stocked the area with Florida strain bass several times to enhance the fishery. Bass fishing tournaments now occur in the area, and professional bass fishermen from tournaments held in other areas of southeast Louisiana drive to the Caernarvon area to fish.

The freshening of the upper basin near the CFDS has enhanced the nursery function of the low salinity habitat, while possibly causing some displacement of harvestable size adults (spotted seatrout) and juveniles (brown and white shrimp). Commercial shrimpers are particularly concerned about the effect of diversions in the spring on the brown shrimp fishery. However, a recent study on spring distribution of brown shrimp in the vicinity of the CFDS found no statistical relationship between brown shrimp abundance and salinity (Rozas and Minello, 2002). Monitoring samples have shown a decrease in the catch per effort in trawls since the diversions began, although greatest preseason catch was observed when April salinities were relatively low (LDWF unpublished data). Other studies show contradictory results on the effect of salinity on brown shrimp abundance (Gunter et al., 1964; Barrett and Gillespie, 1973; Parker, 1970).

Oyster leases are located throughout the Breton Sound Basin, and as far north as Lake Lery. Leases in the upper basin have become non-productive in the low salinity conditions experienced since the CFDS became operational. Since 2000, leases in the middle and lower basin from the sub-basin covering the marsh from Caernarvon out to the open waters of Breton Sound have continued to be productive.

The blue crab fishery has been enhanced by the diversion of river water into the Breton Sound Basin. Guillory (2000) found a positive correlation between blue crab recruitment or statewide commercial harvest and Mississippi River discharge, and a negative correlation with salinity. Blue crabs use submerged aquatic vegetation (SAV) as a preferred habitat (Duffy, 1997), and abundance of SAV (eurasian watermilfoil and coontail) has increased in the Breton Sound Basin in response to diversions. While trawl samples taken by LDWF have shown a decrease in catch per effort of blue crabs since diversions began, landings of blue crabs have increased (Baird et. al., 1998). This could be due to increased SAV providing a refuge from trawl samples but not from commercial crab traps.

Future Conditions with No Action

Without implementation of the proposed action, fisheries in the Breton Sound Basin are expected to experience positive impacts from the reintroduction of Mississippi River water and associated sediment and nutrients. Land loss would continue, however, degrading fisheries habitat. Numerous studies have indicated high shrimp and shellfish production can be associated with marsh disintegration up to a point, after which steep declines in production are forecast (Thomas, 1999).

High flows from January to April are likely to be required to achieve an annual average of 15 ppt at the Ford line. During times when diversions lower salinity in the upper basin, recreational fishing for spotted seatrout would likely decline in the vicinity of the structure, whereas red drum appear to be less affected by the river water. Spotted seatrout abundance has been positively correlated with salinity during the spawning season (May-August), and negatively correlated with salinity in the post-spawning season (September-December) (Helser, Condrey, and Geaghan, 1993).

When diversions cease in May, salinities could increase in the upper basin depending on factors such as wind, tides, rainfall, and river flow. This could result in species with a preference for higher salinities to migrate further inshore than during months of diversion flows.

Habitat for freshwater species, including largemouth bass, crappie, sunfish, and catfish, would expand seasonally. Such an expansion of this low salinity habitat has been observed in the vicinity of the CFDS since diversions began, as indicated by isohaline maps produced from salinity data collected by LDWF. Recreational bass fishing in particular would continue to be enhanced by the project.

The primary impact of this alternative would be the seasonal shifts in salinity, and its effect on habitat and species distribution. Habitat could be affected by high salinities that would not be countered by diversion of river water from May through December. Fisheries impacts of the CFDS are described in greater detail in the FEIS.

Future Conditions with the Proposed Action

With implementation of the proposed action, impacts to fisheries would differ in some ways from the impacts of the CFDS without the proposed action. Year-round diversions would be likely to affect distribution of various fish and shellfish, particularly in the vicinity of the structure. Estuarine species that exhibit a preference for higher salinities would be continuously displaced by the year-round flow, even during the months of May through December. When greater flows for these months are implemented (0 to 8,000 cfs), conditions would remain fresh throughout a wider area. At such times, freshwater species would have a greater area of low salinity environment available to them.

Overall salinity goals differ from the No Action alternative mainly in the criteria used. The resulting salinity in the Breton Sound Basin is likely to be similar, whether the Ford line criteria or the maintenance of the position of the average annual 5 ppt line is used. The greatest difference would be in the timing of the flows. Less forecasting of weather conditions and salinities would be required to achieve target salinities than if diversions were restricted from January to April. The proposed action would create a more steady diversion of water over time, compared to all of the water being diverted during 4 months of the year. This would cause lower flows in April compared to No Action possibly reducing any displacement of brown shrimp.

Habitat would be preserved by the use of the CFDS to maintain salinities throughout the year, although land loss would continue. To the extent that pulses are implemented, fisheries habitat in the upper basin would benefit from the sediment input into the marshes. Any possible shock effect to juvenile organisms from a sudden influx of low temperature, low salinity water would be greatest during pulses. The impacts of the proposed action would be similar to the impacts of the CFDS observed over the last 12 years. The more flow of river water through the structure, the more nursery habitat would be enhanced and preserved, and the greater the possible displacement of the harvest. Oyster landings data has remained fairly stable since 2000 and is expected to maintain this trend with the increased flows. The salinity monitoring constraints numbers 2, 3, and 4 shown at the bottom of the 2007 Operational Plan (Table 9) has been implemented in the past and used as a guide for oyster production in Bay Gardene and public seed grounds. According to landing data, the blue crab fishery has been enhanced by the diversion of river water into the Breton Sound Basin since 2000 and is expected to maintain this trend with the increased flows.

Indirect impacts of the proposed action could include a change in fishing patterns in response to changes in abundance and distribution of various species. One such change was the increased fishing for largemouth bass in the upper basin in response to increased abundance after the diversion project became operational. The increased pressure eventually impacted the population, causing a reduction in catch per effort. Another example of indirect impacts of the proposed action include a change in the fishing pattern for spotted seatrout. Displacement of seatrout during high flows can result in a concentration of fishing effort in areas of the middle basin where an obvious color change marks the boundary between two water masses. High catch per effort in these areas results in greater participation, which could eventually impact the local population.

ESSENTIAL FISH HABITAT

Existing Conditions

The national importance of essential fish habitats is recognized by the Magnuson-Stevens Fisheries Conservation and Management Act of 1996 (Public Law 104-297). EFH is ecologically significant because, as the Act states, EFH is "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." EFH is publicly significant because of the high value that the public places on the seafood and the recreational and commercial opportunities EFH provides.

Wetland and aquatic sites in the project area consist of EFH for red drum, brown shrimp, and white shrimp. Specific categories of EFH in the project area include the estuarine waters and substrates of the receiving area and adjacent waterbottoms. Substrates include mud and sand bottoms, with mud bottoms much more prevalent than sand. Coastal wetlands provide nursery and foraging habitat that supports economically important marine fishery species such as spotted seatrout, southern flounder, Atlantic croaker, gulf menhaden, striped mullet, and blue crab. The following life stages of managed species are expected to occur in the EFH of the project area:

Species	Life Stage	EFH
white shrimp	postlarvae/juvenile	marsh edge, SAV, marsh ponds, inner marsh, oyster reefs
brown shrimp	postlarvae/juvenile	marsh edge, SAV, tidal creeks, inner marsh
red drum	postlarvae/juvenile	SAV, estuarine mud bottoms, marsh/water interface

Future Conditions with No Action

Without implementation of the proposed action, EFH in the vicinity would be affected by the diversion of fresh turbid, nutrient rich river water during the months of January through April. The river water would be lower in temperature than the receiving water. Some disruption of habitat use as a nursery for managed species could occur if there is thermal shock from exposure to cold river water. However, this impact is expected to be minor, and limited to the immediate vicinity of the project.

