APPENDIX N: OPERATIONS AND MAINTENANCE PLANS

Contents:

Maurepas Swamp Project Operations Plan

MAUREPAS SWAMP PROJECT OPERATIONS PLAN

1.0 Introduction

The Maurepas Swamp Project, hereafter referred to as MSP, is being considered by the United States Army Corps of Engineers (USACE) New Orleans District (CEMVN) for swamp habitat compensatory mitigation for construction impacts by the West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction (WSLP) project. The MSP was converted into several viable compensatory mitigation alternatives, the Tentatively Selected Plan is Maurepas Swamp Alternative – 2 (MSA-2: Public Lands only). The goal of MSA-2 is to create approximately 947 Average Annual Habitat Units (AAHUs) of swamp habitat by reintroducing Mississippi River derived fresh water, nutrients, and sediments that are expected to improve the health, and essential functions and values of the existing swamp. When constructed, the MSP would include three groups of features, the conveyance channel, embankment features, and weirs (Figure 1).

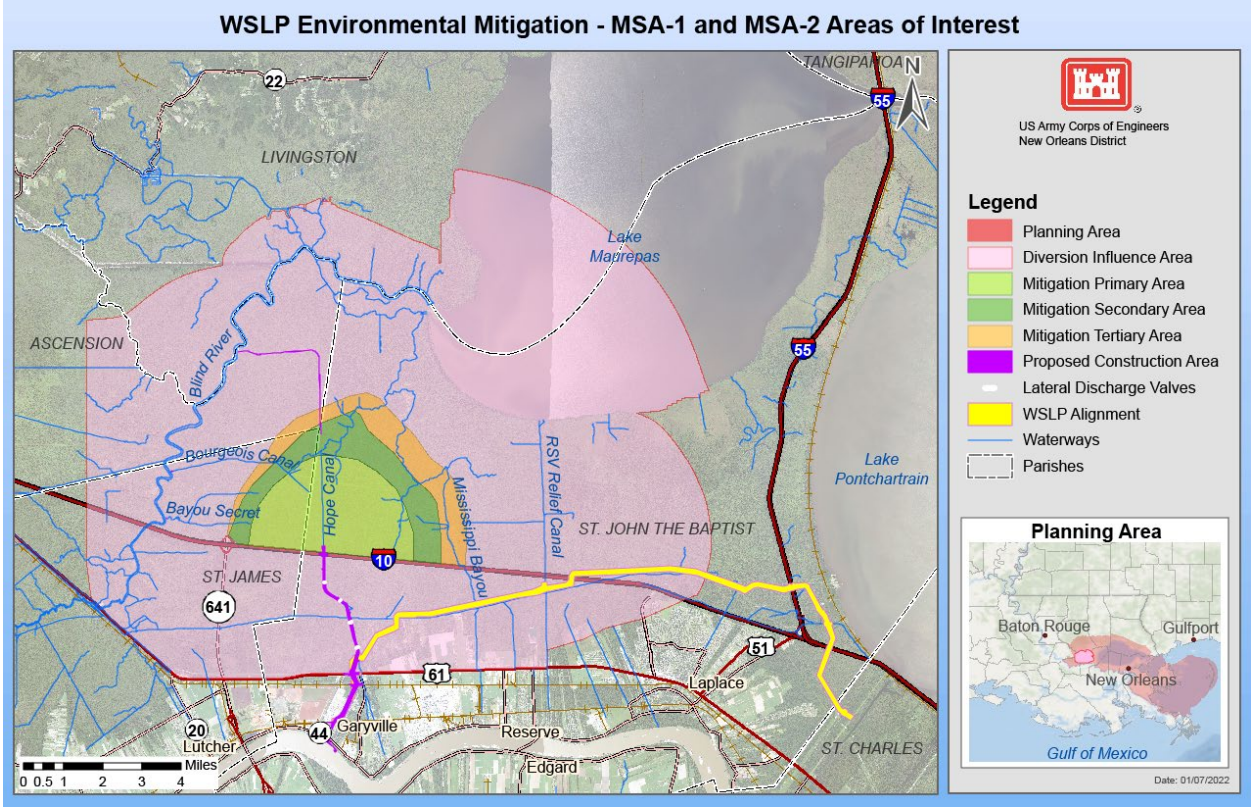

Figure 1. Maurepas Areas of Interest.

There are two types of structures that would be operated to achieve mitigation success for MSA-2. The first are gated intake structures that would allow Mississippi River water into the diversion canal. The goal of operating these structures would be to achieve mitigation success in the primary, secondary, and tertiary benefit areas. The second type of structures are lateral discharge valves (LDVs) which would be operated to reduce and minimize indirect impacts to swamp, bottomland hardwoods, and marsh that would occur south of I-10.

1.1 Purpose

The purpose of this document is to describe the 50-year operations plan for the MSP.

2.0 Gated Intake Structure Operations

The gated intake structure at the Mississippi River would control discharge into the swamp via the conveyance channel. Operational assumptions for this structure were developed to achieve the compensatory mitigation benefits for the MSP. The benefit areas for the MSA-2 are near the conveyance channel outfall where the benefits are anticipated to be greatest. The primary goals of MSA-2 and this Operations Plan are to achieve the mitigation goals (see Monitoring Plan for more details).

The Habitat Evaluation Team (HET) with input from the Maurepas Technical Advisory Group (TAG), created project operational assumptions for the Gated Intake Structure benefit Wetland Value Assessments (WVAs). There were three objectives that guided the process of creating operational assumptions:

1. To include two pulses that coincide with anticipated high Mississippi River discharge,
2. To maximize benefits during the swamp forest growing season in the first half of the calendar year, and
3. To include non-flow periods to reduce flooding stress and allow for potential swamp soil dewatering.

This variability in discharge is expected to improve swamp health. Discharge assumptions are shown in the hydrographs below with the operations hydrograph (red-dashed line) based on Mississippi River discharge year (solid black line) reflecting the fortieth percentile maximum flow rate hydrograph (15 December 1997–05 August 2020; Mississippi River at Reserve Gauge 01260; Figure 2). This river discharge percentile was used so that a conservative estimate of when and how the gated intake structure could be operated with maximum discharge (2000 cubic feet per second, cfs) into the swamp. Environmental conditions, such as Mississippi River discharges, are very likely to be dynamic. The conservative nature of the average hydrograph would incorporate operational flexibility.

Endangered Species Act coordination with the US Fish and Wildlife Service resulted in the following gated intake structure operational requirement to minimize impacts to pallid sturgeon.

- Gate operation that would significantly increase or decrease the velocity through the structure should be implemented over several hours to allow fish sufficient time to migrate back to the river or swim away from the structure.

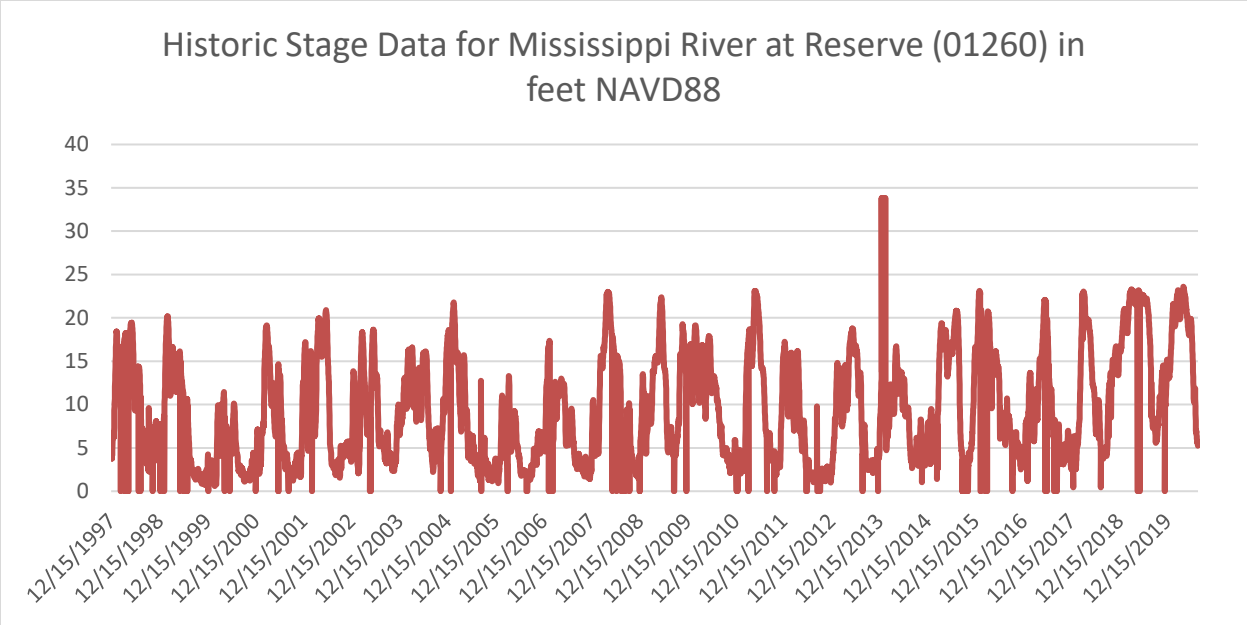

Figure 2. Historic stage data for Mississippi River at Reserve (01260) in feet (NAVD88) for the time period used to generate the 40th percentile values.

