

**ANNEX D**  
**DRAFT OPERATING MANUAL**

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## **D DRAFT PROJECT OPERATING MANUAL**

### **D.1 INTRODUCTION**

The main purpose of a Project Operating Manual (POM) is for day-to-day use in water control for essentially all foreseeable conditions affecting a project during the Project Implementation Report/Environmental Impact Statement (PIR/EIS) Phase. Report preparation is pursuant to Engineering Regulation 1110-2-240, and is in accordance with guidance contained in Engineering Manual 1110-2-3600 and Engineering Regulation 1110-2-8156. The Fill Phase for each impoundment will follow the Initial Impoundment Fill Plan, which will be developed during design and construction. All elevations referenced in this draft operating manual are in feet, the 1929 National Geodetic Vertical Datum (NGVD), unless otherwise stated.

Development of POM is an iterative process that will continue throughout the life of the project. The POM will be updated at specific intervals during the detailed design, construction and operational testing and monitoring Phase) phases of the project. Refinements to the operating criteria in the POM will be made as more information is obtained on project detailed design, data, operational experience and general information gained during these phases. It is also anticipated that once the POM is completed and the long-term operations and maintenance phase is underway, it may be necessary to revise the POM from time to time based on additional scientific information, new CERP or non-CERP activities being implemented, and new CERP updates.

### **D.2 GENERAL PROJECT PURPOSES, GOALS, OBJECTIVES, AND BENEFITS**

The Everglades Agricultural Area (EAA) Reservoir project was designed to reduce frequency and magnitude of Lake Okeechobee regulatory releases to the estuaries and the backpumping from the EAA into Lake Okeechobee by sending the water to the reservoir. Additional goals include the following: Improve the timing of environmental deliveries through the detention and release of water to the Everglades in a manner responsive to environmental demands; provide for STA inflow equalization and optimization of treatment performance by capturing peak storm event discharges within the reservoir for slow release to the STAs; and decrease reliance of the agricultural community (currently served by the EAA canals and other areas served by Lake Okeechobee) on deliveries from Lake Okeechobee to meet water supply demands.

#### **Operational Intent Under Existing Conditions (Preliminary Operations)**

It is recognized that the timing and volumes of deliveries from the reservoir to downstream natural areas could be affected by many existing operational and

structural constraints of the regional water management system. Several of the existing constraints are planned to be reduced and/or eliminated by the time the EAA Reservoir becomes operational. CSOP for example includes the phased construction of several water management features and improvements that will be completed and operational as by 2010. If the EAA Reservoir is completed prior to the scheduled completion date presented in this document, it is possible that the operation of the reservoir will be constrained by some existing operational and structural constraints. Examples of such potential constraints include limitations imposed by downstream structure capacities, and special water management operations tailored toward yielding very specific hydrologic conditions during specific periods of the year.

Until such time that additional water can be delivered in a manner consistent with restoring and/or sustaining hydrologic conditions necessary to achieve the benefits to the natural system, total volumes of water made available by the EAA Reservoir project for introduction to the Everglades Protection Area are likely to remain near existing levels. If existing constraints still exist upon completion of construction, it is intended that the reservoir will be operated in the presence of existing constraints:

- to receive water from Lake Okeechobee and/or from surrounding agricultural runoff;
- to deliver water from the reservoir to downstream natural areas via STA-3/4 during the dry season, only at times of natural system need; and
- to deliver water from the reservoir to meet local agricultural water supply demands that would otherwise be met via deliveries from the regional water management system.

It is anticipated that there will be periods during which releases from the reservoir will be necessary to maintain reservoir stages at safe/acceptable levels and/or in preparation for storm events.

The benefits quantified below are based on conditions that are consistent with the preliminary operations characterized above.

#### Operational Intent Under Future Conditions (Future Operations)

It is anticipated/planned that projects such as the Modified Water Deliveries to Everglades National Park Project will have reduced and/or eliminated many of the existing operational and structural constraints by the time the EAA Reservoir Project becomes operational. Consistent with the general operational intent of the EAA Reservoir, it is intended that the reservoir will be operated in a manner consistent with restoring and/or sustaining hydrologic conditions necessary to achieve the benefits to the natural system. Toward that end, it is

intended that the reservoir will be operated in the absence of these existing constraints:

- to receive water from Lake Okeechobee and/or from surrounding agricultural runoff;
- to deliver water from the reservoir to downstream natural areas via STA-3/4 during the wet and dry seasons in a manner consistent with stage and/or volume-based restoration targets; and
- to deliver water from the reservoir to meet local agricultural water supply demands that would otherwise be met via deliveries from the regional water management system.

Once existing constraints on operations are reduced and/or eliminated such that additional water could be delivered in a manner consistent with restoration goals, total volumes of water made available by the EAA Reservoir project for introduction to the Everglades Protection Area are anticipated to be greater than existing levels. Such deliveries will be released to the Everglades Protection Area by way of STA-3/4. Because the volumes of water to be delivered to the Everglades Protection Area are likely to increase in the future and/or as more CERP projects are constructed, it is possible that additional STA optimization and/or capacity may be required to handle the additional hydraulic and nutrient loading rates associated with CERP-like deliveries. The potential need for STA optimization and/or additional capacity is being further investigated and will be finalized if required during the detailed design phase.

### **D.3 PROJECT FEATURES**

(Please refer to Figure D.1 on page E-32 for location of both existing and proposed structures).

#### **D.3.1 Existing Features**

1. *Pump Station G-370 (G-370)*. G-370 provides flood protection to the upstream agricultural basins. The primary function is to remove stormwater runoff from the upstream basins. In addition, to flood control for the S-2/7 Basin, G-370 will convey regulatory releases and supplemental flows from Lake Okeechobee (i.e. releases to the downstream environment, water conservation areas (WCA) and Everglades National Park (ENP) and releases sent to Stormwater Treatment Area 3 / 4 (STA 3 / 4). (STA 3/4 Operation Plan, May 2004)
2. *Pump Station G-372 (G-372)*. G-372 has four pumps with a discharge capacity (each pump) of 925 cubic feet per second (cfs) and is located on the east side of Miami Canal approximately 25 miles southwest of Belle

Glade, and 7 miles north of Pump Station 8 (S-8). The primary function is to remove stormwater runoff from the upstream basins. In addition to flood control for the S-3/8 Basins, G-372 is used to remove excess flows from the C-139 and Chapter 298 Basins and to convey regulatory releases and supplemental flows from Lake Okeechobee (i.e. releases to the downstream environment, water conservation areas (WCA) and Everglades National Park (ENP) and releases sent to Stormwater Treatment Area 3 / 4 (STA 3 /4). G-372 can directly release some water into the Holey Land Wildlife Area. (STA 3/4 Operation Plan, May 2004)

3. *Miami Canal*. This canal is located to the west of Cell 2. The Miami Canal provides drainage to the area extending from Pump Station 3 (S-3) to Pump Station 8 (S-8).
4. *North New River (NNR) Canal*. The NNR Canal is located along the eastern border of Cell 1. This canal provides drainage to the area extending from Pump Station 2 (S-2) to Pump Station 7 (S-7).