There would likely be some displacement of managed species by the low salinity conditions during January through May. In drought years, managed species may extend their range farther inland than they are usually found, but this is unlikely to occur in the upper Breton Sound Basin when river water is being diverted through the CFDS.

Similarly, commercial and recreational shrimpers in interior waters catch both brown and white shrimp, and these juvenile shrimp are unlikely to be abundant there when diversions lower salinities below 1 ppt. Red drum are often found in low salinity water and may not be displaced by diversions. Overall, while the CFDS may make some EFH unavailable for use by managed species, these species are expected to benefit from the preservation of marsh in the Breton Sound Basin.

Future Conditions with the Proposed Action

With implementation of the proposed action, the displacement of managed species from the EFH in the immediate vicinity of the project would be virtually year round. There typically would be a steady flow of at least 2,000 cfs on average from the diversion structure, which would tend to exclude use of the immediate area as a nursery for juveniles of managed species. The EFH near the project would experience low salinities throughout the year, and the extension of range by managed species observed in drought years would not occur there in the future, even from June through December. However, a more stable salinity regime in the vicinity of the project is expected to preserve and enhance marsh, which provides cover and a source of detritus to fuel the food chain. The proposed action could provide greater benefits than the No Action alternative, because of the greater flexibility to modify flows as the estuary changes, and as more data becomes available.

WILDLIFE

Existing Conditions

The national importance of wildlife resources is recognized by the Fish and Wildlife Coordination Act of 1958, as amended and the Migratory Bird Treaty Act of 1918. Wildlife species are ecologically and economically significant because: they are a critical element of many valuable aquatic and terrestrial habitats; they are an indicator of the health of various aquatic and terrestrial habitats; and many species are important commercial resources. Wildlife species are publicly significant because of the high priority the public places on their ecological aesthetic, recreational, and commercial benefits.

The study area contains a great variety of mammals, birds, reptiles, and amphibians. Abundant furbearers, including nutria, muskrat, mink, otter, and raccoon, formerly supported a trapping industry in the Terrebonne Basin. Other species inhabiting the area include white-tailed deer, skunks, rabbits, squirrels, armadillos, and a variety of smaller mammals. Large populations of migratory waterfowl, including gadwalls, blue-winged teal, green-winged teal, wigeons, mottled ducks, lesser scaup, shovelers, pintails, and mallards, are present during winter in the area. Mottled ducks are present year-round. These waterfowl are highly sought by sportsmen. In addition, coots, gallinules, rails, mourning doves, and snipe are important game species.

Non-game wading birds, shore birds, and sea birds include egrets, ibis, herons, sandpipers, willets, black-necked stilts, gulls, terns, skimmers, grebes, loons, cormorants, and white and brown pelicans. Various raptors such as barred owls, red-shouldered hawks, northern harriers (marsh hawks), American

kestrel, and red-tailed hawks are present. Passerine birds present include sparrows, vireos, warblers, mockingbirds, grackles, red-winged blackbirds, wrens, blue jays, cardinals, and crows. Many of these birds are present primarily during periods of spring and fall migrations. The area provides habitat for salamanders, toads, frogs, turtles, and several species of poisonous and nonpoisonous snakes. The American alligator is abundant in fresh to intermediate marsh and is caught commercially for its hides and meat throughout the area.

Numerous terrestrial invertebrates are found throughout the study area. The most notable are insects, which often serve as vectors, transmitting disease organisms to higher animals, including man. Mosquitoes are the most important of the vectors in the area, although other groups, such as deer flies, horseflies, and biting midges are also considered vectors. The area provides suitable breeding habitat for such species as *Aedes sollicitans* (salt-marsh mosquito), *Culex salinarius*, and other species of mosquitoes. Mosquitoes carry the West Nile virus, which has recently caused some illness and even death of both animals and humans in Louisiana.

Future Conditions with No Action

Without implementation of the proposed action, terrestrial wildlife in the vicinity of the project could experience mortality or displacement from inundation of wetlands during periods of high flows. During flows greater than 5,000 cfs, there is flooding within 5-8 miles of the structure that could impact wildlife. Predators, such as raptors, could benefit from the concentration of prey species on high ground. In years when salinities are such that high flows are called for, wintering waterfowl would be displaced to shallow ponds, which allow for easier feeding, once diversions begin in January.

Project impacts on wildlife in the Breton Sound Basin would be positive overall, because of the habitat preservation expected, but without the diversion marsh would continue to subside and reduce alligator nesting habitat. Furthermore, the freshening of the upper basin and fertilizing of submerged aquatic vegetation would improve habitat for wintering waterfowl.

Future Conditions with the Proposed Action

With implementation of the proposed action, displacement of terrestrial wildlife from the vicinity of the project could occur. The CFDS will have a potential flow range up to 8,000 cfs. Pulses as high as 7,500 cfs have been introduced, and during flows of this magnitude, flooding was observed within 5-8 miles of the structure that could impact wildlife. The gradual onset of the flooding could result in some mortality from drowning, and displacement of terrestrial wildlife to high ground. In addition, if high flows are diverted when animals are nesting, eggs could be lost to flooding. There have been reports of alligator eggs being lost to flooding in the upper basin in the past during diversions.

Migratory waterfowl usage would be affected throughout the period that the birds are present, typically late August through January. Waterfowl prefer shallow water habitat, which is abundant in the vicinity of the project, waterfowl have been observed in the Big Mar and adjacent marshes while the CFDS was flowing; however, some waterfowl are expected to move into adjacent, more shallow areas. In general, reducing wetland loss in the receiving area would preserve wildlife habitat.

Indirect impacts of the proposed action could include a change in hunting patterns in response to changes in wildlife distribution caused by the diversion structure operation. For example, high flows during waterfowl hunting season could displace ducks and hunting effort from the vicinity of the CFDS to

areas several miles away. In addition, increased SAV abundance in the upper Breton Sound Basin could result in increased abundance of waterfowl relative to neighboring basins, particularly in drought years. This would be likely to increase hunting pressure in the upper basin.

ENDANGERED OR THREATENED SPECIES

Existing Conditions

The national importance of endangered or threatened species is recognized by the Endangered Species Act of 1973, as amended; the Marine Mammal Protection Act of 1972; and the Bald Eagle Protection Act of 1940. Endangered (E) or threatened (T) species are ecologically significant because the status of such species provides an indication of the overall health of an ecosystem. These species are publicly significant because of the desire of the public to protect them and their habitats.

Threatened species that may be present in the project area include the bald eagle and the piping plover. The Gulf sturgeon and pallid sturgeon were listed as threatened species since the biological assessment for this project was prepared. Gulf sturgeon are not likely to occur in the project area, while pallid sturgeon are known to occur in the Mississippi River.

Endangered species actually or potentially present in the area include the brown pelican and West Indian manatee. Endangered Kemp's ridley sea turtles, hawksbill sea turtles, and leatherback sea turtles, and threatened loggerhead sea turtles and green sea turtles are not likely to be present in the immediate project area.

Biological assessments (BA) addressing the impacts of maintenance dredging of navigation channels on Gulf sturgeon were prepared on March 14, 1991, and on March 15, 2001. A draft BA for Gulf sturgeon was prepared in June 2004 and updated in June 2006. Gulf sturgeon are not likely to be present either in the Mississippi River in the vicinity of the CFDS or in the upper Breton Sound Basin near the structure.