The proposed annual operational period for the diversion is between January 1 and July 1. The first 3 years of operation would gradually increase flow duration and magnitude (i.e., a "ramp-up" period). This ramp-up period (Figures 3-5) is intended to reduce the initial shock to the system and enable adaptive management based upon observed water flow and environmental responses (See Adaptive Management Plan for more information). The first three years would be followed as closely as possible to the ramp-up period. Some flexibility in operations (e.g., timing, discharge rate, and duration of pulses) would be allowed from years 4 on through a monitoring and adaptive management process with the goal of achieving mitigation success.

Pallid Sturgeon Operational Requirements

Gate operation that would significantly increase or decrease the velocity through the structure should be implemented over several hours to allow fish sufficient time to migrate back to the river or swim away from the structure.

2.1 Operational Assumptions

The operational assumptions described below were used to guide Hydrological modeling and estimate Project impacts (e.g., WVAs).

> Year 1 – Start operations at 250 cfs on January 1 and increase by 250 cfs increments to 1,000 cfs over the course of six weeks. After five weeks at 1,000 cfs, increase to 1,500 cfs for one week, then to 2,000 cfs for one week, and stop discharging on April 1. Restart operations at 500 cfs on May 13, continue for 15 days at this discharge, and then increase discharge to 750 cfs for 7 days. Then increase again to 1,000 cfs, and continue until June 30 (Figure 3).

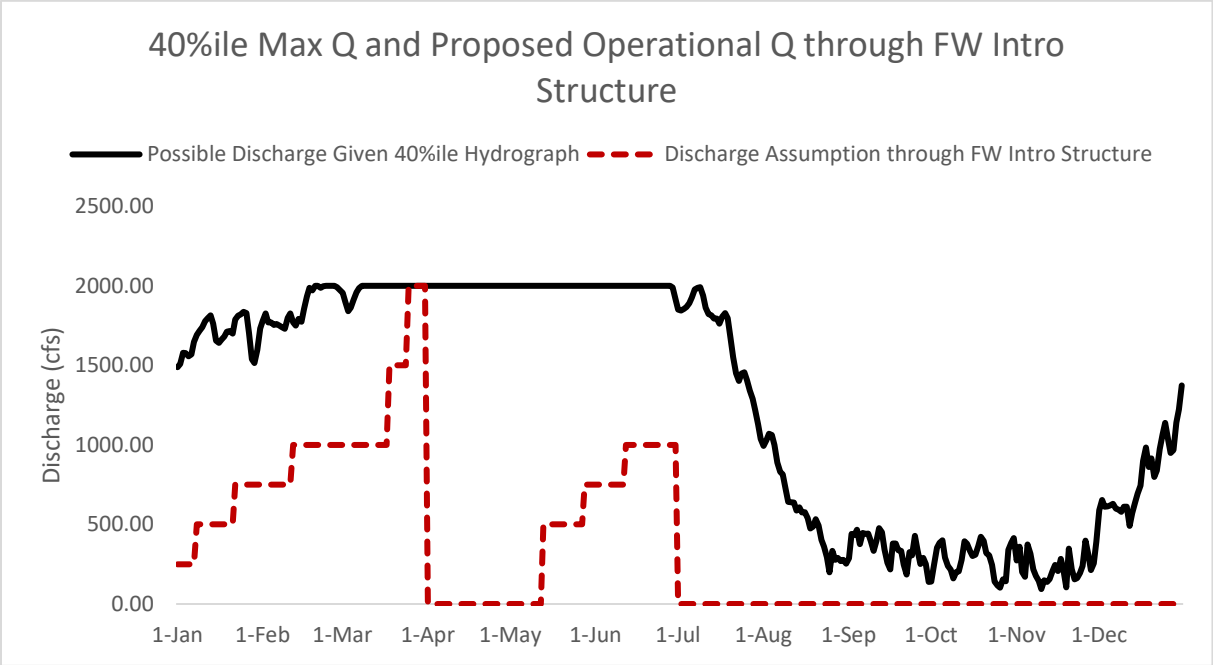

Figure 3. Year 1 operations plotted with the fortieth percentile maximum flow rate hydrograph of the Mississippi River.

Year 2 – Start operations at 250 cfs on January 1 and increase by 250 cfs every 10 days until 2,000 cfs. Continue discharging at 2,000 cfs or maximum operating capacity based on river conditions is achieved until April 1 and then stop flow. Restart operations at 500 cfs on May 13 and increase by 500 cfs every 10 days until 2,000 cfs or maximum operating capacity based on river conditions is achieved. Continue discharging at 2,000 cfs or maximum operating capacity based on river conditions is achieved until June 30 and then stop flow (Figure 4).

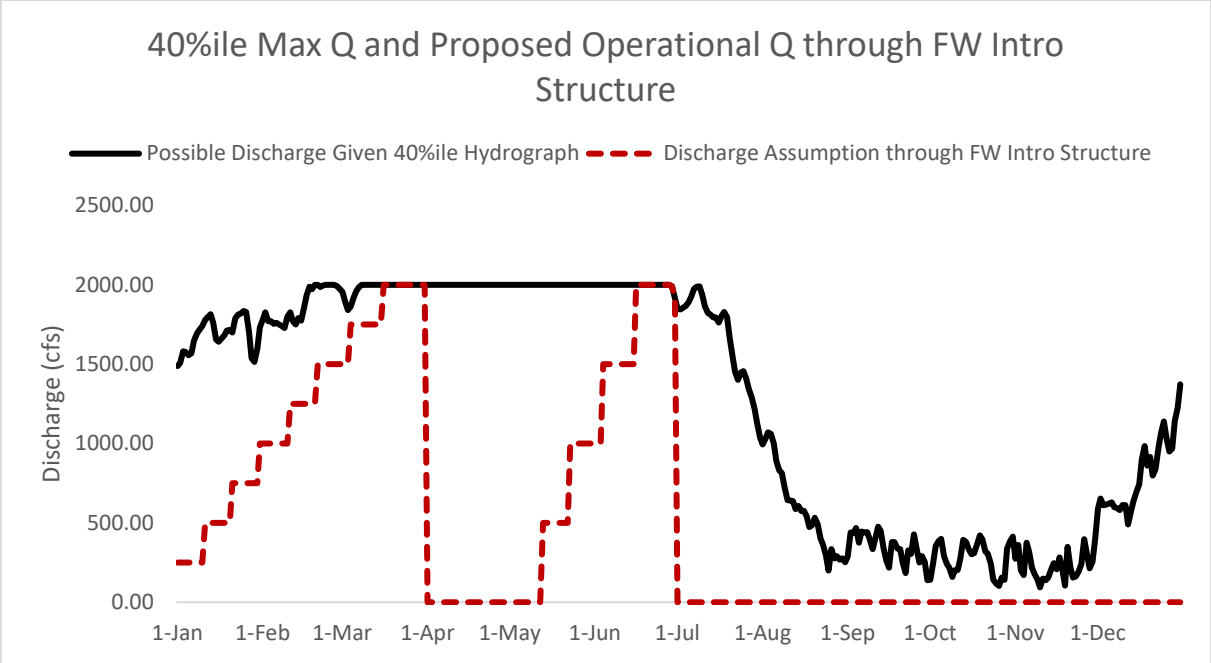

Figure 4. Year 2 operations plotted with the fortieth percentile maximum flow rate hydrograph of the Mississippi River.