### D.3.2 Proposed Features

1. Structure 601 (S-601). S-601 is a 2-barrel gated box culvert located in the southeastern corner of the reservoir Cell 1. This culvert is an outflow structure from Cell 1 to the North New River Canal. The design capacity is 2000 cubic feet per second (cfs). Refer to Table D-1 for additional design data.
2. Structure 602 (S-602). S-602 is a 4-barrel gated box culvert located in the southern levee of Cell 1. This culvert is an outflow structure to Stormwater Treatment Area 3 /4. The design capacity is 3,000 cfs. Refer to Table D-2 for additional design data
3. Structure 603 (S-603). S-603 is a 4-barrel gated box culvert located in the southern levee of Cell 1. This culvert is an outflow structure to Stormwater Treatment Area 3 /4. The design capacity is 3,000 cfs. Refer to Table D-3 for additional design data.
4. Structure 604 (S-604). S-604 is a 3-barrel gated box culvert located in the interior levee between Cells 1 and 2. This structure allows flow between the cells. The design capacity is 2,000 cfs. Refer to Table D-4 for additional design data.
5. Structure 605 (S-605). S-605 is a 3-barrel gated box culvert located in the ring levee near the southeastern corner of Cell 1. This structure is an

- inflow structure to Cell 1. The design capacity is 2,000 cfs. Refer to Table D-5 for additional design data.
6. Structure 606 (S-606). S-606 is a 2-barrel box culvert located in the ring levee near the southeastern corner of Cell 1. This structure is an inflow structure to STA 3 / 4. The design capacity is 1,500 cfs. Refer to Table D-6 for additional design data.
  7. Structure 607 (S-607). S-607 is a 2-barrel box culvert located in the northeastern corner of Cell 2. This structure is a Cell 2 outflow structure with a design capacity of 2,000 cfs. Refer to Table D-7 for additional design data.
  8. S-608 is a 2-barrel box culvert located in the southwestern corner of Cell 2. This structure is a Cell 2 outflow structure with a design capacity of 2,000 cfs. Refer to Table D-8 for additional design data.
  9. Structure 609 (S-609). S-609 is a 6-barrel box culvert located in the northeastern corner of Cell 1. This structure will allow Cell 1 to discharge to North New River, discharge to STA 3 / 4 is not possible. The design capacity is 2,000 cfs. Refer to Table D-9 for additional design data.
  10. Structure 610 (S-610). S-610 is a Cell 1 inflow pump station located in the northeast corner of Cell 1. The design capacity will be 2,000 cfs. Refer to Table D-10 for additional design data.
  11. Structure 611 (S-611). S-611 is the reservoir seepage pump station located in the southwestern corner of Cell 2. The design capacity will be 200 – 800 cfs. Refer to Table D-11 for additional design data.

#### **D.4 PROJECT RELATIONSHIPS**

During storm events the reservoir capacity will be used to capture, detain and store the peak storm event discharges within the reservoir for slow releases to the STAs. Proposed culverts will discharge to the STA 3/4 supply canal. In addition, G-370, a primary inflow pump station to STA 3/4 will discharge to the ring levee which will provide a means for routing water into the reservoir through S-605.

#### **D.5 MAJOR CONSTRAINTS**

- a) The STA 3/4 supply canal is maintained between 11.0 and 15.5 ft. Therefore, releases from Cell 1 of the reservoir through S-603 and S-602 to the STA 3/4 supply canal will not occur unless the canal water level is at the minimum. (11.0 ft.)

- b) STA 3/4 Cell Maintenance. During STA 3/4 maintenance, inflow to the cells of STA 3/4 will be reduced.

## **D.6 STANDING INSTRUCTIONS TO PROJECT OPERATIONS**

Once the operational testing and initial monitoring phase for interim operations phase for the EAA Storage Reservoir is concluded, SFWMD will manage the day-to-day project operations of the newly constructed reservoir and pump stations. Standing instructions for the SFWMD project operators will be further developed during the interim operations phase of the project that include refinements in operations due to general and past operational experience, additional scientific information, CERP updates and new CERP or non-CERP activities that have been completed.

During normal conditions, the project structures shall be operated in accordance with the approved operating manual (draft and project). Deviations from the normal operations will be permitted as deviation from normal operating criteria as outlined in Section D.15 of this Project Operating Manual.

## **D.7 OPERATIONAL STRATEGY TO MEET PROJECT OBJECTIVES**

The EAA reservoirs are designed to capture excess water and reduce backpumping to Lake Okeechobee (i.e. runoff from the EAA and Lake Okeechobee regulation schedule releases). Releases from the reservoirs will be used to attenuate and help maintain adequate flows through STA 3/4 to deliver water to the downstream natural areas in a manner responsive to environmental needs, and to help meet water supply demands normally met from Lake Okeechobee. The reservoirs will allow Lake Okeechobee regulation discharges to be directed to the reservoir first, when conveyance and storage are available in the system, rather than immediately discharging excess water to the Caloosahatchee River and St. Lucie Canal – thereby reducing the frequency and volumes of large regulatory discharges directed to the estuaries. The additional residence time in the reservoir may also improve the water quality prior to discharging to STA 3 /4.project relationships and interactions

It should be recognized that much of the EAA runoff that is currently passed to the WCAs is an important part of the water budget of those areas. Additionally, some regulatory releases from the lake to the WCAs are also beneficial to the WCAs. However, there are times when the stages in WCAs are too high (exceed the regulation schedules.) – during those times, the runoff and regulatory releases to the WCAs can exacerbate the high stage problems. The EAA reservoirs provide places to store EAA runoff and excessive lake water rather than pushing water to WCAs not ready to receive the additional water. As a general operational strategy, the EAA reservoirs should be operated to hold

water during high stage periods in the WCA until a beneficial release can be made to the environment and/or agricultural water supply.

The operations discussed herein do not represent the project operations as envisioned for the 2050 conditions. The operations covered here represent the start-up operational strategy recognizing that new information will become available (such as average ground elevation within the cells) as well as elements from other projects. Projects like Modified Waters and CSOP will add/remove project structures that could have additional operational impacts on the EAA reservoir operations. The discussion given in Section D.7.1. accentuates the rationale behind the EAA reservoir operations; however details may change because of uncertainty of future changes in the region. Until the average ground elevation of the reservoirs are determined, the discussion of reservoir levels will be in terms of the water depth.

#### **D.7.1 Achieving Natural System Goals, Objectives, and Benefits**

In order to assure the water supply project purposes, the concept of an STA3/4 cutoff stage is introduced. The STA3/4 cutoff level in the reservoir is the level below which no releases are made from the reservoir to STA3/4. Water above the STA3/4 cutoff level is considered to be destined for environmental deliveries. Water below the STA3/4 cutoff level is considered to be destined for EAA water supply deliveries. EAA water supply releases can be made above the STA3/4 cutoff levels, but an adjustment (lowering) of the cutoff levels will be made.

The STA3/4 cutoff level in Cell 1 and 2 was set to mimic the amount of storage provided for EAA water supplies while accounting for passing water between reservoirs and conducting environmental releases to WCA3A. The default STA3/4 cutoff level for Cell 1 is 3.30 feet; the default STA3/4 cutoff level for Cell 2 is 4.00 feet. If EAA water supplies are needed prior to dropping to the default STA3/4 cutoff levels, an accounting for the water supply releases will be done using the following information:

- 1 cfs-day = 2 af/day;
- Default STA3/4 cutoff for Cell 1 is 4.00 ft. and Cell 2 is 3.30 feet.
- 1 ft of storage depth in Cell 1 has about 17,000 af;
- 1 ft of storage depth in Cell 2 has about 14,000 af.

Example: If an average of 200 cfs per day was made for 10 days from Cell 2 when stages were above the default STA3/4 cutoff (4.0 ft). 200 cfs for 20 days would be equal to about 4,000 af. To determine the new STA3/4 cutoff: 4000 af / 14,000 af per ft would be about 0.29 ft less than default, or about (4.00 - 0.29) 3.71 feet.

It should be noted that EAA reservoir releases for water supply to Miami and North New River Canals can be done anytime there is water in either reservoir. However, if the reservoir is above the default STA3/4 cutoff level, then the accumulative water supply flows must be calculated and the STA3/4 cutoff level shall be appropriately lowered.