Biological assessments (BA) were prepared on April 4, 1991, and on June 1, 1992, addressing the impacts of river engineering works in the Mississippi and Atchafalaya Rivers on the pallid sturgeon. In January 1997, a CEMVN-funded study, addressing the habitat, movement, and reproduction status of pallid sturgeon in the Mississippi and Atchafalaya Rivers, was completed. Pallid sturgeon are benthic dwellers, and are not likely to be pulled into the diversion structure, which draws water from near the top of the water column. Based on the findings of the BA, this 1997 study, and review of recent sightings data, there would be no effect to pallid sturgeon or their critical habitat.

Future Conditions with No Action

Without implementation of the proposed action, no direct or indirect impacts to threatened or endangered species or their critical habitats would occur.

Future Conditions with the Proposed Action

The proposed action is not likely to adversely impact these species or their critical habitats. The proposed activity was coordinated with the USFWS. By memo dated April 25, 2007, the USFWS provided their concurrence.

CULTURAL RESOURCES

Existing Conditions

The national importance of cultural resources is recognized by the National Historic Preservation Act of 1966, as amended; the Native American Graves Protection and Repatriation Act of 1990; and the Archeological Resources Protection Act of 1979; as well as other statutes. Cultural resources are locally, regionally, and sometimes nationally significant because of: their association or linkage to past events, to historically important persons, and to design and/or construction values; and for the important information about prehistory and history they can yield. Cultural resources are publicly significant because preservation groups and private individuals support their protection, restoration, enhancement, or recovery. A cultural resources survey of the CFDS site, Plaquemines Parish, Louisiana, was conducted by R. Christopher Goodwin and Associates, Inc. in 1987 (Poplin et al. 1987). A portion of the Caernarvon structure site has also been included in earlier regional investigations (Shenkel 1977). When these investigations were conducted, no cultural resources eligible for inclusion on the National Register of Historic Places were identified.

Future Conditions with No Action

There is no reason to believe that No Action will have any positive or negative impact to cultural resources.

Future Conditions with the Proposed Action

With implementation of the proposed action, flow through the diversion will be increased or decreased dependent upon monthly flow ranges and desired salinity. The proposed action should not impact any undisturbed land surfaces within the project area and no direct impacts to cultural resources are expected. Therefore, there is no reason to believe that the Proposed Action will have any positive or negative impact to cultural resources.

RECREATIONAL RESOURCES

Existing Conditions

The national importance of recreational resources is recognized by the Federal Water Project Recreation Act of 1965, as amended, and the Land and Water Conservation Fund Act of 1965, as amended. Recreational resources are economically significant because of the high economic value of recreational activities and their contribution to local, state, and national economies. Recreation resources are publicly significant because of: the high value that the public places on fishing, hunting, and boating, as measured by the large number of fishing and hunting licenses sold in Louisiana; and the large per-capita number of recreation boat registrations in Louisiana. St. Bernard and Plaquemines Parishes have 20,361 resident fishing licenses, 3,491 resident hunting licenses and 9,590 boat registrations (2000-2001 LDWF Data). The total population of the two parishes is 93,490 (2000 census). An unusually large number of the adult population of these parishes possesses hunting and fishing licenses when compared to other parishes of the state. The economy of this region benefits from the migration of outdoor sportsmen from the New Orleans metropolitan area into the project area as well as sportsmen from out of state.

Recreation currently taking place in the vicinity consists of fishing, hunting, sightseeing and birding. The parish contains numerous lakes, bayous, bays, estuarine swamps, and marshes that provide an excellent environment for year round outdoor recreational opportunities. Specifically, the Biloxi and Plaquemines marshes are very good for fishing, hunting and birdwatching.

In a recent publication written by Dr. Rex Caffey of the LSU Agricultural Center and placed on their website, he states the following: "Post-diversion catch rates increased at LDWF sampling stations for seven of eight fin fish species monitored. Some of this increase may have been caused by a rebound of stocks following the severe freeze of December 1989." The eight species being monitored by LDWF include speckled trout, red drum, black drum, sheepshead, sand seatrout, Atlantic croaker, spot and Gulf menhaden. Additionally, "From a recreational standpoint, charter boat operators targeting spotted seatrout have reported some displacement of the fishery since the freshwater diversion began, but they point out that the overall recreational catch has not been affected detrimentally." In an article written by Bob Marshall, Outdoor Editor for the Times-Picayune, in the October 25, 1996 issue, he states "By now most anglers know that, with the help of the Mississippi River diversion project at Caernarvon, the St. Bernard and Plaquemines Parish marshes east of the river have become one of the hottest bass fishing holes in the land." Monitoring data collected by the LDWF has shown that since the structure went into operation in 1991, the average number of largemouth bass caught has almost doubled, and the number of waterfowl has increased dramatically.

The *Louisiana Game & Fish Magazine* in their October 28, 2003 article talk about the "...canals remain one of the best places to lip a double-digit bass in southeast Louisiana. Shallow lagoons and canals around Lake Lery, the Crow's Foot - branching of different canals, and thousands of other unnamed canals, sloughs and lagoons, provide a rich resource for growing big bass." In regards to duck hunting, *Louisiana Game and Fish Magazine* (November 3, 2003) claimed that "...Louisiana hunters still bagged more birds than did anyone else in the nation..." in the 2002-03 season. "The average Louisiana hunter bags about 24 ducks per year - about three times the national average." The marsh near the Caernarvon structure is known to be a productive area for duck hunting.

Future Conditions with No Action

Recreational opportunities will continue to be good, but will depend on the health of the lakes and marshes around Big Mar and the ability of other coastal restoration activities to contribute to the quality and longevity of the recreational activities.

Future Conditions with the Proposed Action

Recreational fishing and hunting opportunities in and around the CFDS will benefit from the supply of fresh water flowing into the marshes. The quality of the estuary in the receiving area will improve and the fish community in the vicinity will prosper due to the inflow of freshwater, sediments and nutrients. Freshwater recreational fishing will flourish. The proposed project modification will allow the diversion structure to be operated at pulsing flows mimicking historic seasonal water levels in the marsh.

This operational situation will encourage some species of ducks to increase their habitation at this location. Duck hunting should be good to very good with the project established and operating as proposed. However, those factors influencing duck migration are still variable and yearly duck populations that arrive in the lower part of the Mississippi River flyway will depend on weather, drought at the prairie breeding grounds, available wetlands along the flyway, predation, and forage availability upon arrival. Indirect impacts of the proposed action on recreation include changes in the distribution of fishing and hunting effort, due to shifts in distribution of target species. Positive impacts of structure operation to populations of target species are likely to result in increased effort and increased success for fishermen and hunters. Displacement of waterfowl and some estuarine species of fish would likely result in a corresponding displacement of recreational fishing and hunting.

AIR QUALITY

Existing Conditions

The state-wide and national importance of clean air is recognized by the Louisiana Environmental Quality Act of 1983, as amended, and the Clean Air Act of 1963, as amended. Air Quality is technically significant because of the status of regional ambient air quality in relation to the National Ambient Air Quality Standards (NAAQS). It is publicly significant because of the desire for clean air expressed by virtually all citizens.

Future Conditions with No Action

With the No Action alternative, no direct or indirect impact to air quality would occur.

Future Conditions with the Proposed Action

No construction would occur under this alternative, and therefore there would be no effect on air quality.

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

The CEMVN is obligated under Engineer Regulation 1165-2-132 to assume responsibility for the reasonable identification and evaluation of all Hazardous, Toxic, and Radioactive Waste (HTRW) contamination within the vicinity of the proposed action. The risk of encountering HTRW for the proposed action is low, based on the fact that no construction would occur. If a Recognized Environmental Condition (REC) release would occur in the Mississippi River the structure coordinator would close the CFDS according to the March 1992, CEMVN Operation and Maintenance Manual for the CFDS.