Year 3 – Start operations at 500 cfs on January 1 and increase by 500 cfs every 15 days until 2,000 cfs. Continue discharging at 2,000 cfs or maximum operating capacity based on river conditions is achieved until April 1 and then stop flow. Restart operations at 500 cfs on May 13 and increase flow by 500 cfs every 10 days until 2,000 cfs or maximum operating capacity based on river conditions is achieved. Continue discharging at 200 cfs or maximum operating capacity based on river conditions is achieved until June 30 and then stop flow (Figure 5).

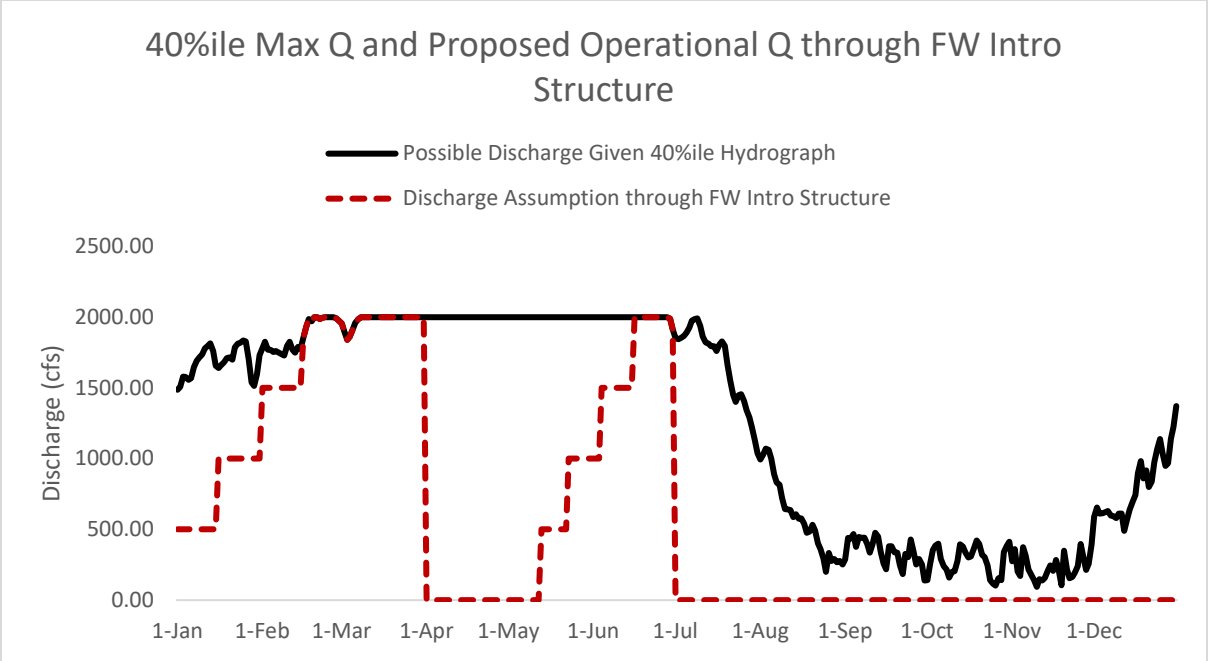

Figure 5. Year 3 operations plotted with the fortieth percentile maximum flow rate hydrograph of the Mississippi River.

Years 4–50 – Operate at 2,000 cfs or maximum operating capacity based on river conditions from January 1 until April 1. Operate at 2,000 cfs from May 13 until June 30 (Figure 6).

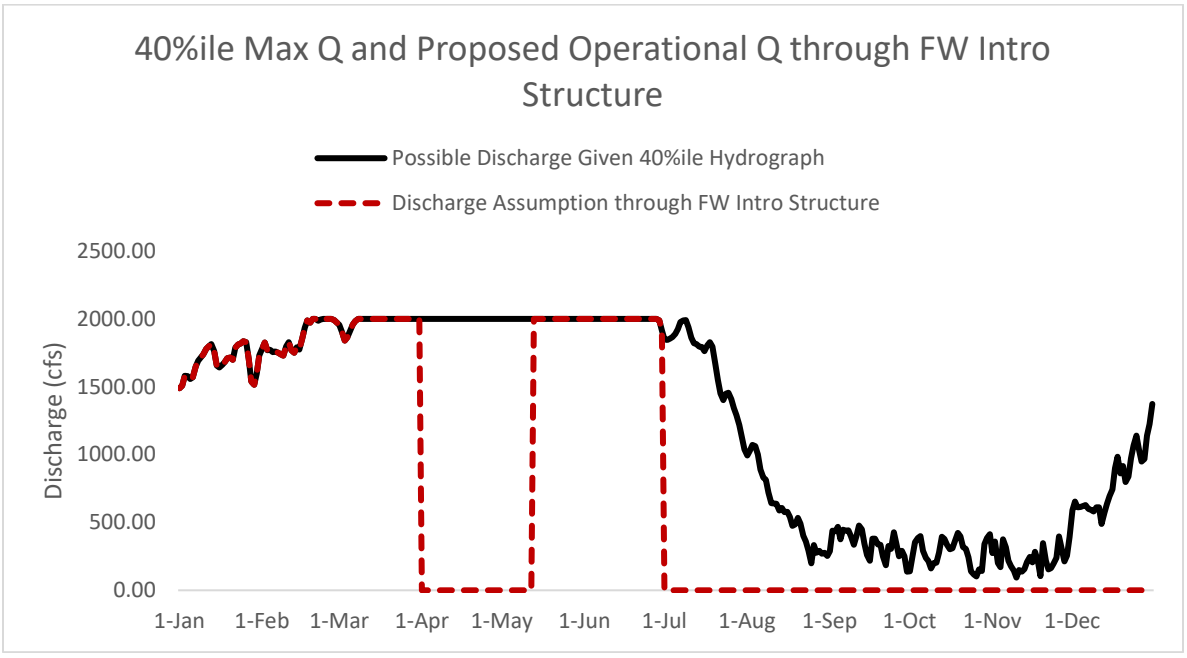

Figure 6. Years 4-50 operations plotted with the fortieth percentile maximum flow rate hydrograph of the Mississippi River.

