REstoration COordination and VERification (RECOVER)
Evaluation Team, Regional Evaluation Report
**TRANSMITTAL LETTER**

April 3, 2006

Project Managers and Planning Technical Leads
Lake Okeechobee Watershed Project
Comprehensive Everglades Restoration Plan

Dear Project Team Managers and Planning Technical Leads,

RECOVER has completed its regional evaluation of the LOW Project alternative plans and our final report is attached.

RECOVER's evaluation of project alternatives fulfills the following requirements as prescribed by the Programmatic Regulations:

1. Support project teams to achieve consistency with the CERP's goals and objectives;
2. Document the performance of the project alternative plans using RECOVER approved system-wide performance measures, project performance measures (when appropriate), and best professional judgment. RECOVER determines the ability of each alternative plan to meet the targets established for each performance measure and describes the resulting effects upon the natural system. When appropriate, RECOVER evaluations include a qualitative analysis on how the project fulfills CERP goals and objectives;
3. Suggest improvements to the project, which if pursued could improve project performance or enhance benefits to the natural system;
4. Provide insight, if possible, and alert the project teams of any inconsistent modeling assumptions for the project as originally modeled in the CERP.

Recommendations discussed within the RECOVER regional evaluation report generally fall into one of three categories:

1. Recommendations that can easily be incorporated into the plan formulation process;
2. Recommendations that are more conceptual in nature, which the Project Team may select to incorporate into preliminary designs to improve project performance; and
3. Recommendations that are crucial to the project, but cannot be addressed prior to the AFB meeting.

Concerning the latter category, RECOVER significantly expedited its regional evaluation to satisfy the need for timely reporting, while bringing forward as much science as possible. As a result, this report may not constitute the entirety of RECOVER's review as specified in the Programmatic Regulations. Therefore, RECOVER may provide additional information supporting and refining the original regional evaluation, with the expectation that those additional evaluation comments be considered by the project team.

Best regards,

Evaluation Team Chairs
(Orlando Ramos-Ginés, Kim Jacobs, Steve Traxler)

# Lake Okeechobee Watershed (LOW) Project
# System-wide Evaluation Report
# Prepared by RECOVER

## 1.0 Introduction and Purpose of the Evaluation

The Lake Okeechobee Watershed (LOW) Project Team has identified their initial array of alternative plans and requested that Restoration Coordination and Verification (RECOVER) conduct a system-wide evaluation of the alternative plans being considered. The role of RECOVER is to organize and apply scientific and technical information in ways that are most effective in supporting the objectives of the Comprehensive Everglades Restoration Plan (CERP or Comprehensive Plan). One of the primary missions of RECOVER is to work with the project team to evaluate and maximize the contribution made by each project to the system-wide performance of the CERP. The RECOVER Evaluation Team (ET) is charged with the responsibility of conducting system-wide evaluations.

The ET is an interagency and interdisciplinary scientific and technical team charged with developing and using performance measures for evaluating alternative plans developed for project implementation reports (PIRs). The purpose of the ET evaluation is to ensure that alternative plans are consistent with the goals and purposes of the CERP. For its evaluations, the ET has developed a suite of approximately 40 ecological performance measures and 8 water supply and flood protection performance measures (see http://www.evergladesplan.org/pm /recover/eval_team_perf_measures.cfm). Output from the South Florida Water Management Model (SFWMM) version 5.4, which is the primary hydrologic simulation model for the CERP, is used to produce performance measure output. The SFWMM is a regional-scale model that provides simulations of hydrologic conditions at a two-mile by two-mile spatial resolution. Because of the large-scale resolution of the model and the relatively small hydrologic influence of some CERP projects, ET performance measures may not always reveal differences in system-wide performance of project alternative plans. In these cases, RECOVER uses other scientific information to evaluate the potential performance of project alternatives on the system.

The purposes of system-wide evaluations are to (1) inform the project team of the compatibility of proposed project alternative plans with regional CERP restoration goals and performance expectations; (2) determine the performance of each alternative plan toward meeting system-wide goals and objectives through the use of system-wide performance measures, project performance measures, and best professional judgment; (3) identify improvements for project performance that would improve its system-wide performance, and (4) provide decision-makers required information regarding system-wide performance expectations of specific projects.

The type of RECOVER evaluations may vary depending on the applied tools, new information that may have become available, the project's relationship to the Central and Southern Florida (C&SF) Project, or the project implementation schedule. In the case of hydrologically isolated projects, RECOVER may not be able to rely on regional modeling results for their evaluations. For these projects, the scope of RECOVER's evaluations may be limited to reviewing project-level model results and applying best professional judgment.