CUMULATIVE IMPACTS

The proposed modification to the operation of the CFDS will tend to keep salinities in the Breton Sound Basin slightly lower than the No Action alternative. Pulsed diversions would tend to increase sediment delivery into nearby marshes enhancing growth and reducing land loss. There are presently two other existing freshwater diversion projects in the Breton Sound Basin, a siphon with a capacity of 250 cfs at White's Ditch, and two structures at Bayou Lamoque with a combined capacity of 12,800 cfs. These projects are in need of repair and cannot presently operate at their design capacity. The proposed action would benefit the environment by moderating the peak salinities while the other diversion projects are not being operated. The CFDS will likely have its greatest impact on waters of the upper basin, including Big Mar and Lake Lery, while the Bayou Lamoque structures have only a localized impact in the lower basin around California Bay. Large-scale diversions have been proposed at other locations, such as American Bay and Fort St. Philip. If constructed, these diversions would likely be operated in coordination with the Caernarvon project. Thus future modification to the operation of the CFDS can be expected in the future.

Marshes of the Breton Sound Basin were originally formed by sediment transported by the Mississippi River. Flood control levees have been built along the Mississippi River under the Mississippi River and Tributaries Project. These levees have stopped the delivery of sediment from the river into the adjacent coastal marshes, and a continuous source of sediment is needed to sustain these marshes. The proposed action would do more to offset the impact of the levee construction than the No Action alternative because

of the positive affects of the proposed increase in quantity and frequency of the structure's operation on marshes.

The release of Mississippi River water introduces nutrients, sediments, and point and non-point source contaminants from agricultural lands and industrial run-off into the marshes of Louisiana through the Davis Pond Freshwater Diversion; Atchafalaya Basin; Venice passes; and various locks along the Mississippi River. The CFDS also contributes to the introduction of contaminants into the marsh and with the increased flows the potential for increased contaminants are likely. Organic and inorganic contaminants from the Mississippi River would potentially increase into the Breton Sound Basin when the structure is operated according to the 2007 operational plan.

In time, there would be a marsh conversion from saline to an increase in freshwater marsh. The increased introduction of freshwater may push saltwater fish species further out. The increased flows would provide additional freshwater fish habitat but may elevate levels of nutrients in the water causing potential algal blooms. The blue crab fishery has been enhanced by the diversion of river water according to the landings data, and could potentially maintain this trend with the increased flows. Oyster landings data has remained fairly stable since 2000 and is expected to maintain this trend with the increased flows. Waterfowl habitat should expand and attract additional waterfowl to the area.

A coastal restoration project called the Caernarvon Diversion Outfall Management Project was completed in the upper Breton Sound Basin. The purpose of the project is to maximize the benefits of the diverted water to marshes in the receiving area. A series of plugs with culverts, spoil bank gaps, spoil bank repairs, and culverts with flap gates were designed to allow the diverted river water to reach areas previously isolated from its effects, and to enhance the flow of water over the marsh. The proposed action, in combination with this project, would provide positive impacts to marshes of the upper basin.

COORDINATION

Preparation of this EA and a draft Finding of No Significant Impact (FONSI) has been coordinated with appropriate Congressional, Federal, state, and local interests, as well as environmental groups and other interested parties. The following agencies, as well as other interested parties, are receiving copies of this EA and draft FONSI:

U.S. Department of the Interior, Fish and Wildlife Service
U.S. Environmental Protection Agency, Region VI
U.S. Department of Commerce, National Marine Fisheries Service
U.S. Natural Resources Conservation Service, State Conservationist
Advisory Council on Historic Preservation
Governor's Executive Assistant for Coastal Activities
Louisiana Department of Wildlife and Fisheries
Louisiana Department of Natural Resources, Coastal Management Division
Louisiana Department of Natural Resources, Coastal Restoration Division
Louisiana Department of Environmental Quality
Louisiana State Historic Preservation Officer
Plaquemines Parish Government
St. Bernard Parish Government

In an e-mail dated August 31, 2007, the Plaquemines Parish Government responsible for the Braithwaite/Scarsdale non-federal levee commented that once the repairs are completed and grass cover is established the flow rate can be increased to 8,000 cfs; however, the maximum water level should not exceed + 3.0 feet North American Vertical Datum 1988. The increased flows will be monitored by the Plaquemines Parish Government, Land Department and Coastal Zone. Monitoring will include checking the Reggio gage; maintaining two high water alarm gages; and the daily parish monitoring of the water elevations. A Coastal Zone Consistency (C20070108) letter dated April 10, 2007, for EA # 392 CFDS, Change in Structure Operation was consistent with the Louisiana Coastal Resource Program (LCRP). In an e-mail dated March 9, 2007, the LDEQ stated a new water quality certification is not required for the change in operation. The USFWS concluded in a memo dated April 25, 2007, the proposed action is not likely to adversely affect threatened or endangered species or their critical habitats.

MITIGATION

The proposed modification to the operation of the CFDS will keep salinities in the Breton Sound Basin lower. Pulsed diversions would tend to increase sediment delivery into nearby marshes, thereby enhancing growth and reducing land loss. The analysis of the proposed project indicates that it will cause no significant impacts to any of the resources reviewed above and therefore no mitigation will be required.

COMPLIANCE WITH ENVIRONMENTAL LAWS AND REGULATIONS

Environmental compliance for the proposed action would be achieved upon: coordination of this EA and draft Finding of No Significant Impact (FONSI) with appropriate agencies, organizations, and individuals for their review and comments; USFWS and NMFS confirmation that the proposed action would not be likely to adversely affect any endangered or threatened species; LDNR concurrence with the determination that the proposed action is consistent, to the maximum extent practicable, with the Louisiana Coastal Resources Program; revision of a Water Quality Certificate from the State of Louisiana; receipt of the Louisiana State Historic Preservation Officer Determination of No Effect on cultural resources; receipt and acceptance or resolution of all USFWS Fish and Wildlife Coordination Act recommendations; receipt and acceptance or resolution of all LDEQ comments on the air quality impact analysis documented in the EA; and receipt and acceptance or resolution of all NMFS EFH recommendations. The draft FONSI will not be signed until the proposed action achieves environmental compliance with applicable laws and regulations, as described above.

CONCLUSION

The proposed action consists of a modification to the operational plan for diverting river water through the CFDS. This modification calls for a potential flow range of 0-8,000 cfs. The 2007 Operational Plan will have a typical flow of at least 0-6,500 cfs for all months, with pulses up to 7,500 cfs for 20 days, and a monthly target salinity range in the area of the "with-project 5 ppt" line, as shown in the FEIS. Future changes to this operational plan are expected. This office has assessed the environmental impacts of the proposed action and has determined that the proposed action would have no impact upon cultural resources and no significant impact on marshes, water bodies, water quality, fisheries, wildlife, essential fish habitat, endangered or threatened species, cultural resources, recreational resources, and air quality.

PREPARED BY

EA # 392 and the associated draft FONSI were prepared by Michael Brown, Biologist, and Bruce Baird, Biologist, with relevant sections prepared by: Bruce Baird - HTRW; Cyril Mann - Cultural Resources; and Jay Gamble - Recreational Resources. The address of the preparers is: U.S. Army Corps of Engineers, New Orleans District; Planning, Programs, and Project Management Division, CEMVN-PM; P.O. Box 60267; New Orleans, Louisiana 70160-0267.