During the early part of the wet season, flood control runoff from the EAA will begin flowing into the EAA reservoirs. Water from the lake, if the stages are above the lake regulatory Zone D or from regulatory releases from lower zones, can be passed to the EAA reservoir. If the WCA stages increase to a stage where cutoff from lake releases to WCA 3A normally occurs (seasonally varying from 9.25 to 10.5 feet), then releases from the lake to the EAA reservoir should also cease. After the water elevation in Cell 1 is greater than a STA3/4 cutoff, releases to STA3/4 can begin subject to downstream considerations (rules of operation for STA3/4, and hydraulic capacities). If water elevation in Cells 2 is greater than a STA3/4 cutoff depth, and if Cell 1 is lower than 11.5 feet (and lower than Cell 2), then the maximum practical releases can be made into Cell 1. If the water elevation in Cell 2 drops below the STA3/4 cutoff level, then releases to Cell 1 should cease. If Cell 1 is below the STA3/4 cutoff level but Cell 2 is above the STA3/4 cutoff level and is passing water in to Cell 1, then there should be a release of similar quantity to STA3/4 (limited, if necessary, due to STA3/4 considerations). If the water elevations in Cell 1 and Cell 2 drop below the STA3/4 cutoff levels, then all releases to STA3/4 should cease. Water remaining below the STA3/4 cutoff levels in Cell 1 and 2 will be used for EAA water supplies. Normally, water would not pass from Cell 1 to Cell 2; the only time this would occur is when Cell 1 is above 11.0 feet and Cell 2 is less than 11.0 feet.

During times when the EAA reservoirs are full (i.e 12 feet maximum depth), EAA runoff pumping into the reservoir can continue at a rate equal to the EAA reservoir outflow rate (which is subject to STA3/4 operations). As the wet periods pass, the reservoir will continue to flow to the STA3/4 (subject to STA3/4 constraints) until the STA3/4 cutoff stages are reached. Water should not be held longer than necessary in the EAA reservoir due to potential ET losses.

#### **D.7.1.1 Lake Operations Associated with EAA Reservoirs**

Under existing conditions, regulatory releases from Lake Okeechobee are made southward subject to downstream constraints. Regulatory releases can occur in the WSE pulse zones as well as the higher zones. For EAA storage, the normal rules apply for making regulatory releases except that the maximum regulatory releases rate to the reservoirs will be 2800 cfs from S-351 and 1600 cfs from S-354. In addition to lake regulatory releases, the EAA storage "injection" line is identical to Zone D of the WSE schedule. After the lake is above that line (break

points shown below), maximum practicable releases can be made to the EAA reservoirs (subject to maximum rate at S-351 of 2800 cfs, maximum rate at S-354 of 1600 cfs, canal capacities, and reservoir water elevations). If Cell 1 is above 11.0 feet, then lake releases to Cell 1 should cease. If Cell 2 is above 11.0 feet, then lake releases to Cell 2 should cease. In the case where EAA water supplies are needed and regulatory releases are indicated by the lake schedule (e.g. in some late dry seasons), lake regulatory releases in excess of the water supply demand can be stored in the reservoirs. The amount of the regulatory releases southward from Lake Okeechobee, should be consistent with operations prior to usage of the EAA reservoir, subject to the maximum release rates at S-351 and S-354.

Table 1. EAA Storage Line Breakpoints:

Date	Lake Elevation
January 1	17.00
May 31	15.50
September 15	16.25
October 1	17.00
December 31	17.00

#### D.7.1.2 EAA Reservoir Operations

The following hydrologic cases are provided below to help guide the operators to take appropriate actions. For all cases below, if the WCA stages increase to a stage where cutoff from lake releases to WCA 3A normally occurs (seasonally varying from 9.25 to 10.5 feet), then releases from the lake to the EAA reservoirs shall also cease.

Case 1: If Cell 1 and Cell 2 are below STA3/4 cutoff elevations (as calculated above).

- Allow EAA runoff to be pumped into the reservoirs at maximum rate, if needed, according to flood control triggers above.
- Allow regulatory releases or storage releases from Lake Okeechobee, if needed, subject to conveyance capacity (including the reservoir inflow pumps). The maximum release rate for S-351 is 2800 cfs; maximum rate for S-354 is 1600 cfs. As a priority, pass maximum practicable storage release into Cell 1, and the remainder, if needed, into Cell 2.
- If lake regulatory or storage releases exceed EAA water supply needs (as indicated by the above triggers), then store the excess regulatory release.
- Allow EAA storage water into either cell, if lake is above WSE Zone D. As a priority, pass maximum practicable storage release into Cell 1, and the remainder, if needed, into Cell 2.
- Allow EAA water supply releases, if needed, and no re-calculation of the default STA3/4 cutoff level(s) is needed.

Case 2: If Cell 1 is above the STA3/4 cutoff elevation and Cell 2 is below the STA3/4 cutoff elevation:

- Allow releases to STA3/4, consistent with STA3/4 operations.
- Allow inflows from EAA runoff, if needed according the flood control triggers, and allow regulatory releases, if maximum pump capacity allows.
- Allow EAA water supply releases, if needed, and keep a total of the water supply releases so that a new STA3/4 cutoff level can be calculated..
- Cell 2 operates as in Case 1, above.

Case 3: If Cell 2 is above the STA3/4 cutoff elevation and Cell 1 is below the STA3/4 cutoff elevation:

- Allow releases from Cell 2 into Cell 1 and pass the inflow to Cell 1 to STA3/4, consistent with STA3/4 operations, to inflows rates from Cell 1.
- Allow inflows from EAA runoff to either cell, if needed according the flood control triggers, and allow regulatory releases, if maximum pump capacity allows.
- Allow EAA water supply releases, if needed, and keep a total of the water supply releases so that a new STA3/4 cutoff level can be calculated..
- Cell 1 operates as in Case 1, above.

Case 4. If Cell 1 and Cell 2 are above the STA3/4 cutoff elevation, but below 11.0 feet:

- Pass maximum practicable releases from Cell 1 to STA3/4, consistent with STA3/4 operations.
- Allow inflows from Cell 2.
- Allow EAA runoff into either cell, if needed according to the flood control triggers.
- Allow regulatory releases into either cell, if available from the lake.
- Allow EAA storage water into either cell, if above the WSE Zone D. As a priority, pass maximum practicable storage release into Cell 1, and the remainder, if any, into Cell 2.
- Allow EAA water supply releases, if needed, and keep a total of the water supply releases so that a new STA3/4 cutoff level(s) can be calculated..

Case 5. If Cell 1 is above 11.0 feet and Cell 2 is below 11.0 feet:

- Cease all releases from the lake to Cell 1.
- Make maximum practicable releases to STA3/4.
- Allow water to pass water from Cell 1 to Cell 2.
- Continue to accept EAA runoff from North New River Canal, if needed.

- Allow EAA water supply releases, if needed, and keep a total of the water supply releases so that a new STA3/4 cutoff level(s) can be calculated..

Case 6. If Cell 1 is above 11.0 feet and Cell 2 is above Cell 1:

- Cease all releases from the lake to Cell 1.
- Make maximum practicable releases to STA3/4.
- Continue to pass water from Cell 2 to Cell 1.
- Continue to accept EAA runoff from North New River Canal, if needed.
- Allow EAA water supply releases, if needed, and keep a total of the water supply releases so that a new STA3/4 cutoff level(s) can be calculated..

Case 7. If Cell 2 approaches 11.80 feet and Cell 1 is below 11.50 feet:

- Avoid releases from the lake to Cell 2.
- Reduce flood control inflow rate to equal the outflow rate into Cell 1.
- Allow EAA water supply releases, if needed, and keep a total of the water supply releases so that a new STA3/4 cutoff level(s) can be calculated..

Case 8. If Cell 1 approaches 11.80 feet:

- Avoid releases from the lake to Cell 1.
- Continue to store EAA runoff, if needed, and allow inflows from Cell 1, but the total rate inflows should be limited to the rate of outflow into STA3/4.
- Priority of inflows (whether from North New River or Miami River) can be given to the canal having the higher stages.
- Allow EAA water supply releases, if needed, and keep a total of the water supply releases so that a new STA3/4 cutoff level(s) can be calculated..