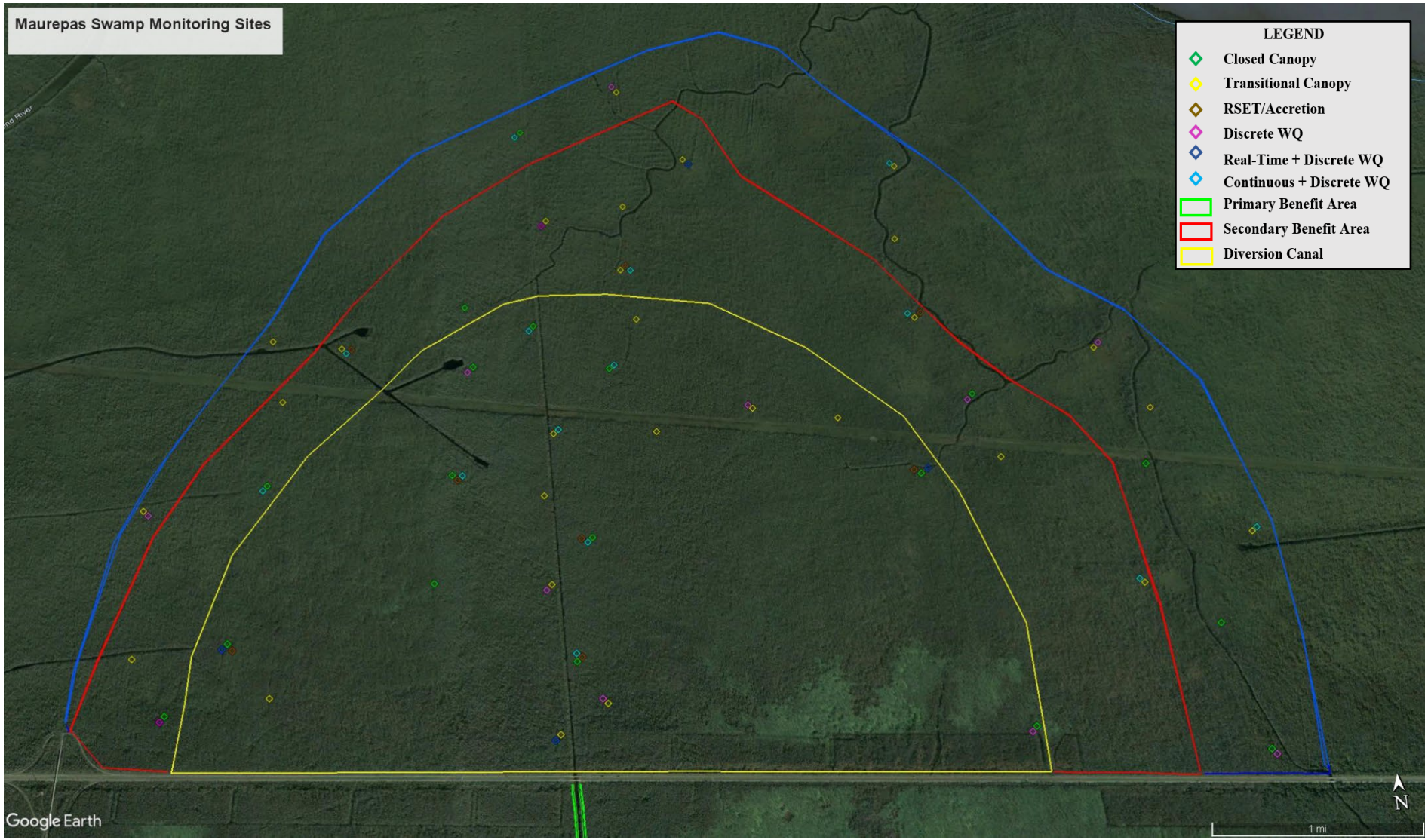

Figure 7. Locations of proposed mitigation monitoring stations for the MSA-2.

Discharges may deviate from the Operations Plan as outlined below. The Interagency Environmental Team (IET) would be consulted prior to any operational changes except emergencies. With respect to emergency operations, the responsible agency anticipates the IET would provide comments or suggestions at regularly scheduled meetings, not for each operational event. Emergency operations are, by nature, time-sensitive and it is unlikely the responsible agency would have time to obtain comments or suggestions prior to closing the structure.

- A high-water elevation trigger for shutdown of the gated intake structure would be established. The precise water elevation and location of where this elevation would be measured have not yet been determined. It would be installed under coordination with the Coastal Protection and Restoration Authority (CPRA), CEMVN, and Louisiana Department of Wildlife and Fisheries (LDWF). The MSP Monitoring Plan would be considered when deciding a final location.

- The MSP gated intake structure would be linked to sensors in the Mississippi River established to detect chemical spills from the adjacent Pin Oak oil and gas terminal. These sensors trigger an alarm which would alert the project operator to immediately close the gated intake structure to prevent chemicals from being drawn into the conveyance channel.

- A supervisory control and data acquisition (SCADA) system would be used allow for real-time monitoring and management of project operations and rapid intake closure in emergency situations.

- Operations would cease if directed by entities in charge of rescue operations in the Mississippi River due to a capsized vessel or other related human life and safety emergency. Operations would resume only when it is safe to do so.

- Emergency, maintenance, and local parish issues would be evaluated on a case-by-case basis to determine operational needs. All parties shall be notified if operations outside of the plan are required.

- The structure may be operated for public relations and/or educational purposes, though output is not to exceed 500 cfs and the demonstration would not exceed 2 hours.

- Operations of the structure may occur at any time during the year to ameliorate high salinities that could be associated with events such as but not limited to droughts or tropical storms.

- The option not to operate the structure or to operate at a reduced capacity may occur to coincide with low water Maurepas Swamp conditions conducive to recruitment of swamp tree species.

3.0 Lateral Discharge Valve Operations

Between I-10 and US 61 there would be up to approximately 16 locations where pipes with lateral discharge valves (LDVs) would traverse a conveyance channel levee. The LDVs would be constructed of 24-inch reinforced concrete pipes approximately 80 feet long. There would be a total of up to approximately 32 pipes, 16 on each conveyance channel levee. The LDVs would be actively operated and bidirectional to facilitate drainage of discharged water and precipitation events to minimize potential impacts from increased inundation duration which would reduce and minimize impacts to wetlands between I-10 and US 61 associated with altered hydrology in the vicinity of the conveyance channel.

3.1 Operational Assumptions

The LDVs would be open when the Gated Intake Structure is closed to allow for exchange flow and drainage from the conveyance channel and surrounding wetlands.

The LDVs would discharge approximately 140 cfs on each side of the conveyance channel (280 cfs total) for at approximately 7 or more days at the end of each pulse defined within the gated intake structure discharge assumptions (Figure 8; Section 2.1). Operating LDVs to coincide with the end of each gated intake structure pulse would deliver flowing water, nutrients, and potentially sediments into portions of those wetlands while allowing the introduced water to drain afterwards. The HET evaluated 7 days of discharge through the LDVs through Delft3D modeling (See H&H Appendix for more details); however, operations may be altered through an adaptive management process (See Adaptive Management Plan for more details).

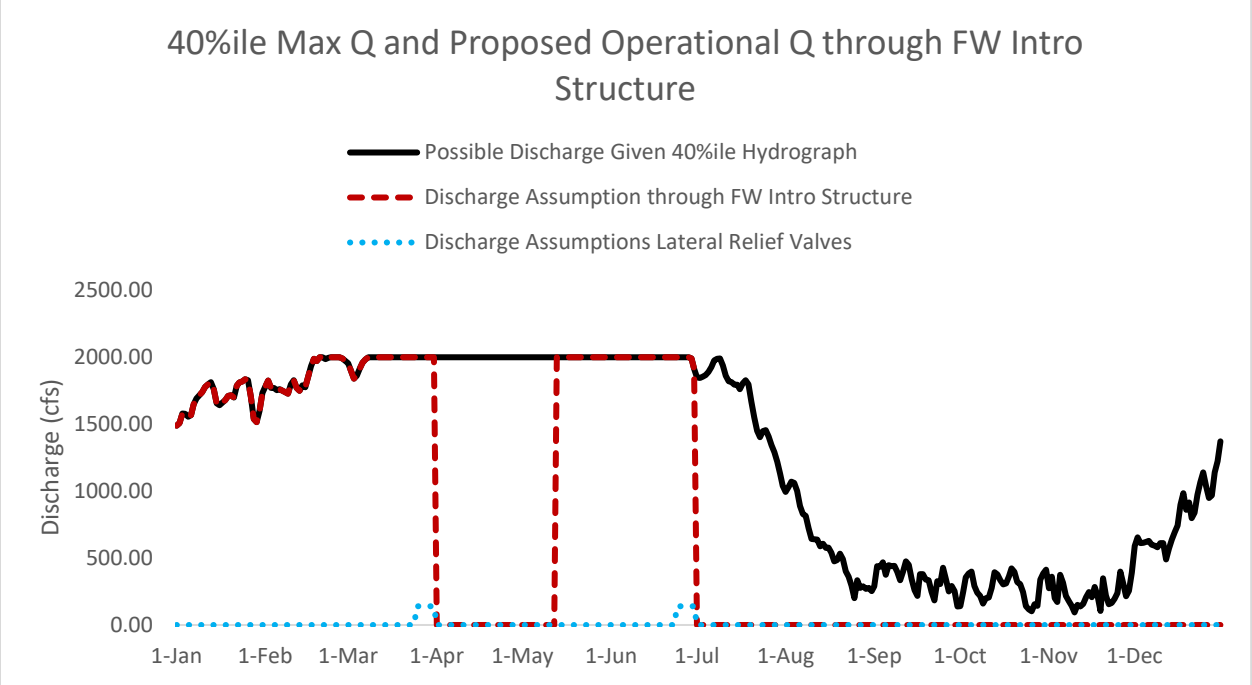

Figure 8. Maurepas Swamp Project discharge assumptions adapted to include Lateral Discharge Valve discharge assumptions.