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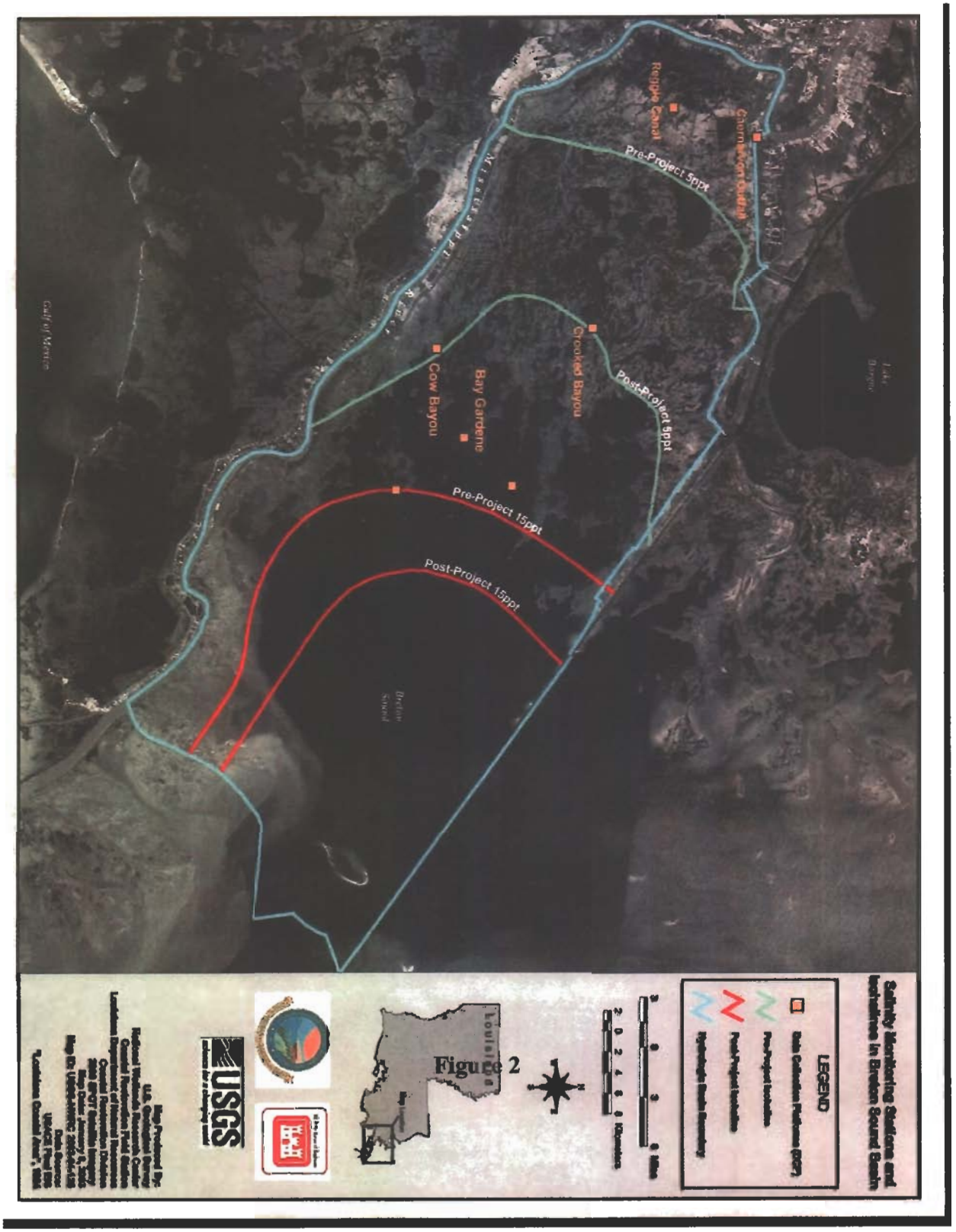
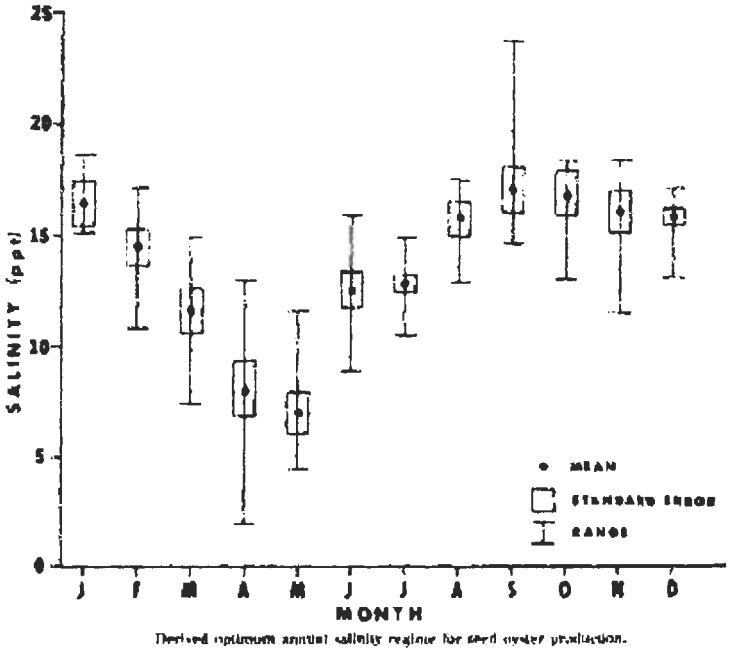
Figures

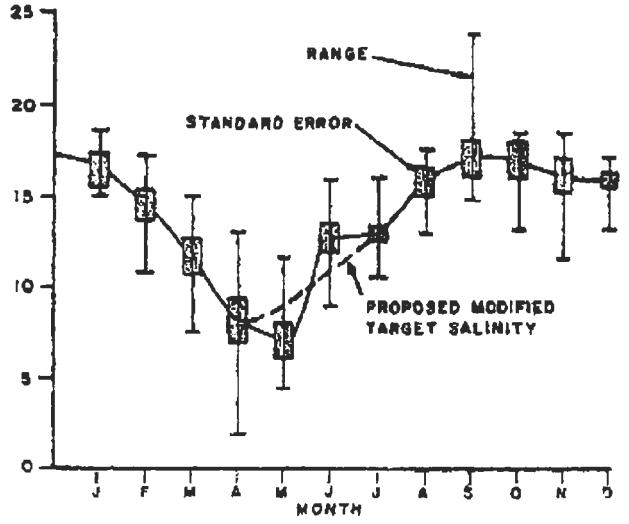
Figure 1


Salinity Monitoring Stations and Isohalines in Breton Sound Basin
LEGEND
Pre-Project Isohaline
Post-Project Isohaline
Hydrologic Basin Boundary
Ridge Canal
Pre-Project 5ppt
Cow Bayou
Bay Gardene
Crooked Bayou
Post-Project 5ppt
Pre-Project 15ppt
Post-Project 15ppt
Gulf of Mexico
Lake Borgne
Breton Sound
Louisiana
Figure 2
USGS



Derived optimum annual salinity regime for seed oyster production.

Figure 3



First operational plan, November, 1990

Mean monthly salinity, range, and standard error for good oyster years from stations on the public seed grounds in Breton Sound (LDWF, unpublished data). Dashed line represents proposed smoothing of optimal (target) salinity that would be attainable by the project.