### **D.7.1.3 Operational Safeguards for Initial Operations**

This type of dual-reservoir operation is unique. The reservoir flow-through characteristics are untested. Inflows come from two major sources and outflows go into environmentally sensitive areas through a highly controlled STA. To avoid unintentional adverse issues within the natural system (particularly associated with WCA 3A tree islands), STA3/4, and within the EAA, precautionary steps have been identified for initial operations before full implementation of the selected alternative. This is especially needed in the WCA system until restrictions along Tamiami Trail can be reduced. At the time of this writing, components of the Modified Water Deliveries project are not complete. Additionally, the Combined Structural and Operational Plan has not been implemented. The safeguard steps will provide a time for monitoring and evaluation so that modeling assumptions and operational guidelines can be safely tested as other projects' features are implemented. Additionally, the

operation of STA3/4 is an important consideration for the reservoir outflows and some operational experience is needed to ensure operational consistency.

The first safeguard was to raise the EAA storage line to Zone D of WSE. Varying breakpoints of the EAA reservoir storage line was not evaluated as part of the study and the default line was set at the currently suggested breakpoints for CERP. The second safeguard limited the maximum rate at which water was moved from Lake Okeechobee to the EAA reservoirs (2800 cfs from S-351, and 1600 cfs from S-354). The third safeguard includes operations in the EAA reservoir that have operational considerations once pool depths reach 11.0 feet deep in Cell 1 and in Cell 2 to slow the rate of rise, with a temporary maximum depth of 11.8 feet. Once operation experience has been acquired, quickly rising to the maximum depth of 12 feet deep can be safely done.

#### **D.7.2 Flood Damage Reduction**

The EAA reservoirs can receive EAA flood runoff anytime the reservoirs are below 12 feet deep; however, at a reservoir depths of 11.8 feet, the flood inflows should not exceed the reservoir outflows. From Cell 2 at 11.8 feet or greater, the inflows cannot exceed the outflow to Cell 1. From Cell 1 at 11.8 feet or greater, the inflows cannot exceed the outflow to STA3/4. After sufficient operational experience, the reservoirs can be operated at the maximum depths of 12.0 feet instead of 11.8 feet. Lake releases to Cell 1 shall cease when Cell 1 is at or above 11.0 feet. Lake releases to Cell 2 shall cease when Cell 2 is at or above 11.5 feet.

##### **Cell 1:**

Flood control triggers for inflows from North New River (S-610 and G-370 in conjunction with S-605):

Turn On: between 11.0 to 12.0 feet NGVD

Turn Off: between 9.0 to 10.0 feet NGVD (note: water level should never drop below 9.0 feet.

##### **Cell 2:**

Flood control trigger for inflows from Miami River (S-611 and G-372):

Turn On: between 11.0 to 12.0 feet NGVD

Turn Off: between 9.0 to 10.0 feet NGVD (note: water level should never drop below 9.0 feet.

### **D.7.2.1 Normal and Emergency Operations**

When the North New River Canal is greater than 12.0 ft-NGVD and the reservoir is less than or equal to 22.0 ft-NGVD, the S-610 reservoir inflow pump station will begin pumping. S-605 will be closed and S-606, S-603 and S-602 will be opened to allow flow to STA 3/4. When the head differential is 2 ft. or greater at the reservoir interior bi-directional S-604, the structure will be opened to allow discharges from Cell 1 to Cell 2 or vice versa.

### **D.7.2.2 Hurricane or Tropical Storm Operations**

The official hurricane season is from 1 June through 30 November. However, tropical cyclone activity can occur outside of this timeframe. When there are tropical depressions, tropical storms, and/or hurricanes in the Atlantic/Caribbean Basin or Gulf Coast of Florida, the National Hurricane Center (NHC) issues tropical cyclone public advisories, forecast advisories, forecast discussions, and strike probability forecasts.

Water management operations within EAA Storage Reservoirs for hurricanes or tropical storms should follow the SFWMD's Emergency Preparedness Manual – Suggested Hurricane Operating Procedures, April 2004. CESAJ SOP 500-1-1 dated 9 September 2002 should be consulted for emergency preparation and actions.

### **D.7.2.3 Storage Area Weir Discharge**

Both reservoir cells will have an emergency overflow spillway. Design details of the emergency spillways will be addressed in the Detail Design Report. This section will be updated during a future phase of the project.

### **D.7.2.4 Uncontrolled Discharge**

Under the current plan, there are no uncontrolled discharges

### **D.7.3 Water Quality.**

The proposed action is expected to improve water quality in the EAA, as well as in Lake Okeechobee, the Caloosahatchee Estuary, the St. Lucie Estuary, and the Everglades Protection Area (Water Conservation Areas). However, there are no special operations for water quality.

### **D.7.4 Water Supply Operations**

**Cell 1:**

During dry conditions, outflows from the reservoir will begin when North New River Canal elevation is between 9 FT-NGVD and 10.0 FT-NGVD, S-601 will be opened to let water out of the reservoir into the North New River Canal. Structures S-603, S-602, S-606, S-605 will be closed.

**Cell 2:**

When, the Miami River Canal elevation is between 9.0 and 10.0 FT-NGVD, S-607 and S-608 will open to discharge from Cell 2. When the headwater stage rises to between 9.5 and 11.5 FT-NGVD, S-608 and S-607 will be closed.

If water supply is needed in the WCAs (or east), S-605 will be closed, S-606 will be opened to allow flow to STA 3/ 4. S-602 and S-603 will open to allow flow to STA 3 /4.

Water supply triggers for outflows to North New River (S-601, with optional S-607 from Cell 2): Open gates: 9.0 to 10.0 feet NGVD. Close gates: 9.5 to 11.5 feet NGVD.

**D.7.5 Recreation**

Recreational activities including fishing will be permitted in the reservoir. Motor boating will be allowed, but may be restricted to areas and the manner of boat operation to ensure that the facilities can be operated. However, no special operations will occur to maintain recreational activities or opportunities

**D.7.6 Fish and Wildlife**

The reservoir will include deep-water fish refugia. In addition, littoral shelves will be created along seepage canal. However, no special operations will occur to maintain deep water refugia or littoral shelving.

**D.8 NAVIGATION**

Not applicable to the project.

**D.9 OTHER**

Not applicable

**D.10 PRE-STORM/STORM OPERATIONS**

In anticipation of heavy rainfall based on National Weather Service Advisories and SFWMD forecasts, the North New River Canal and Miami Canal water levels will be drawn down as much as practicable in order to allow for the

maximum amount of canal and groundwater storage. Water management operations within EAA Storage Reservoirs for hurricanes or tropical storms should follow the SFWMD's Emergency Preparedness Manual – Suggested Hurricane Operating Procedures, April 2004. CESAJ SOP 500-1-1 dated 9 September 2002 should be consulted for emergency preparation and actions.

#### **D.11 CONSISTENCY WITH THE IDENTIFICATION OF WATER AND RESERVATIONS OR ALLOCATIONS FOR THE NATURAL SYSTEM**

The Programmatic Regulations (Section 385.28(a)(6)(vi)) for the CERP require that the operating manual be consistent with the reservation or allocation of water for the natural system as described in the PIR. The operating criteria within this Operating Manual are consistent with the operating criteria used to identify the water available for the natural system as described in the PIR and, therefore, reflect the operating criteria used in the identification of the appropriate quantity, timing, and distribution of water dedicated and managed for the natural system and other water-related needs.