4.0 Deviations from Operations Assumptions

The operational assumptions (Section 2.1) provide seasonal variability of discharges in a pulsed manner that coincides with higher river stages and the growing season of the swamp. These goals and assumptions would guide operations, especially through the first three years; however, once operations are initiated, knowledge gained through an intensive data collection effort would be used to feed back into and refine the Operations Plan to better meet mitigation success criteria. The Monitoring Plan (Figure 7) and Adaptive Management Plan have details regarding mitigation success criteria, data collection efforts, and how these data would be used to refine the Operations Plan. This Operations Plan would be a living document and adjustments could be made based on site conditions, a review of project monitoring data, and an adaptive management approach.

4.1 Interaction with other projects

The adaptive management approach as described in the Adaptive Management Plan would allow operators to consider potential effects for existing or future authorized projects when operating this Project. Three such existing authorized projects are described below. Other projects could be added to this section, as necessary.

1. The Bonnet Carré Spillway (BCS) consists of 350 20-foot bays that when fully operated can discharge approximately 250,000 cfs. The BCS is in St. Charles Parish and is operated to reduce flood damage and loss of life in the New Orleans area and other downstream communities caused by high flood stages on the Mississippi River. When open, the discharge from the BCS generally flows east through Lake Pontchartrain towards the Gulf of Mexico and does not significantly increase water levels in Pass Manchac or the Maurepas Swamp, which influence water levels in Maurepas Swamp (e.g., Georgiou, 2002; McCorquodale & Georgiou, 2004).

2. The West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction feature in St. Charles and St. John the Baptist Parish (WSLP levee system) share its western levee sections (WSLP-111, 112, and 113) with the MSP conveyance channel. Delft3D hydraulic modeling study (FTN, 2020) and the HEC-RAS modeling study (Agnew, 2019) results indicate gated intake structure operation at 2,000 cfs would not significantly increase water levels ($\sim < +0.2$ feet) with the WSLP levee system. Therefore, WSLP is not expected to affect operations.

3. Operations of the Project's gated intake structure are not expected to significantly impact navigation in the Mississippi River. A FLOW-3D modeling study (Meselhe et al., 2015) indicate that under high as well as low river flow conditions, the flow approaches the intake channel entrance along the shoreline of the Mississippi River without significantly affecting flow in the Mississippi River navigation channel. Additionally, Meselhe and others found that high water conditions in the Mississippi River are not likely to affect MSP structural components. The headworks and rebuilt Mississippi River levee would be constructed to meet the USACE standards for mainline flood protection.

5.0 Responsibilities

The responsible agency is defined as the agency responsible for carrying out this operations plan. This would be CEMVN, or its designee, to the extent this is consistent with the "Project Partnership Agreement between the Department of the Army and the State of Louisiana and the Pontchartrain Levee District for the West Shore Lake Pontchartrain Hurricane and Storm Damage Reduction Project". Full turn over would occur after initial success for mitigation is met. The Non-Federal Sponsor (NFS) or its designee would be responsible for operations and maintenance actives associated with the Project after full turn over. The Maintenance, Monitoring, and Adaptive Management Plans all have details regarding decision making and responsibilities of the responsible agency.

As part of the adaptive management approach an IET comprised of federal, state, and local agencies would be established to meet periodically (not likely to be more than annually) to manage and discuss MSP operation. The IET would provide advice on the operational plan for the structure, procedures for test operations of the structure, emergency shutdown procedures, and other operational concerns the responsible agency deems appropriate by following the procedures described in the Maintenance, Monitoring, and Adaptive Management Plans to consider changes to the Operations Plan. The mitigation success criteria detailed in the Monitoring Plan would be the primary consideration when making decisions about operation of the diversion.

6.0 Budget

The CPRA provided an estimated cost for operations of the Project based on this Plan of $105,000 per year. This amount is based on a full time CPRA appropriate level staff annual salary including indirect cost. Because the diversion structure is only expected to operate for six months out of the year, the $105,000 full salary per year cost is a conservative estimate that includes all other incidental, and relatively insignificant, associated costs such as electricity, back-up generator, overhead costs, etc. The 50-year cost, including 2.5% inflation, is $5,381,250.

7.0 References

Agnew, M. (2019). West Shore Lake Pontchartrain hydraulic design of pump stations and drainage structures. Draft Report. US Army Corps of Engineers. New Orleans, Louisiana.

FTN (2020). Water quality modeling of the proposed river reintroduction into Maurepas swamp (PO-0029). Report submitted by FTN Associates to the Coastal Protection and Restoration Authority, Baton Rouge, Louisiana.

Georgiou, I. Y. (2002). Three-dimensional hydrodynamic modeling of saltwater intrusion and circulation in Lake Pontchartrain. A dissertation for Doctor of Philosophy in Engineering and Applied Science in the Department of Civil and Environmental Engineering, University of New Orleans, New Orleans, LA.

McCorquodale, J. and Georgiou, I. (2004). Modelling Freshwater Inflows in a Shallow Lake. *Archives of Hydro-Engineering and Environmental Mechanics* Vol. 51, No. 1, pp. 75–84.

Meselhe, E., Richardson, J., Lagumbay, R., Allison, M., Jung, H. (2015). Simulation of Flow near Proposed Dock Facility and Freshwater Diversion Reserve, Louisiana at River Mile 144.2. Prepared for and funded by the Coastal Protection and Restoration Authority. Baton Rouge, LA.

Maurepas Swamp Project Maintenance Plan

MSA-2
Maintenance Plan

CPRA Project Maintenance Plan Summary

CPRA's restoration project, the River Reintroduction into Maurepas Swamp Project (PO-0029), includes all of the maintenance and inspection associated with the head works and all secondary features that are also associated with the Tentatively Selected Alternative (TSA): Maurepas Swamp Alternative 2 – MSA-2 (public lands only). Maintenance features and general description of activities are as follows:

- Head Works: inspect and maintain in operable condition
- Sedimentation Basin: dredging and structural maintenance
- Access Roads: maintain in operable condition
- Outfall Channel: mowing, spraying, erosion control, etc.
- Airline Highway Culverts: maintain in operable condition
- I-10 Check Valves: inspect and maintain in operable condition
- Weirs: inspect and maintain in operable condition
- Railroad Embankment Cuts: inspect and maintain in operable condition

Additional details on maintenance activities are provided in the appended Maintenance Task Descriptions (see **Appendix A**) for Engineering and Design Feature Maintenance. Maintenance activities described therein do not include "Ancillary Channel Maintenance" as subsequently described.

Ancillary Channel Maintenance Activities

In addition to maintaining project design features, maintenance activities for MSA-2 will be associated with ancillary channel maintenance, including routine inspections and bathymetric surveys every five years, removal of debris and deposited material, and invasive and nuisance species management. Ancillary channels include conveyances within the MSA-2 area that are not associated with the Engineering and Design Features. Further description of ancillary channel maintenance activities is provided below.

- Routine inspections will involve visually observing the condition of the ancillary channels. Bathymetric surveying will be conducted periodically (every 5 years). The survey data will be used to evaluate whether deposition or scouring has significantly affected the channel invert elevation or the overall cross-section.

- Maintenance will include the removal of debris and deposited material as needed (every 25 years, or based on inspection results).

- Maintenance will include management of invasive and nuisance species such as Chinese tallow and black willow along levees and spoil banks, and any invasive species that might affect the operation of the diversion. Examples of invasive species that might affect the operation of the diversion are zebra mussels, floating aquatic vegetation, and nutria. Management will primarily consist of mechanical removal.

APPENDIX A
MAINTENANCE TASK DESCRIPTIONS

The maintenance tasks of the various features that comprise the Maurepas Diversion and their required frequencies are briefly described below. The features are grouped into the following eight categories: 1) Intake & Levee Crossing, 2) Headworks, 3) Roadway Crossings, 4) Sediment Basin & Conveyance Channel, 5) Railroad Crossings, 6) Check Valves, 7) Flow Distribution Features, and 8) Remote Sensors. The maintenance tasks defined in this document include only the maintenance and inspection duties required to ensure satisfactory operation of the diversion features over a 50-yr project life. The maintenance tasks described herein will be incorporated into the Operations, Maintenance, Monitoring, and Adaptive Management (OMMAM) Plan. The additional monitoring and adaptive management tasks that comprise the complete OMMAM plan are discussed in a separate document; they are not included herein.