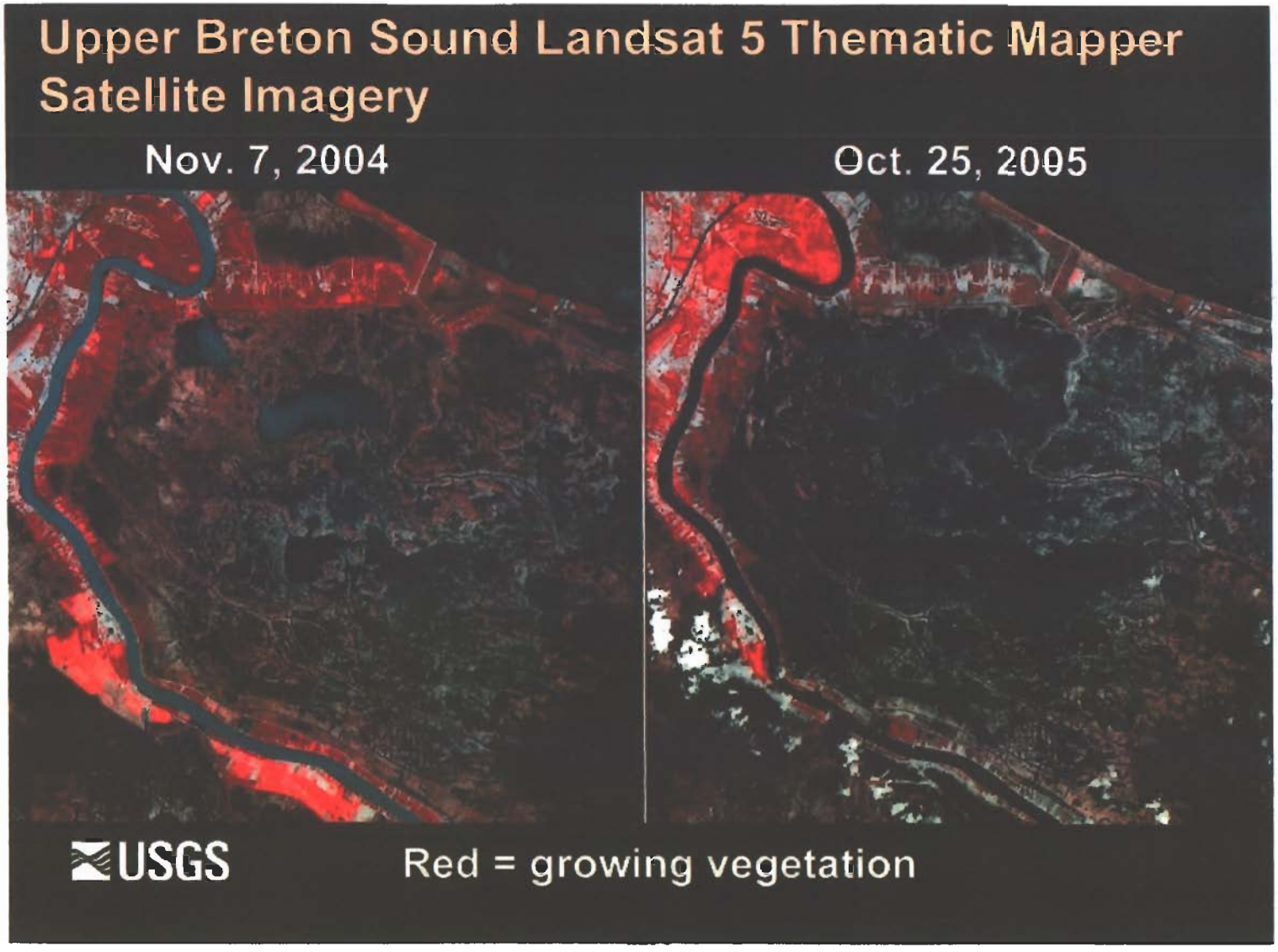
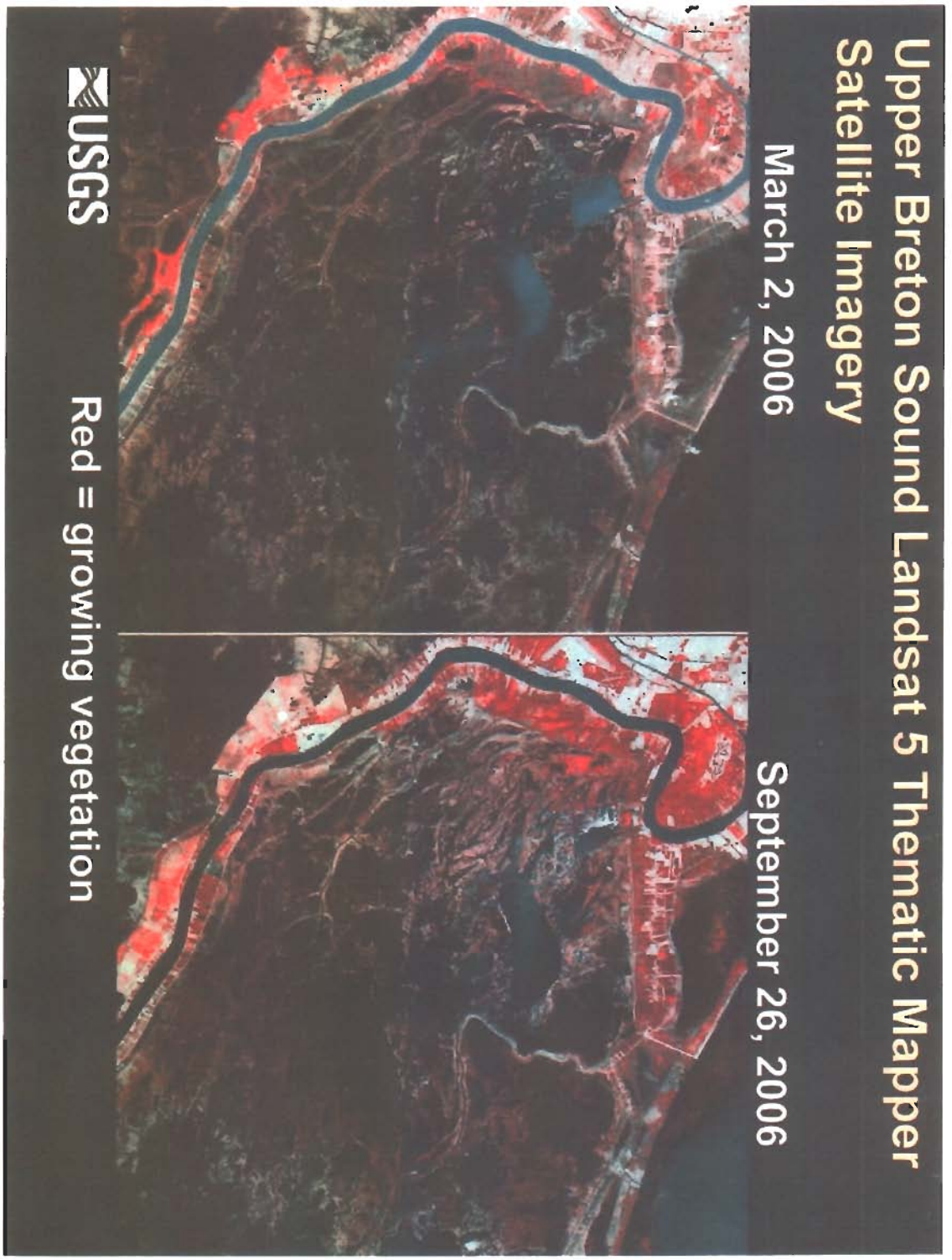

Upper Breton Sound Landsat 5 Thematic Mapper Satellite Imagery
Nov. 7, 2004
Oct. 25, 2005
USGS
Red = growing vegetation

Figure 4

Figure 5


Upper Breton Sound Landsat 5 Thematic Mapper
Satellite Imagery
March 2, 2006
September 26, 2006
USGS
Red = growing vegetation

Tables

Table 1

CAERNARVON FRESHWATER DIVERSION

*OPERATIONAL OBJECTIVES

Maintain, to the extent practicable, the average of the mean monthly bottom salinities at California Bay, Black Bay, and Bay Gardene as follows:

	ppt
January	15.0
February	11.0
March	11.6
April	8.0
May	7.0
June	11.0
July	12.5
August	15.7
September	17.0
October	16.8
November	16.1
December	13.0

Daily Average discharge rates will be set at two week intervals using a formula, or formulas, to be derived, and updated as necessary, by the Technical Work Committee of the Caernarvon Interagency Advisory Committee (CIAC).