#### **D.12 CONSISTENCY WITH SAVINGS CLAUSE AND STATE ASSURANCES PROVISIONS**

In accordance with WRDA 2000, CERP projects may not eliminate or transfer existing (as of December 2000) legal sources of water until a new source of water of comparable quantity and quality is available to replace the water lost as a result of project implementation. The EAA Storage Reservoir Project will result in a transfer of a portion of the existing legal source for agricultural water supply in the Everglades Agricultural Area from Lake Okeechobee to water supplied by the reservoir. However, implementation of the EAA Project will not preclude operation of the C&SF Project to deliver water from Lake Okeechobee to meet agricultural water supply needs or to the WCAs and Everglades National Park to meet environmental demands for water supply in those areas. Therefore, no additional sources of water need to be identified due to the partial transfer resulting from the project since Lake Okeechobee will continue to provide water to agricultural users and the WCAs and Everglades National Park. An explanation of the modeling performed and the results of the evaluation can be found in Annex G of the EAA Storage Reservoir PIR/EIS. The operating criteria within this operating manual are consistent with those used for evaluating conformance with the Savings Clause during development of the PIR.

#### **D.13 DROUGHT CONTINGENCY PLAN**

During a drought in the project area, operations will be in accordance with SFWMD Rules, Chapter 40E-21, Water Shortage Plan. The Drought

Contingency Plan in Appendix B of the Lake Okeechobee and EAA Master Control Plan should be reference for operations.

#### **D.14 FLOOD EMERGENCY ACTION PLAN**

The Flood Emergency Action Plan (FEAP) will be completed for the EAA Storage Reservoir Project during the detailed design phase, prior to construction completion and may be included in a future revision of the project operating manual. The FEAP to be developed should be consulted for related emergency preparation and action. Local emergency management offices will be provided copies of the FEAP as necessary. This plan may be used to supplement Hurricane or Tropical Storm Regulations. As outlined in Engineering Regulation 1130-2-530, the Flood Emergency Action Plan shall include:

- A written Emergency Notification Procedure for serious abnormal conditions to provide for safety of people in the vicinity of the storage area and also trigger immediate response for remedial assistance to the levee/water control structure.
- A description or list of conditions leading to emergency situations and ways of dealing with them should they occur.
- Storage area de-watering procedures.
- Levee/water control structure failure inundation maps.
- Listing of location, types, and quantity of emergency repair materials and equipment.
- Details outlining responsibilities for inspection and execution of emergency repairs.
- List of contractors available within a reasonable distance of the project area.

#### **D.15 DEVIATION FROM NORMAL OPERATING CRITERIA**

The USACE District Commander is occasionally requested by the non-Federal sponsor to approve deviations from normal operating criteria. Prior approval for a deviation is required from USACE-SAD except as noted in subparagraph D 15.1 below. Deviation requests usually fall into the following categories:

##### **D.15.1 Emergencies**

Some emergencies that can be expected include drowning and other accidents, failure of project facilities, and flushing of pollutants. Antecedent conditions, as well as forecasted storm events, may result in SFWMD declaring an Emergency Authorization Order, which would result in an Emergency Deviation. Water control actions necessary to abate the problem should be implemented immediately unless such action would create equal or worse conditions. The

Division Office (SAD) must be informed of the problem and the emergency operating changes as soon as practicable. In addition, the non-Federal sponsor, the State of Florida (FDEP and SFWMD), and the Department of the Interior should be informed.

#### **D.15.2 Unplanned Minor Deviations**

There are unplanned instances that create a temporary need for minor deviations from the normal operating criteria, although these deviations are not considered emergencies. Construction accounts for the major portion of these incidents requiring minor deviations. Examples of activities that may require short-term deviations include construction of utility stream/canal crossings and bridge work. Deviations are also sometimes necessary to carry out maintenance and inspection of facilities. Requests for changes in release rates generally involve time periods ranging from a few hours to a few days. Each request should be analyzed on its own merits. In evaluating the proposed deviation, consideration must be given to upstream watershed conditions, potential flood threat, existing condition of the reservoir/storage area, and alternative measures that can be taken. In the interest of maintaining good public relations, requests for minor deviations are generally granted, providing that these deviations will not have adverse effects on the ability of the project (or projects) to achieve the authorized purposes. Approval for these minor deviations normally will be obtained from SAD by telephone. Written confirmation explaining the deviation and the cause will be furnished to the SAD water control manager. In addition, the non-Federal sponsor, the State of Florida (FDEP and SFWMD), and the Department of the Interior should be informed.

#### **D.15.3 Planned Deviations**

Each circumstance should be analyzed on its own merits. Sufficient data on flood potential, lake and watershed conditions, possible alternative measures, benefits to be expected, and probable effects on other authorized and useful purposes, together with the USACE district recommendation, will be presented by memorandum, facsimile, or electronic mail to the USACE-SAD for review and approval. In addition, the non-Federal sponsor, the State of Florida (FDEP and SFWMD), and the Department of the Interior should be consulted as part of the process of receiving approval from SAD for the deviation.

#### **D.16 Rate of Release of Change**

Stilling basins are located downstream of the project structures to reduce the discharge velocities. Additional information regarding the rate of release of change will be updated during a future phase of the project.

#### **D.17 SEEPAGE CONTROL**

The seepage canal will be located along the eastern, northern, and western reservoir perimeter. Seepage will be collected in the seepage canal which will be 10 feet wide at the bottom and 16 feet deep. The side slopes will be 1V on 2H, with the exception of the reservoir side slope which will be shaped to include an environmental littoral shelf by sloping the top 7 feet into a flatter 1V on 5H slope. .

#### **D.18 INITIAL RESERVOIR STORAGE FILLING PLAN**

The Initial Storage Filling Plan (ISAFP) is defined as a deliberate impoundment of water to meet project purposes and is a continuing process as successively higher water levels are attained. The initial reservoir filling is the first test of containing levees and water control structures to perform the function for which they were designed. In order to monitor this performance, the rate of filling will be controlled to the extent feasible to allow as much time as needed for a predetermined monitoring program including the observation and analysis of instrumentation data. Information furnished in the ISAFP will generally be concerned with action that can be taken without a significant impact to project purposes, provided no unsafe conditions are observed. Windbreak impoundments were designed for the reservoir. Windbreaks were included to reduce wave run-up/wind set up during storm events. An ISAFP will be developed during design and construction. This plan will include but is not limited to the following:

- Preferred filling rate and the available options to control the rate of filling, as well as the consequences of operation with the prime objective of controlling the rate of reservoir rise.
- The most likely type of problem(s) that may develop during initial filling and the monitoring necessary to detect those problems.
- A description of the proposed hydrologic data collection and transmission system and a plan for reading the instruments and evaluating the data with regard to the filling plan.
- A plan for inspecting the dam and downstream areas prior to and during filling, including the relationship between frequency of inspection and rate of pool rise.
- Instructions for observers on conditions that required immediate attention of personnel authorized to make emergency decisions. Clearly identify who is responsible for decisions and how they can be contacted. Alternative decision makers should be identified.
- An emergency plan listing responsibilities, name and/or positions, telephone numbers, page numbers, and radio frequencies to be used.
- Water quality requirements, if any, for the initial filling.

### **D.19 Non-Typical Operations for Reservoir Performance**

NO non-typical operations have been established during the PIR Phase. This section will be updated in the future if necessary.

### **D.18 Aquifer Storage and Recovery System Plan**

This section is not applicable to this project.

## **E WATER CONTROL DATA ACQUISITION SYSTEM PLAN (WCDASP)**

For the EAA Storage Reservoir Project, all pump stations and water control structures with gates will be equipped with remote automation components and operated by use of a remote telemetry system known as Supervisory Control and Data Acquisition (SCADA). The automation components of all pump stations and structures that will eventually be operated and maintained by the SFWMD must conform to SFWMD standards. Equipment used in data acquisition essential to the water control management function will be included in the Water Control Data Acquisition System Plan (WCDASP). This includes all hardware and software to be used for acquisition, transmission, processing, display, and dissemination of hydrologic, meteorological, water quality, and project data for the purpose of supporting the water control mission. For the EAA Storage Reservoir Project, this includes, but is not limited to; uninterruptible power supplies, field data collection platforms, and data communication devices and circuits. The WCDASP will also identify site location of all hardware included within the plan. Hardware siting will be determined through coordination with appropriate agencies including the U.S. Geological Survey and the SFWMD. The WCDASP will be completed during the Plans and Specifications phase and will be a subset of the Water Control Data System (WCDS).