1. Intake & Levee Crossing

2. Intake Channel

- An initial inspection, including visual examination and bathymetric surveying, will be conducted upon completion of construction. Subsequent routine annual inspections will involve visually observing the condition of the channel riprap armoring and the revetment along the Mississippi River hurricane levee slope. Bathymetric surveying will be conducted annually for the first two years and, if no significant changes are observed based on comparison of the year-over-year survey data, subsequently every five years thereafter. The survey data will be used to evaluate whether deposition or scouring has significantly affected the channel invert elevation or the overall cross-section. Additional ad-hoc inspections may be conducted, as needed, after extreme events, such as extremely high river levels, the passage of a 2% storm, or other atypical phenomena. Additional inspections due to such incidents are anticipated to be required every ten years.

- Annual maintenance will include the removal of debris, which is anticipated to consist primarily of floating material. The need for removal of deposited sediment will be based on the findings of the bathymetric surveying; this is estimated to be required every five years. The replacement of riprap and the repair of revetment will be also performed based on the bathymetric inspection findings. It is anticipated that riprap replacement will be required every five years and revetment repair every ten years.

3. Concrete Inflow & Outflow U-frames

- An initial detailed inspection, including visual examination and Non-Destructive Testing (NDT), as required, will be conducted upon completion of construction, prior to excavating the last earthen section in the Intake Channel (i.e., prior to flooding the structure). Subsequent routine annual inspections will include visually inspecting the channels for structural integrity as well as for potential erosion or sedimentation. Bathymetric surveying will be conducted concurrent with the Intake Channel survey (annually for the first two years and subsequently every five years thereafter) to detect signs of possible settlement or movement of the monoliths. As with the Intake Channel, bathymetric survey data will be collected for the U-frames after extreme events; this is anticipated every ten years.

- Maintenance tasks will be conducted based on the inspection findings. Floating debris removal will be conducted on an annual basis. Removal of deposited material is anticipated to be required every five years. Structural repairs of damage to the concrete channels are anticipated every twenty-five years.

4. Culverts under Levee & River Rd

- Inspection of the culverts under River Road will be coordinated with LADOTD. An initial detailed inspection, including visual examination and NDT, as required, will be conducted upon completion of construction, prior to flooding the structure. Subsequent inspections will include visual examination via a walk-through of the culverts to assess debris accumulation, sediment build-up, and potential structural distress. Signs of settlement, including movement of the structures, differential settlement from the adjoining U-frames, as well as indications of water leakage will also be investigated. These inspections will require dewatering of the structure using the dewatering sluice gate on the river side of the headworks structure and the bulkhead slot in the last culvert (C-6). The frequency of such inspections will be annually for the first two years and then on a five-year basis.

- Maintenance will be dictated by the inspection findings. The debris and sediment accumulation is anticipated to be minimal since the relatively high velocity through the culverts minimizes the potential for deposition. Since the maintenance activities require dewatering, the removal of any debris which has been caught in the culvert along with any deposited material will follow the same frequency as the detailed inspections. Thus, these maintenance activities will be performed annually for the first two years and thereafter every five years. The culverts have been designed for a fifty-year life, so the need for structural repairs will be infrequent; they are projected to be required every twenty-five years.

5. River Road Crossing

- A visual inspection of the soundness of the roadway over the culverts will be conducted annually to discern if there are any potential problems with the underlying culverts. The travel lanes and shoulders of the roadway will be checked for areas of potential settlement, base failures, potholes, rutting, and other riding surface issues. Those findings will be recorded as

part of the Maurepas Diversion OMMAM findings and will be relayed to LADOTD for their roadway performance assessment.

- Maintenance activities that relate to the roadway itself, such as the repair of roadway base failures or driving surface restoration will remain the responsibility of the LADOTD. All roadway repair and maintenance activities will be the responsibility of the LADOTD.

6. Levee at Headworks

- An initial detailed inspection of the levee section adjacent to the Headworks will be conducted per USACE protocol upon completion of construction. This initial inspection will involve close visual examination by Geotechnical, Structural and Civil engineers as well as topographic and bathymetric surveying to ensure that the construction has been performed according to the plans and specifications.

- Two successive inspections will be conducted annually for the first two years, in May, which is representative of site conditions following high river levels. These inspections will be visual examinations by the noted engineering specialties, conducted to verify and rate the levee system operation and maintenance in accordance with the USACE Levee Safety Program.

- Subsequently, a comprehensive periodic inspection of the levee will be conducted by a USACE multidisciplinary team, led by a professional engineer and including the levee sponsor, every five years. It will include: 1) data collection comprised of a review of existing O&M data, previous inspections, emergency action plans and flood fighting records, 2) field inspection, similar to the routine visual inspection, but with additional features, and 3) a report including the data collected, field inspection findings, an evaluation of any changes in design criteria from the time the levee was constructed, and additional recommendations as warranted, such as areas that need further evaluation.

- An elevation survey of the levee crown will be conducted in conjunction with the bathymetric surveying of the Intake Channel - annually for the first two years, then every five years thereafter.

- Grass cutting on the levee surface will be performed every two weeks between mid-March through mid-September and monthly during the remainder of each year.

- A levee lift to maintain the required design protection elevation is anticipated every ten years.

2. Headworks

7. Control Building & Structure

- Annual routine visual inspections will be made of the control building structure and its ancillary on-site facilities. A detailed inspection of the entire concrete structure including the sections supporting the building and those housing the sluice gates will be conducted annually for the

first two years and then every five years thereafter. The inspections will consist of both visual examination as well as NDT, as needed. Deficiencies will be noted for repair or replacement.

- Annual routine maintenance will consist of pesticide and herbicide treatment as well as utilities repair, as required. It is anticipated that cleaning and painting of miscellaneous components will be required every five years. Repairs to the building are expected to be needed every ten years. Minor concrete repairs are anticipated to be required every ten years. Major structural repairs to the concrete structure are expected to be required on a twenty-five-year basis.

8. Sluice Gates & Actuators

   - Annual inspections will be conducted, including observing the physical condition and functional operability of the gates, hydraulic actuator systems, and ancillary mechanical components. The incoming electrical supply to the overall Headworks and specifically to the gates and actuators will also be inspected yearly. The bulkheads and bulkhead slots will be inspected annually to ensure their capability of achieving a water tight seal when needed for temporary closure to dewater or for emergency operation. The gate hoist mechanism will be checked for bolt loosening, limit switch damage, lubricant leaks, paint damage, and desiccant condition, among other items.

   - Annual maintenance activities will include items such as lubrication of the gears, drum, and shaft bearings; replacement of worn components; top-off of hydraulic fluid levels; etc. Additional tasks would include recoating anchor bolts, replacing cracked hoses, tightening leaking fittings, replacing O-rings, etc. The maintenance schedule of moving parts will be guided by the monitoring findings and by the maintenance recommendations of the component manufacturers. Additional maintenance actions will include the repair and replacement of damaged or inoperable hydraulic components, which are expected to be performed every five years. Repair or replacement of the gate seals along with painting of the bulkheads is anticipated every ten years. Major gate rehabilitation is expected to occur every twenty-five years.

9. Stand-By Generator

   - To ensure operability, the generator will be automatically operated for ten minutes each week. The generator will be inspected monthly, including checking the fuel, oil, and coolant levels; battery charge; drive belt; exhaust system; fuel storage tank; safety and alarm devices; and radiator hoses, among other items. An operational test will be performed on the generator each month to ensure that it is capable of transferring sufficient power to the designated headworks features; that the output voltage is within range; and that there are no leaks or exhaust system deficiencies.

   - Maintenance of the generator will include a tune-up on an annual basis. This will include servicing the lubrication, cooling, and fuel systems as well as testing the starting batteries. Any mechanical problems that can be repaired, such as, replacing fuel lines and hoses, cleaning and

tightening the battery connections, replacing engine and exhaust system gaskets, etc. will also be performed. The service life of the generator is expected to be 25 years, at which point the unit will be replaced.

10. SCADA System

- Annual inspection will include visual inspection of the electrical components and instrumentation along with performance testing to verify signaling and control capabilities. Inspections will also include routine testing of the inter-connection of the headworks SCADA system to that of the Marathon Oil terminal emergency leak detection and shutdown system. This will ensure that any potential leaks can be detected and that the system can be shut down quickly to eliminate the transport of any potential spill into the diversion channel.