Operational plan, November, 1991

Table 2

Pre-Outfall Management Plan

Month	Salinity (PPT)[3]	Discharge Cubic Feet / Second
January	> 5 ppt & > 3 ppt	8000 cfs[4]
February	> 5 ppt & > 3 ppt	8000 cfs[4]
March	< 11.6 ppt	700 cfs min. & up to 8000 cfs for salinity modification
April	< 8.0 ppt	700 cfs min. & up to 8000 cfs for salinity modification
May	< 9.0 ppt	700 cfs minimum & up to 8000 cfs for salinity modification
June	< 11.0 ppt	700 cfs minimum & up to 8000 cfs for salinity modification
July	< 12.5 ppt	700 cfs minimum & up to 8000 cfs for salinity modification
August	< 15.7 ppt	700 cfs minimum & up to 8000 cfs for salinity modification
September	< 17.0 ppt	700 cfs minimum & up to 8000 cfs for salinity modification
October	< 16.8 ppt	700 cfs min. & up to 8000 cfs for salinity modification
November	< 16.1 ppt	700 cfs min. & up to 8000 cfs for salinity modification
December	> 5 ppt & ppt > 3 ppt	8000 cfs[4]

[3] All Salinities are in reference to the Caernarvon Target zone

[4] 8000 cfs will be discharged if the 3 station salinity average (N. California Bay, Bay Gardene, and Black Bay) > 5 ppt & salinity is > 3 ppt at the Bay Gardene Station.

Operational plan, August, 1993

Table 3

CAERNARVON FRESHWATER DIVERSION OPERATIONAL PLAN
December 1997

Month	Flow Range (cfs)[1]
January	3000-4000 [2]
February	3000-4000 [2]
From February 15 - March	500-2000 [4]
April	500-2000 [4]
May	500-4000 [3]
June	1000-4000 [3]
July	1000-2000 [4]
August	1000-2000 [4]
September	1000-2000 [4]
October	1000-2000 [4]
November	1000-2000 [4]
December	2500 [2]

[1] Notwithstanding these flow range targets, operational procedures relating to emergencies, closure of the structure or reduction of flow to reduce the threat of coastal flooding or high water levels reflected by monitoring and operational procedures pertaining to low Mississippi River stage or drought conditions shall all remain in effect. The structure will be closed if the water level measured by a real-time gauge at the southeast corner of Big Mar reads above 3.1 NGVD.
[2] Salinity at Bay Gardene will by monitored to stay above 3 ppt.
[3] For oyster production, the salinities at the Bay Gardene station will be monitored during these months. The structure will be operated at the lower discharge levels. If the Bay Gardene station moves to 9 ppt based on a two-week average, Caernarvon discharge will be increased, but will not exceed 4000 cfs, to decrease the average to 9 ppt. Water levels gauges will be added to certain sites and monitored.
[4] Seek to maintain annual average 5 ppt line, based on a yearly average, and monitor salinities as to promote enhancement of oyster production in the public seed grounds and to achieve other stated benefits of the project, up to 2000 cfs.

Table 4

CAERNARVON FRESHWATER DIVERSION OPERATIONAL PLAN
March 2000

Month	Flow Range (cfs)[1]
January	3000-4000 [2]
February	3000-4000 [2]
From February 15 - March	500-4000 [5]
April	500-4000 [5]
May	500-4000 [3]
June	1000-4000 [3]
July	1000-2000 [4]
August	1000-2000 [4]
September	1000-2000 [4]
October	1000-2000 [4]
November	1000-2000 [4]
December	2500 [2]

[1] Notwithstanding these flow range targets, operational procedures relating to emergencies, closure of the structure or reduction of flow to reduce the threat of coastal flooding or high water levels reflected by monitoring and operational procedures pertaining to low Mississippi River stage or drought conditions shall all remain in effect. The structure will be closed if the water level measured by a real-time gauge at the southeast corner of Big Mar reads above 3.1 NGVD.

[2] Salinity at Bay Gardene will by monitored to stay above 3 ppt.

[3] For oyster production, the salinities at the Bay Gardene station will be monitored during these months. The structure will be operated at the lower discharge levels. If the Bay Gardene station moves to 9 ppt based on a two-week average, Caernarvon discharge will be increased, but will not exceed 4000 cfs, to decrease the average to 9 ppt. Water levels gauges will be added to certain sites and monitored.

[4] Seek to maintain annual average 5 ppt line, based on a yearly average, and monitor salinities as to promote enhancement of oyster production in the public seed grounds and to achieve other stated benefits of the project, up to 2000 cfs.

[5] Seek to maintain annual average 5 ppt line, based on a yearly average, and monitor salinities as to promote enhancement of oyster production in the public seed grounds and to achieve other stated benefits of the project, up to 4000 cfs.

Table 5

CAERNARVON FRESHWATER DIVERSION OPERATIONAL PLAN
January 2003

Month	Flow Range (cfs)[1]
January	3000-4000 [2]
February	3000-4000 [2]
April	500-4000 [5]
May	500-4000 [3]
June	1000-4000 [3]
July	1000-2000 [4]
August	1000-2000 [4]
September	1000-2000 [4]
October	1000-2000 [4]
November	1000-2000 [4]
December During Duck Season Split	2500 [2] 5600 [1,2]

[1] Notwithstanding these flow range targets, operational procedures relating to emergencies, closure of the structure or reduction of flow to reduce the threat of coastal flooding or high water levels reflected by monitoring and operational procedures pertaining to low Mississippi River stage or drought conditions shall all remain in effect. The structure will be closed if the water level measured by a real-time gauge at the southeast corner of Big Mar reads above 3.1 NGVD.
[2] Salinity at Bay Gardene will by monitored to stay above 3 ppt.
[3] For oyster production, the salinities at the Bay Gardene station will be monitored during these months. The structure will be operated at the lower discharge levels. If the Bay Gardene station moves to 9 ppt based on a two-week average, Caernarvon discharge will be increased, but will not exceed 4000 cfs, to decrease the average to 9 ppt. Water levels gauges will be added to certain sites and monitored.
[4] Seek to maintain annual average 5 ppt line, based on a yearly average, and monitor salinities as to promote enhancement of oyster production in the public seed grounds and to achieve other stated benefits of the project, up to 2000 cfs.
[5] Seek to maintain annual average 5 ppt line, based on a yearly average, and monitor salinities as to promote enhancement of oyster production in the public seed grounds and to achieve other stated benefits of the project, up to 4000 cfs.

Table 6

CAERNARVON FRESHWATER DIVERSION OPERATIONAL PLAN
January 2004

Month	Flow Range (cfs)[1]
January 1 - 18 January 19 - February 8	3000-4000 [2] 3000-5000 [2]
Pulse Low Flow Feb. 09 - Feb. 19 Pulse High Flow Feb. 20 - Mar. 04	500 6500 [5]
Pulse Low Flow Mar. 05 - Mar. 18 Pulse High Flow Mar.19 - Apr. 02	500 6500 [5]
April	500-4000 [4]
May	500-4000 [3]
June	1000-4000 [3]
July	1000-4000 [4]
August	1000-4000 [4]
September	1000-4000 [4]
October	1000-4000 [4]
November	1000-4000 [4]
December During Duck Season Split	2500 [2] 5600 [2]

[1] Notwithstanding these flow range targets, operational procedures relating to emergencies, closure of the structure or reduction of flow to reduce the threat of coastal flooding or high water levels reflected by monitoring and operational procedures pertaining to low Mississippi River stage or drought conditions shall all remain in effect. The structure will be closed or reduced if the water level measured by the official USGS gauge at the southeast corner of Big Mar reads above 3.1 NAVD-88.