Inflow and outflow data for the EAA Storage Reservoir Project will be maintained in a database for future analysis. Specific frequency of data acquisition for project features will be determined during the Plans and Specifications phase. In addition, the specific method for quantification of flows is dependent on the project features' specifications provided by the manufacturer, which will be determined during the Plans and Specifications phase. The water management data may be used to demonstrate the project performance. Adaptive management practices will be implemented accordingly.

The regulation schedule for WCA-3A uses the average of Sites 65, 64 and 63 as the indicator gages for the official elevation while the regulation schedule for WCA-2A uses either Site 2-17 or S-11B headwater depending on the season. In addition, the regulation schedule for Lake Okeechobee uses the average of gages L001, L005, L006 and LZ40 as the indicator for the official elevation. All data is

acquired in a real time basis and converted in an hourly and daily basis for simple management.

### **E.1 CONSISTENCY WITH THE ADAPTIVE MANAGEMENT PROGRAM AND PERIODIC CERP UPDATES**

After initiation of long-term operations and maintenance of this project, the operating manual may be further modified based on operating criteria approved by the USACE and the SFWMD that results from CERP updates and/or recommendations from the adaptive assessment process as outlined in Guidance Memorandum Number 6.

### **E.2 INTERIM OPERATIONS DURING CONSTRUCTION**

During the Detailed Design-Plans and Specifications Phase, the Draft POM may be further developed and modified for use during construction. This updated Draft POM will focus on facilitating construction of the project components while maintaining established levels of project purposes, such as water supply, flood protection, and any required delivery of water to the natural system. Some of these POM modifications may result from value engineering analyses conducted during the Detailed Design-Plans and Specifications Phase. Defining operating criteria to be used during construction will require consideration of issues that are unique to the construction phase such as real estate issues, construction schedules, contract sequencing, temporary by-pass canals, and dewatering activities. As a result, this modified Draft POM will likely contain operating criteria that are only applicable during the construction phase.

### **E.3 STRUCTURE DESIGN DATA TABLES**

See following pages for structure design data tables on pages E-18 through E-30

**E.4. Project Water Budget is located in Table D-1, on page E-31**  
(Table be updated with flows (acre-ft.) as soon as they are available.

**TABLE E-1: S-601 DESIGN DATA**

Design Conditions	
Discharge	2,000 cfs
Headwater Elevation (ft-NGVD)	14
Tailwater Elevation (ft-NGVD)	10
Optimum Conditions	
Headwater Elevation (ft-NGVD)	
Tailwater Elevation (ft-NGVD)	9-12
SPF Conditions	
Discharge (cfs)	NA
Headwater Elevation (ft-NGVD)	NA
Tailwater Elevation (ft-NGVD)	NA
Maximum Head Difference	
Max. Headwater Elevation (ft-NGVD)	26 ft-NGVD
Min. Tailwater Elevation (ft-NGVD)	9 ft-NGVD
Culvert Data	
Number of boxes	2
Barrel type	Concrete
Single culvert barrel width (ft.)	10
Single culvert barrel height (ft.)	10
Length (ft.)	200
Upstream invert elevation	-1 ft-NGVD
Downstream invert elevation	-1 ft-NGVD
Stilling Basin	
Design discharge (cfs)	3,000
Apron elevation	-3.5 ft NGVD
Apron length from culvert to exit to toe of endsill (ft.)	39
Baffle block elevation	-1 ft NGVD
Baffle block height/width (ft.)	2.5/2.5
Distance from culvert exit to 1st row of baffle blocks (ft.)	22
Distance from culvert exit to 2nd row of baffle blocks (ft.)	28
Training wall elevation (ft-NGVD)	NA
End sill elevation (ft-NGVD)	-3.5
Apron Width (ft.)	30
Total apron length from culvert exit to end of endsill (ft.)	40
Slope from apron to top of end sill	1 on 3
Velocity over the endsill (ft per second)(fps)	8

**TABLE E-2: S-602 DESIGN DATA**

Design Conditions	
Discharge	3,000 cfs
Headwater Elevation (ft-NGVD)	16
Tailwater Elevation (ft-NGVD)	13.5
Optimum Conditions	
Headwater Elevation (ft-NGVD)	15
Tailwater Elevation (ft-NGVD)	11
SPF Conditions	
Discharge (cfs)	NA
Headwater Elevation (ft-NGVD)	NA
Tailwater Elevation (ft-NGVD)	NA
Maximum Head Difference	
Max. Headwater Elevation (ft-NGVD)	26 ft-NGVD
Min. Tailwater Elevation (ft-NGVD)	11 ft-NGVD
Max. Head Discharge Condition (ft.)	15
Culvert Data	
Number of boxes	4
Barrel type	Concrete
Single culvert barrel width (ft.)	10
Single culvert barrel height (ft.)	10
Length (ft.)	200
Upstream invert elevation	1 ft-NGVD
Downstream invert elevation	1 ft-NGVD
Stilling Basin	
Design discharge (cfs)	4,000
Apron elevation	-1 ft NGVD
Apron length from culvert to exit to toe of endsill (ft.)	30
Baffle block elevation	1 ft NGVD
Baffle block height/width (ft.)	2 / 2
Distance from culvert exit to 1st row of baffle blocks (ft.)	17
Distance from culvert exit to 2nd row of baffle blocks (ft.)	24
Training wall elevation (ft-NGVD)	NA
End sill elevation (ft-NGVD)	0
Apron width (ft.)	50
Total apron length from culvert exit to end of endsill (ft.)	33
Slope from apron to top of end sill	1 on 3
Velocity over the endsill (ft per second)(fps)	7.5

**TABLE E-3: S-603 DESIGN DATA**

Design Conditions	
Discharge	3,000 cfs
Headwater Elevation (ft-NGVD)	16
Tailwater Elevation (ft-NGVD)	13.5
Optimum Conditions	
Headwater Elevation (ft-NGVD)	15
Tailwater Elevation (ft-NGVD)	11
SPF Conditions	
Discharge (cfs)	NA
Headwater Elevation (ft-NGVD)	NA
Tailwater Elevation (ft-NGVD)	NA
Maximum Head Difference	
Max. Headwater Elevation (ft-NGVD)	26 ft-NGVD
Min. Tailwater Elevation (ft-NGVD)	11 ft-NGVD
Max Head Discharge Condition (ft.)	15
Culvert Data	
Number of boxes	4
Barrel type	Concrete
Single culvert barrel width (ft.)	10
Single culvert barrel height (ft.)	10
Length (ft.)	200
Upstream invert elevation	1 ft-NGVD
Downstream invert elevation	1 ft-NGVD
Stilling Basin	
Design discharge (cfs)	4,000
Apron elevation	-1 ft NGVD
Apron length from culvert to exit to toe of endsill (ft.)	30
Baffle block elevation	1 ft NGVD
Baffle block height/width (ft.)	2 / 2
Distance from culvert exit to 1st row of baffle blocks (ft.)	17
Distance from culvert exit to 2nd row of baffle blocks (ft.)	24
Training wall elevation (ft-NGVD)	NA
End sill elevation (ft-NGVD)	0
Apron width (ft.)	50
Total apron length from culvert exit to end of endsill (ft.)	33
Slope from apron to top of end sill	1 on 3
Velocity over the endsill (ft per second(fps))	7.5