- Maintenance of the SCADA system will involve the repair and/or replacement of components as indicated by the scheduled annual inspection or the manufacturer's recommendations. Such electrical and instrumentation maintenance is anticipated to be required every five years. The system software will also need to be upgraded to maintain communication with the host network; this is anticipated to be required every five years. Replacement of dysfunctional components is anticipated to be every ten years, as they age and/or technology progresses.

11. Access Roads.

- Inspection of the access roads to the Headworks and Conveyance Channel will occur annually for the first two years and then every two years afterward. Inspection of the access road to the Sedimentation Basin will be conducted annually due to its heavy usage for the semi-annual removal of accumulated sediment. The inspections will consist of visually inspecting the condition of the roads, including their grades and cross-slopes, the stability of both the sub-grade and top aggregate wearing course, as well as their overall condition.

- Maintenance of the access roads will consist of re-grading along with base and surface repairs, as needed, to ensure continuous access to the headworks facilities, sedimentation basin, and conveyance channel. The relatively light usage of the Headworks and Conveyance Channel access roads merits roadway repairs on a five-year interval. The access road to the sedimentation basin will be used every six months by numerous trips of heavy equipment to remove the accumulated sediment; therefore, maintenance activities on this access road are anticipated to be required every two years.

12. Monitoring Equipment.

- Inspection of the various devices will involve their periodic calibration to ensure detection accuracy as well as data polling to insure continued operation. These activities will occur on a basis unique to each component, as specified by the manufacturer. Depending upon the devices, the calibration frequency may be as often as every month, but all instrumentation shall be calibrated at least annually.

- Maintenance of the monitoring equipment will consist of routine replacement of standard component elements that degrade in the normal course of wear and tear. The maintenance of sensing elements will be conducted on at least an annual basis, if not more frequently. Repair and/or replacement of the various instrumentation is estimated to be required every five years, depending upon the type of device and the advances in technology.

3. Roadway Crossings

13. Airline Highway Crossing

- The inspection of the culverts under Airline Highway will be coordinated with the LADOTD. The culvert inlets and outlets will be checked for evidence of erosion, accumulation of sediment and/or debris, and adverse flow phenomena, e.g., scour, eddies or stagnant areas. In addition, visual inspection of the concrete culvert elements will be conducted, via walk-through of the culverts to assess potential structural issues, settlement, sediment build-up, or leakage. The culverts are 9' x 9' boxes, which are large enough to walk in; however, they will almost always be full of water due to their low relative elevation. Sandbags, inflatable dams, or other means will be used to block the upstream and downstream ends of the conveyance channel to allow the culverts to be dewatered. The inspections will be conducted annually for the first two years and then every five years.

- A general examination of the soundness of the roadway over the culverts will also be conducted annually. The travel lanes and shoulders of the roadway will be checked for areas of potential settlement, base failures, potholes, rutting, and other riding surface issues. Those findings will be relayed as a courtesy to LADOTD for their roadway performance assessment.

- The removal of observable debris will be performed annually. Additional maintenance activities will include the removal of sediment accumulation as well as repair of eroded channel materials (riprap), as needed. These activities will occur annually for the first two years and then every five years thereafter. In addition, structural concrete repairs to the culverts will be performed on a ten-year basis. Maintenance activities that relate to the roadway itself, such as the repair of roadway base failures or driving surface reparation will remain the responsibility of the LADOTD.

14. Interstate 10 Crossing

- The crossing under I-10 is an open trapezoidal section with bridge revetment and bridge piers. Visual inspection can be readily performed on the dry sections of revetment. Inspection of the underwater revetment and the areas around the bridge piers will be made by boat via rod probing. Annual inspections will be conducted for the first two years and then at five-year intervals. The inspections will check for erosion and/or sediment build-up in the channel underneath the interstate and around the bridge piers. The condition of the cement bag/concrete revetment system that comprises the channel lining protection underneath the bridge will also be inspected to ensure that the configuration of the channel cross section is stable. The tie-in

of the revetment system to the bridge approach slabs will be examined to further document the stability of the bridge\channel crossing. The information collected will be relayed to the LADOTD for their review and documentation. Structural inspection of the bridge sub- and super-structure itself will be conducted by the LADOTD under their periodic bridge inspection program.

- Maintenance dredging and/or filling of scour holes around the bridge piers and throughout the channel cross section will be performed based on the inspection findings. These repairs are expected to be required on a ten-year cycle. The findings will be forwarded to the LADOTD for their use. Repairs to the channel lining revetment, bridge, and\or roadway will be the responsibility of the LDOTD.

4. Sediment Basin & Conveyance Channel

15. Sedimentation Basin

- The condition of the Sedimentation Basin side slopes and bottom will be inspected yearly to ensure that the gross geometric configuration of the basin remains stable. The monitoring and recording of sediment accumulation by manual depth probing will be conducted monthly for the first two years, and thereafter every six months, to assess the need for clean-out. Monthly sampling of the sediment will be performed for the first year to characterize the sediment captured (e.g., specific gravity determination, sieve analysis of grain size distribution, etc.).

- A key maintenance activity will be the excavation, removal, and haul-off of the accumulated sediment. Based on the estimated accumulation rate, it is anticipated that sediment removal will be required every six months. The frequency of the basin clean-out will be adjusted based on the actual sediment accumulation rate as the diversion is operated over time. A sediment removal and disposal plan will be developed during Final Design; the methodology could be suction dredging, clam-shell excavation, front-end loader and dump trucks, or other means. The accumulated material is anticipated to be similar to batture sand and therefore has value as structural fill, offsetting all or part of the removal and disposal costs. Additional maintenance activities will include the repair of any damage to the access roads, side slopes, and bottom, including rehabilitation of the revetment lining, on a ten-year basis. The lining of the basin is to be grouted riprap, which should stand up well to whatever excavation procedure is designated.

16. Conveyance Channel

- Annual visual inspection of the channel side slopes for stability, erosion problems, health of protective turf, animal burrowing damage, and possible leaks will be performed. These inspections will be conducted by walking the levee on the outboard side and from a boat for observation of the channel inside slope. The levee crown roadways will also be inspected annually for potholes, sloughing, loss of surfacing materials, and potential base failures or soft spots that impair surface integrity. A specific protocol will be developed to ensure that

maintenance vehicles stay on the levee crown to prevent potential ruts. Every five years, a bathymetric survey of the channel will be conducted. Concurrently, a more detailed five-year periodic inspection of the wetted surface of the inside of the channel will be performed to examine for vegetative growth, observe debris and/or sediment accumulation, and note problematic water flow regime phenomena, e.g., scour, eddies or stagnant areas.

- Grass cutting on the guide levee surface will be performed every two weeks between mid-March through mid-September and monthly during the remainder of each year. Additional maintenance activities will include the repair of the roadway crown stability concerns, channel erosion problems, and leaks in the guide levees every two years. Dredging to restore a smooth internal channel surface, remove debris, repair scour holes, and clear areas of excessive vegetation will be performed on a ten-year cycle to preserve the maximum flow capacity of the diversion. Guide levee lifts will also be required on a ten schedule to maintain the desired elevations.

5. Railroad Crossings

17. CN RR Crossing

- Visual inspection of the culverts via walk-through will be conducted to assess potential structural issues, settlement, sediment build-up, or leakage. Observation of erosion at the culvert inlets and outlets, examination for the accumulation of debris and/or sediment, and surveillance for evidence of potential flow problems, e.g., eddies, stagnant areas, etc. will also be conducted. Sandbags, inflatable dams, or other means will be used to block the upstream and downstream ends of the Conveyance Channel to allow the culverts to be dewatered. The inspections will be conducted annually for the first two years and then every five years.

- Annual maintenance will consist of the removal of observable debris. Removal of sediment accumulation in the culverts, replacement of riprap due to scouring, as well as any other corrective measures required to address flow-related problems will be conducted annually for the first two years and then every five years. Structural repairs to deteriorated sections of the culverts themselves are anticipated to be required every twenty-five years. Maintenance of the RR elements themselves will be the responsibility of CN RR.

- All activities within the RR Right-of-way will be coordinated in advance with CN RR, as required. Observations on the general condition of the RR infrastructure components in relation to the culvert crossing will be submitted as a courtesy to CN RR for their use. The formal inspection of the railroad will be the responsibility of the CN RR per the procedures and schedule dictated in the national AREMA standards as well as their specific requirements.