[2] Salinity at Bay Gardene will by monitored to stay above 3 ppt.

[3] For oyster production, the salinities at the Bay Gardene station will be monitored during these months. The structure will be operated at the lower discharge levels. If the Bay Gardene station moves to 9 ppt based on a two-week average, Caernarvon discharge will be increased, but will not exceed 4000 cfs, to decrease the average to 9 ppt. Water levels gauges will be added to certain sites and monitored.

[4] Seek to maintain annual average 5 ppt line, based on a yearly average, and monitor salinities as to promote enhancement of oyster production in the public seed grounds and to achieve other stated benefits of the project, up to 4000 cfs.

[5] Seek to maintain annual average 5 ppt line, based on a yearly average, and monitor salinities as to promote enhancement of oyster production in the public seed grounds and to achieve other stated benefits of the project, up to 4000 cfs.

Table 7

CAERNARVON FRESHWATER DIVERSION OPERATIONAL PLAN
2005

Month	Flow Range (cfs)[1]
January 1 - 23 January 24 - Febuary 2	3000-6500 [2] 3000-6500 [2]
Pulse Low Flow Feb. 03 - Feb. 13 Pulse High Flow Feb. 14 - Feb. 28	500 6500 [5]
Pulse Low Flow Mar. 01 - Mar. 13 Pulse High Flow Mar.14 - Mar. 28	500 6500 [5]
April	500-6500 [4]
May	500-6500 [3]
June	1000-6500 [3]
July	1000-6500 [4]
August	1000-6500 [4]
September	1000-6500 [4]
October	1000-6500 [4]
November	1000-6500 [4]
December During Duck Season Split	2500 [2] 6500 [2]

[1] Notwithstanding these flow range targets, operational procedures relating to emergencies, closure of the structure or reduction of flow to reduce the threat of coastal flooding or high water levels reflected by monitoring and operational procedures pertaining to low Mississippi River stage or drought conditions shall all remain in effect. The structure will be closed or reduced if the water level measured by the official USGS gauge at Reggio Canal near Wills Point reads above 2.4 NAVD-88.

[2] Salinity at Bay Gardene will by monitored to stay above 3 ppt.

[3] For oyster production, the salinities at the Bay Gardene station will be monitored during these months. The structure will be operated at the lower discharge levels. If the Bay Gardene station moves to 9 ppt based on a two-week average, Caernarvon discharge will be increased, but will not exceed 6500 cfs, to decrease the average to 9 ppt. Water levels gauges will be added to certain sites and monitored.

[4] Seek to maintain annual average 5 ppt line, based on a yearly average, and monitor salinities as to promote enhancement of oyster production in the public seed grounds and to achieve other stated benefits of the project, up to 6500 cfs.

[5] During the period from the end of duck season through March 28 conduct two two-week 6500 cfs pulse flows with a two-week period of either low flow 500 cfs (experimental request) or existing flow and salinity targets for the month. With the approval of the LSU study group, maximize the discharge between the period of high flows February 28th and March 13th.

Table 8

CAERNARVON FRESHWATER DIVERSION OPERATIONAL PLAN
2006

Month	Flow Range (cfs)[1,2,4]
January	May pulse up to 7500 and 20 days, otherwise 0-6500[5]
February	May pulse up to 7500 and 20 days, otherwise 0-6500[5]
March	May pulse up to 7500 and 20 days, otherwise 0-6500[5]
April	May pulse up to 7500 and 20 days, otherwise 0-6500[5]
May	May pulse up to 7500 and 20 days, otherwise 0-6500[3,5]
June	May pulse up to 7500 and 20 days otherwise 0-6500[3,5]
July	0-6500
August	0-6500
September	0-6500
October	0-6500
November	0-6500
December	May pulse up to 7500 and 20 days, otherwise 0-6500[5]

[1] Notwithstanding these flow range targets, operational procedures relating to emergencies, closure of the structure or reduction of flow to reduce the threat of coastal flooding or high water levels reflected by monitoring and operational procedures pertaining to low Mississippi River stage or drought conditions shall all remain in effect.
[2] Salinity at Bay Gardene will be monitored to stay above 3 ppt as a 4 week moving average
[3] For oyster production, if the salinity at the Bay Gardene station rises above 9 ppt, based on a 4 week moving average, Caernarvon discharge will be increased, but will not exceed 6500 cfs, to decrease the average to 8-9 ppt.
[4] Seek to maintain annual average 5 ppt line, based on a yearly average, and monitor salinities as to promote enhancement of oyster production in the public seed grounds and to achieve other stated benefits of the project, up to 6500 cfs.
[5] May modify timing of pulse based on waterfowl or fisheries concerns. Every effort will be made to pulse during river rise for sediment delivery for marsh recovery. Pulses during frontal passage may be done at the discretion of the structure coordinator. The length of the pulse may be at the discretion of the structure coordinator and depend on salinity conditions.

Table 9

CAERNARVON FRESHWATER DIVERSION
2007 OPERATIONAL PLAN

Month	Flow Range (cfs)[1,2,4]	Typical Range (cfs) [1,2,4]
January	0-8000	May pulse up to 7500 and 20 days, otherwise 0-6500[5]
February	0-8000	May pulse up to 7500 and 20 days, otherwise 0-6500[5]
March	0-8000	May pulse up to 7500 and 20 days, otherwise 0-6500[5]
April	0-8000	May pulse up to 7500 and 20 days, otherwise 0-6500[5]
May	0-8000	May pulse up to 7500 and 20 days, otherwise 0-6500[3,5]
June	0-8000	May pulse up to 7500 and 20 days, otherwise 0-6500[3,5]
July	0-8000	0-6500
August	0-8000	0-6500
September	0-8000	0-6500
October	0-8000	0-6500
November	0-8000	0-6500
December	0-8000	May pulse up to 7500 and 20 days, otherwise 0-6500[5]

Grass cover must be established on the Braithwaite/Scarsdale non-federal levee prior to increased flows. The Plaquemines Parish Government Land Department, in association with the LDNR CFDS operator and CEMVN, will monitor water levels related to increased flows. Water levels would be monitored along the Braithwaite/Scarsdale non-federal levee and shall not exceed + 3.0 feet North American Vertical Datum 1988 at the Reggio Gauge. Two high-water alarms would also be maintained.

[1] Notwithstanding these flow range targets, operational procedures relating to emergencies, closure of the structure or reduction of flow to reduce the threat of coastal flooding or high water levels reflected by monitoring and operational procedures pertaining to low Mississippi River stage or drought conditions shall all remain in effect.

[2] Salinity at Bay Gardene will be monitored to stay above 3 ppt as a 4 week moving average.

[3] For oyster production, if the salinity at the Bay Gardene station rises above 9 ppt, based on a 4 week moving average, Caernarvon discharge will be increased, but will not exceed 6500 cfs, to decrease the average to 8-9 ppt.

[4] Seek to maintain annual average 5 ppt line, based on a yearly average, and monitor salinities as to promote enhancement of oyster production in the public seed grounds and to achieve other stated benefits of the project, up to 6500 cfs.

[5] May modify timing of pulse based on waterfowl or fisheries concerns. Every effort will be made to pulse during river rise for sediment delivery for marsh recovery. Pulses during frontal passage may be done at the discretion of the structure