**TABLE E-4: S-604 DESIGN DATA**

Design Conditions	
Discharge	2,000 cfs
Headwater Elevation (ft-NGVD)	14
Tailwater Elevation (ft-NGVD)	12
Optimum Conditions	
Headwater Elevation (ft-NGVD)	12-22
Tailwater Elevation (ft-NGVD)	11-21
SPF Conditions	
Discharge (cfs)	NA
Headwater Elevation (ft-NGVD)	NA
Tailwater Elevation (ft-NGVD)	NA
Maximum Head Difference	
Max. Headwater Elevation (ft-NGVD)	22
Min. Tailwater Elevation (ft-NGVD)	10
Max Head Discharge Condition (ft.)	12
Culvert Data	
Number of boxes	3
Barrel type	Concrete
Single culvert barrel width (ft.)	10
Single culvert barrel height (ft.)	10
Length (ft.)	200
Upstream invert elevation	0 ft-NGVD
Downstream invert elevation	0 ft-NGVD
Stilling Basin	
Design discharge (cfs)	3,000
Apron elevation	-1.5 ft NGVD
Apron length from culvert to exit to toe of endsill (ft.)	33
Baffle block elevation	0.5 ft NGVD
Baffle block height/width (ft.)	2 / 2
Distance from toe of Ogee to 1st row of baffle blocks	18
Distance from toe of Ogee to 2nd row of baffle blocks	0
Training wall elevation (ft-NGVD)	NA
End sill elevation (ft-NGVD)	-1.5
Approach/discharge apron width (ft.)	40
Total apron length from culvert exit to end of endsill (ft.)	34
Slope from apron to top of end sill	1 on 3
Velocity over the endsill (ft per second(fps))	7
Canal Section	
Side slopes (vert. on hor.)	3
Upstream bottom width (ft.)	40
Upstream bottom elevation	0
Downstream bottom width (ft.)	40
Downstream bottom elevation(ft-NGVD)	0

**TABLE E-5: S-605 DESIGN DATA**

Design Conditions	
Discharge	2,000 cfs
Headwater Elevation (ft-NGVD)	14.5
Tailwater Elevation (ft-NGVD)	13
Optimum Conditions	
Headwater Elevation (ft-NGVD)	12-23.5
Tailwater Elevation (ft-NGVD)	11-22
SPF Conditions	
Discharge (cfs)	NA
Headwater Elevation (ft-NGVD)	NA
Tailwater Elevation (ft-NGVD)	NA
Maximum Head Difference	
Max. Headwater Elevation (ft-NGVD)	24
Min. Tailwater Elevation (ft-NGVD)	10
Max Head Discharge Condition (ft.)	14
Culvert Data	
Number of boxes	3
Barrel type	Concrete
Single culvert barrel width (ft.)	10
Single culvert barrel height (ft.)	10
Length (ft.)	200
Upstream invert elevation	0 ft-NGVD
Downstream invert elevation	0 ft-NGVD
Stilling Basin	
Design discharge (cfs)	3,000
Apron elevation	-2 ft NGVD
Apron length from culvert to exit to toe of endsill (ft.)	36
Baffle block elevation	0 ft NGVD
Baffle block height/width (ft.)	2 / 2
Distance from toe of Ogee to 1st row of baffle blocks	20
Distance from toe of Ogee to 2nd row of baffle blocks	0
Training wall elevation (ft-NGVD)	NA
End sill elevation (ft-NGVD)	-1.5
Apron width	40
Total apron length from culvert exit to end of endsill (ft.)	38
Slope from apron to top of end sill	1 on 3
Velocity over the endsill (ft per second(fps))	7
Canal Section	
Side slopes (vert. on hor.)	3
Upstream bottom width (ft.)	40
Upstream bottom elevation	0
Downstream bottom width (ft.)	40
Downstream bottom elevation(ft-NGVD)	0

**TABLE E-6: S-606 DESIGN DATA**

Design Conditions	
Discharge	1,500 cfs
Headwater Elevation (ft-NGVD)	15.5
Tailwater Elevation (ft-NGVD)	13.5
Optimum Conditions	
Headwater Elevation (ft-NGVD)	13-17
Tailwater Elevation (ft-NGVD)	11-15
SPF Conditions	
Discharge (cfs)	NA
Headwater Elevation (ft-NGVD)	NA
Tailwater Elevation (ft-NGVD)	NA
Maximum Head Difference	
Max. Headwater Elevation (ft-NGVD)	24
Min. Tailwater Elevation (ft-NGVD)	11
Max Head Discharge Condition (ft.)	13
Culvert Data	
Number of boxes	2
Barrel type	Concrete
Single culvert barrel width (ft.)	10
Single culvert barrel height (ft.)	10
Length (ft.)	200
Upstream invert elevation	1 ft-NGVD
Downstream invert elevation	1 ft-NGVD
Type of control	Slide gate
Stilling Basin	
Design discharge (cfs)	3,000
Apron elevation	-3.5 ft NGVD
Apron length from culvert to exit to toe of endsill (ft.)	39
Baffle block elevation	-1 ft NGVD
Baffle block height/width (ft.)	2.5 / 2.5
Distance from toe of culvert exit to 1st row of baffle blocks	22
Distance from toe of culvert exit to 2nd row of baffle blocks	28
Training wall elevation (ft-NGVD)	NA
End sill elevation (ft-NGVD)	-3.5
Apron width	30
Total apron length from culvert exit to end of endsill (ft.)	40
Slope from apron to top of end sill	1 on 3
Velocity over the endsill (ft per second(fps))	8
Canal Section	
Side slopes (vert. on hor.)	3
Upstream bottom width (ft.)	30
Upstream bottom elevation(ft-NGVD)	1
Downstream bottom width (ft.)	30
Downstream bottom elevation(ft-NGVD)	1

**TABLE E-7: S-607 DESIGN DATA**

Design Conditions	
Discharge	2,000 cfs
Headwater Elevation (ft-NGVD)	14
Tailwater Elevation (ft-NGVD)	10
Optimum Conditions	
Headwater Elevation (ft-NGVD)	12-20
Tailwater Elevation (ft-NGVD)	9-11
SPF Conditions	
Discharge (cfs)	NA
Headwater Elevation (ft-NGVD)	NA
Tailwater Elevation (ft-NGVD)	NA
Maximum Head Difference	
Max. Headwater Elevation (ft-NGVD)	26
Min. Tailwater Elevation (ft-NGVD)	9
Max Head Discharge Condition (ft.)	17
Culvert Data	
Number of boxes	2
Barrel type	Concrete
Single culvert barrel width (ft.)	10
Single culvert barrel height (ft.)	10
Length (ft.)	200
Upstream invert elevation	-1 ft-NGVD
Downstream invert elevation	-1 ft-NGVD
Type of control	Slide gate
Stilling Basin	
Design discharge (cfs)	3,000
Apron elevation	-3.5 ft NGVD
Apron length from culvert to exit to toe of endsill (ft.)	39
Baffle block elevation	-1 ft NGVD
Baffle block height/width (ft.)	2.5 / 2.5
Distance from toe of culvert exit to 1st row of baffle blocks	22
Distance from toe of culvert exit to 2nd row of baffle blocks	28
Training wall elevation (ft-NGVD)	NA
End sill elevation (ft-NGVD)	-3.5
Apron width	30
Total apron length from culvert exit to end of endsill (ft.)	40
Slope from apron to top of end sill	1 on 3
Velocity over the endsill (ft per second(fps))	8
Canal Section	
Side slopes (vert. on hor.)	3
Upstream bottom width (ft.)	30
Upstream bottom elevation(ft-NGVD)	-1
Downstream bottom width (ft.)	30
Downstream bottom elevation(ft-NGVD)	-1