18. KCS RR Crossing

- The condition of the conveyance channel underneath the RR bridge will be visually examined each year for slope stability, observable debris and/or sediment accumulation around bridge piers, and potentially troublesome flow phenomena, e.g., scour, eddies, stagnant areas, etc. Also annually, the wetted surface of the channel under the bridge will be checked for excessive vegetative growth. In addition, the guide levee side slopes will be examined for stability, leaks, erosion problems, and turf establishment yearly.

- All activities within the RR Right-of-way will be coordinated in advance with KCS RR, as required. Structural inspection of the railroad bridge sub- and super-structure components, the horizontal and vertical stability of the track, the condition of the approach slabs, and the examination of other RR features will be the responsibility of the KCS RR.

- Remedial actions to maintain and/or restore the conveyance channel bank will be prioritized to first maintain the structural integrity of the bridge, then address local repairs needed, and finally, maintain as hydraulically efficient a section as possible. Such repairs are expected to occur every five years. The repair or replacement of any structurally deteriorated elements of the bridge sub- and super-structure, approach slabs, piers, track or ancillary elements will be the responsibility of the KCS RR, as dictated by the AREMA and KCS RR standards.

6. Check Valves

19. Check Valves under I-10

- Annual inspection will include the following items. A visual examination of the connections between the valves and their respective drainage pipes to assess their solidity. The observation of potential debris and/or sediment accumulation in the pipe, valve, or nearby area that could potentially prevent proper valve closure. A check for any erosion or undermining effects that could lead to a pipe failure which could prevent proper function by either closing off the pipe, preventing drainage to the north, or by-passing the valves enabling drainage to the south.

- Annual maintenance activities will include removal of debris and/or sediment accumulation. The replacement of damaged pipe sections or pipe/valve connections is anticipated to be required every ten years. Replacement of the valves is scheduled for a twenty-five-year cycle.

7. Flow Distribution Features

20. Weirs at Bayou Secret & Bourgeois Canal

- Annual inspection activities will consist of observing any settlement of the riprap weirs, accumulation of debris and/or sediment, and any loss of material from the weirs. Water surface elevations on both sides of the weirs will also be observed annually (this would ideally occur when significant flow is being routed from the Maurepas Swamp into Blind River). To enable these measurements, staff gages for both the upstream and downstream sides of the weirs will be designed during Final Design. Particular attention will be paid during inspection as to

whether there is a significant volume of flow that by-passes the weirs on either side. Significant flow will be defined as the formation of a flow path, either observed during the flowing condition, or as evidenced by the observable development of channelization around the weirs, that extends 20-ft beyond the termination of the weir cross-section on either side. The water surface elevation data will be recorded for evaluation of the backwater effects created by the weirs and determination of their effectiveness.

- Maintenance activities will include the removal of accumulated debris and/or sediment on a yearly basis. The replacement of riprap lost due to settlement or other reasons is anticipated to be conducted on a five-year basis. Additional material may be added to the weirs, material may be removed from the weirs, or the invert elevations and extents of the weirs may be revised. The frequency of this activity will depend upon the monitoring observations and their assessment, which will be part of the Adaptive Management feature of the OMMAM Plan.

21. Embankment Cuts

- Inspection activities will include observing the stability of the cut sections and noting any sloughing, erosion, or debris and/or sediment accumulation on an annual basis. The movement of water through the embankment cuts will be monitored by visual inspection of flow and measurement of water surface elevations on either side during select periods, when conditions are favorable. Staff gages for both the upstream and downstream sides of the embankment cuts will be designed during Final Design to enable these measurements.

- The removal of accumulated debris and/or sediment will be performed each year. Significant maintenance activities will be performed every ten years, including repairing any embankment areas degraded by sloughing or erosion and reshaping the cut faces to create stable surfaces. Depending upon the observed water movement, the cuts may be widened, deepened, or extended perpendicular to achieve the desired flow.

8. Remote Sensors

- The selection and location of the required monitoring devices to evaluate the performance of the diversion is being conducted by other members of the design team as part of the Monitoring and Adaptive Management portion of the OMMAM Plan. Upon completion of this effort, the operation and maintenance requirements of the remote sensing equipment will be incorporated into the O&M plan.

9. Personnel Salaries

22. Maintenance Personnel Salaries

- Dedicated field personnel will be allocated to the Maurepas Diversion to perform the inspection and maintenance activities described in this document. The following four categories of field personnel are anticipated: Mechanic, Electrician\Instrumentation, Equipment Operator, and Maintenance Worker. While individual personnel may not perform their respective O&M

duties strictly on the subject project, collectively a group of individuals covering the four categories will be required on a part-time basis, averaging 20 hours per week each.

- Office personnel will also be assigned O&M duties for the diversion. The category and man-hour requirements of those personnel will be defined in the finalized version of this plan.

10. Optional Items

23. Airline Highway Sluice Gates

- The installation of sluice gates at Airline Highway is an option that is under consideration by the design team. The purpose of the gates would be to prevent the conveyance of any spill that occurred in the river from reaching the Maurepas Swamp. Operation of the hydraulically actuated sluice gates to block the flow path of any spill in the conveyance channel would be controlled by an automated SCADA system connected to the Marathon Oil spill detection system.

- Routine operation of the gates and hydraulic actuators would be required on a periodic basis to ensure their condition remains fully functional. The SCADA system to be installed will enable the gates to be monitored and controlled remotely by CPRA. Operation of the gates will be performed at least monthly to ensure the functionality of the system. Such operation will require less than an hour of personnel time and the cost of the electricity used will be minimal.

- Annual inspections will be conducted, including observing the physical condition and functional operability of the gates, hydraulic actuator systems, and ancillary mechanical components. The incoming electrical supply to the gates and actuators will also be inspected yearly. The bulkheads and bulkhead slots will be inspected annually to ensure their capability of achieving a water tight seal. The gate hoist mechanism will be checked for bolt loosening, limit switch damage, lubricant leaks, paint damage, and desiccant condition, among other items.

- Annual maintenance activities will include items such as lubrication of the gears, drum, and shaft bearings; replacement of worn components; top-off of hydraulic fluid levels; etc. Additional tasks would include recoating anchor bolts, replacing cracked hoses, tightening leaking fittings, replacing O-rings, etc. The maintenance schedule of moving parts will be guided by the monitoring findings and by the maintenance recommendations of the component manufacturers. Additional maintenance actions will include the repair and replacement of damaged or inoperable hydraulic components, which are expected to be performed every five years. Repair or replacement of the gate seals along with painting of the bulkheads is anticipated every ten years. Major gate rehabilitation is expected to occur every twenty-five years.

- Annual inspection will include visual inspection of the electrical components and instrumentation along with performance testing to verify signaling and control capabilities. Inspections will also include routine testing of the inter-connection of the headworks SCADA

system to that of the Marathon Oil terminal emergency leak detection and shutdown system. This will ensure that any potential leaks can be detected and that the system can be shut down quickly to eliminate the transport of any potential spill into the diversion channel.

- Maintenance of the SCADA system will involve the repair and/or replacement of components as indicated by the scheduled annual inspection or the manufacturer's recommendations. Such electrical and instrumentation maintenance is anticipated to be required every five years. The system software will also need to be upgraded to maintain communication with the host network; this is anticipated to be required every five years. Replacement of dysfunctional components is anticipated to be every ten years, as they age and/or technology progresses.

24. Maintenance Building

If the operation and maintenance of the diversion is to be handled in-house, then a building for equipment storage and to serve as a base of operation for maintenance personnel may be constructed. (Such activities could be based from another off-site facility, or they could be contracted out altogether.) If such a building is constructed, then its O&M requirements will be as follows:

- Operation of the building and its utilities will occur as a passive part of the overall operation of the diversion.

- Annual routine visual inspections will be made of the building structure and its facilities. Deficiencies in the structure, the on-site facilities, and the service utilities will be noted for repair or replacement.

- Routine maintenance will consist of pesticide and herbicide treatment as well as utilities repair, as needed. It is anticipated that cleaning, painting and/or minor facility repairs will be required every five years. Structural repairs to the building are expected to be required on a twenty-five-year basis.