**TABLE E-8: S-608 DESIGN DATA**

Design Conditions	
Discharge	2,000 cfs
Headwater Elevation (ft-NGVD)	14
Tailwater Elevation (ft-NGVD)	10
Optimum Conditions	
Headwater Elevation (ft-NGVD)	12-20
Tailwater Elevation (ft-NGVD)	9-11
SPF Conditions	
Discharge (cfs)	NA
Headwater Elevation (ft-NGVD)	NA
Tailwater Elevation (ft-NGVD)	NA
Maximum Head Difference	
Max. Headwater Elevation (ft-NGVD)	26
Min. Tailwater Elevation (ft-NGVD)	9
Max Head Discharge Condition (ft.)	17
Culvert Data	
Number of boxes	2
Barrel type	Concrete
Single culvert barrel width (ft.)	10
Single culvert barrel height (ft.)	10
Length (ft.)	200
Upstream invert elevation	-1 ft-NGVD
Downstream invert elevation	-1 ft-NGVD
Type of control	Slide gate
Stilling Basin	
Design discharge (cfs)	3,000
Apron elevation	-3.5 ft NGVD
Apron length from culvert to exit to toe of endsill (ft.)	39
Baffle block elevation	-1 ft NGVD
Baffle block height/width (ft.)	2.5 / 2.5
Distance from toe of culvert exit to 1st row of baffle blocks	22
Distance from toe of culvert exit to 2nd row of baffle blocks	28
Training wall elevation (ft-NGVD)	NA
End sill elevation (ft-NGVD)	-3.5
Apron width	30
Total apron length from culvert exit to end of endsill (ft.)	40
Slope from apron to top of end sill	1 on 3
Velocity over the endsill (ft per second(fps))	8
Canal Section	
Side slopes (vert. on hor.)	3
Upstream bottom width (ft.)	30
Upstream bottom elevation(ft-NGVD)	-1
Downstream bottom width (ft.)	30
Downstream bottom elevation(ft-NGVD)	-1

**TABLE E-9: S-609 DESIGN DATA**

Design Conditions	
Discharge	2,000 cfs
Headwater Elevation (ft-NGVD)	10.5
Tailwater Elevation (ft-NGVD)	10
Optimum Conditions	
Headwater Elevation (ft-NGVD)	10-11
Tailwater Elevation (ft-NGVD)	9-11
SPF Conditions	
Discharge (cfs)	NA
Headwater Elevation (ft-NGVD)	NA
Tailwater Elevation (ft-NGVD)	NA
Maximum Head Difference	
Max. Headwater Elevation (ft-NGVD)	11
Min. Tailwater Elevation (ft-NGVD)	9
Max Head Discharge Condition (ft.)	2
Culvert Data	
Number of boxes	6
Barrel type	Concrete
Single culvert barrel width (ft.)	10
Single culvert barrel height (ft.)	10
Length (ft.)	300
Upstream invert elevation	-1 ft-NGVD
Downstream invert elevation	-1 ft-NGVD
Type of control	Slide gate
Stilling Basin	
Design discharge (cfs)	3,000
Apron elevation	-1 ft NGVD
Apron length from toe of ogee to exit to toe of endsill (ft.)	28
Baffle block elevation	0.5 ft NGVD
Baffle block height/width (ft.)	1.5 / 1.5
Distance from toe of Ogee exit to 1st row of baffle blocks	15
Distance from toe of Ogee exit to 2nd row of baffle blocks	19
Training wall elevation (ft-NGVD)	NA
End sill elevation (ft-NGVD)	-0.5
Apron width	70
Total apron length from Ogee Toe to exit to end of endsill (ft.)	30
Slope from apron to top of end sill	1 on 5
Velocity over the endsill (ft per second(fps))	5
Canal Section	
Side slopes (vert. on hor.)	3
Upstream bottom width (ft.)	70
Upstream bottom elevation(ft-NGVD)	-1
Downstream bottom width (ft.)	70

Downstream bottom elevation(ft-NGVD)	-1
Baffle block elevation	0.5 ft NGVD
Baffle block height/width (ft.)	1.5 / 1.5
Distance from toe of Ogee exit to 1st row of baffle blocks	15
Distance from toe of Ogee exit to 2nd row of baffle blocks	19
Training wall elevation (ft-NGVD)	NA
End sill elevation (ft-NGVD)	-0.5
Apron width	70
Total apron length from Ogee Toe to exit to end of endsill (ft.)	30
Slope from apron to top of end sill	1 on 5
Velocity over the endsill (ft per second(fps))	5
Canal Section	
Side slopes (vert. on hor.)	3
Upstream bottom width (ft.)	70
Upstream bottom elevation(ft-NGVD)	-1
Downstream bottom width (ft.)	70
Downstream bottom elevation(ft-NGVD)	-1

**TABLE E-10: S-610 DESIGN DATA**

Design Conditions *	
Flood control (cfs)	2,000
Seepage control(cfs)	200 - 700
Pump Station Capacity Criteria	
Number of pumps	9
*Pump Mix Type and Size	Diesel, 6 @ 360 cfs Electric, 3 @ 115 cfs
Design Operating Heads (ft.)	9-11
Normal (10.0 HW to 22.0 TW) (ft.)	12
Maximum (8.0 HW to 22.0 TW) (ft.)	14.0
Intake Water Surface Elevations	
Maximum non-pumping(ft-NGVD)	14.0
Maximum pumping(ft-NGVD)	14.0
Start pumping(ft-NGVD)	11.0
Normal drawdown(ft-NGVD)	9.0
Minimum drawdown (ft-NGVD)	8.0
Minimum non-pumping(ft-NGVD)	8.0
Channel invert(ft-NGVD)	-17.0
Discharge Water Surface Elevations	
Maximum non-pumping(ft-NGVD)	25.0
Maximum pumping(ft-NGVD)	22.0
Normal pumping	22.0
Minimum pumping (ft-NGVD)	10.0
Minimum non-pumping(ft-NGVD)	10.0
Channel invert(ft-NGVD)	10.0

\*Pump design maximum operational discharge elevations are higher than impoundment design pool to allow greater storage should impoundment demonstrate greater seepage than expected with construction and real-time operational monitoring.

**TABLE E-11: S-611 DESIGN DATA**

Design Conditions * <b>Flood Control</b>	1,600 cfs
Seepage control(cfs)	200 - 800
Pump Station Capacity Criteria	
Number of pumps	8
Pump Mix Type and Size	Diesel, 4 @ 400 cfs Electric, 4 @ 100 cfs
Design Operating Heads (ft.)	
Normal (9.0 HW go 22.0 TW) (ft.)	13.0
Maximum (7.0 HW to 22.0 TW) (ft.)	15.0
Intake Water Surface Elevations	
Maximum non-pumping(ft-NGVD)	14.0
Maximum pumping(ft-NGVD)	14.0
Start pumping(ft-NGVD)	11.0
Normal drawdown(ft-NGVD)	9.0
Minimum drawdown (ft-NGVD)	8.0
Minimum non-pumping(ft-NGVD)	8.0
Channel invert(ft-NGVD)	-10.0
Discharge Water Surface Elevations	
Maximum non-pumping(ft-NGVD)	25.0
Maximum pumping(ft-NGVD)	22.0
Normal pumping	22.0
Minimum pumping (ft-NGVD)	10.0
Minimum non-pumping(ft-NGVD)	10.0
Channel invert(ft-NGVD)	10.0

\*Pump design maximum operational discharge elevations are higher than impoundment design pool to allow greater storage should impoundment demonstrate greater seepage than expected with construction and real-time operational monitoring.

Table D.1

## Reservoir Operations Water Budget

	TSP Operations	NAI Operations
	Average Annual (kaf/yr)	Average Annual (kaf/yr)
Natural System Deliveries (to STA 3/4)	504*	404
Ag Water Supply Deliveries (to NNR and MIA canals)	180	199
Inflow to Reservoir Storage (Lake / EAA runoff)	400 / 300	322 / 294

\*Reduced to about 425 kaf/yr during startup operations

Figure 1