# 2.0 Project Background and General Description of Alternative Plans

## 2.1 Project Goals and Objectives

The LOW Project is part of the CERP as authorized by the Water Resources Development Act (WRDA) 2000 (U.S. Congress 2000). The goal of the LOW Project is to improve habitat and water quality in Lake Okeechobee and its watershed, and to improve habitat in the northern estuaries. The objectives of this project, as identified in the LOW Project Feasibility Scoping Meeting Documentation (USACE and SFWMD 2004) are as follows:

- Improve wetland habitat in the watershed
- Improve upland habitat in the watershed
- Improve deep/open water habitat in the watershed
- Maximize tributary phosphorus reduction benefits
- Improve in-lake water quality
- Provide for better management of releases to the Northern Estuaries
- Increase recreational opportunities in the watershed
- Achieve project benefits as soon as possible
- Provide interim and long-term operational flexibility to adapt to information obtained during operation of the project and other CERP projects
- Provide a cost-effective project
- Achieve reasonable incremental benefits.

## 2.2 Project Background

The overall purpose of the LOW Project can best be understood in terms of its contribution and relationship to the overarching purpose of restoring the South Florida ecosystem. The LOW Project will contribute to South Florida ecosystem restoration through features to improve the water quality of Lake Okeechobee, provide for better management of Lake Okeechobee water levels, reduce damaging releases to the St. Lucie and Caloosahatchee Estuaries, increase the spatial extent of wetlands, and provide for better management of Lake Istokpoga water levels.

Water from the watershed and the lake will be detained in large storage areas during wet periods for later use during dry periods. The increased storage capacity will reduce the duration and frequency of both high and low water levels in the lake that are stressful to its littoral zone ecosystems and will reduce discharges from the lake that are damaging to the downstream estuarine ecosystems. Water from upstream tributaries will be diverted to storm water treatment areas (STAs) to reduce nutrient loadings into the lake (USACE and SFWMD 2004).

## 2.3 General Description of Alternative Plans

The LOW Project identified their final array of project alternative plans. Each alternative plan that is being considered includes reservoir assisted STA management measures. The three watershed alternatives that make up the final suite of alternative plans are detailed in Table 1. Documentation for the management measures associated with each alternative plan was provided by the LOW Project Team and can be found in Attachment A of this report.

**Table 1. Summary of LOW Project alternative plans**

| WA ID | Management Measures | Reservoirs Size (acres) | Reservoirs Depth (ft) | Reservoirs Storage Capacity (ac-ft) | STAs Size (acres) | Total Storage (ac-ft) | Expected TP Load Reduction (mtons/yr) |
|---|---|---|---|---|---|---|---|
| WA02 | K-42 Reservoir | 10,281 | 16 | 161,263 | | 240,823 | 62.0 |
| | I-17 Reservoir | 5,416 | 16 | 79,560 | | | |
| | I-01 STA | | | | 8,044 | | |
| WA04 | K-42 Reservoir | 5,110 | 16 | 74,216 | | 153,776 | 92.6 |
| | I-17 Reservoir | 5,416 | 16 | 79,560 | | | |
| | I-01 STA | | | | 8,044 | | |
| | F-01 STA | | | | 6,360 | | |
| WA06 | T-26 Reservoir | 1,984 | 18 | 32,000 | | 288,823 | 124.6 |
| | T-30B Reservoir | 779 | 14 | 8,000 | | | |
| | T-30D Reservoir | 780 | 14 | 8,000 | | | |
| | T-01 STA | | | | 3,975 | | |
| | K-42 Reservoir | 10,281 | 16 | 161,263 | | | |
| | I-17 Reservoir | 5,416 | 16 | 79,560 | | | |
| | I-01 STA | | | | 8,044 | | |
| | F-01 STA | | | | 6,360 | | |

## 3.0 Evaluation Methodology and Information Considered

This section outlines the methodology used by RECOVER to conduct its system-wide evaluation of alternative plans. It also describes the modeling and technical information considered by RECOVER to evaluate the potential system-wide effects of the LOW Project. RECOVER's analyses of the information presented and implications to the system are presented in later sections of this report.

### 3.1 Methodology

Because the LOW Project is essentially outside the spatial resolution and domain of the SFWMM, the OASIS Lake Okeechobee Watershed Model (OSLOW) was developed and used to simulate water flows and phosphorus loads in the project footprint for each alternative. Results were used to develop a modified data storage (MDS) time series for Lake Okeechobee. The MDS term essentially defines the change in storage provided by each alternative plan. This MDS time series was used as input for the SFWMM runs provided for RECOVER review. The following information was provided for consideration during the system-wide evaluation of alternative plans:

- LOW Project goals and objectives

- SFWMM output for RECOVER performance measures and daily stage/flow data for specific components/structures.
- Lake Okeechobee Water Quality Model (LOWQM) output

Two base conditions were established for the modeling scenarios run. The first base condition (B2) includes the assumption that Everglades Rain Driven Operations (ERDO) will be implemented by a body outside of the CERP and will therefore be present in the 2050 future without CERP condition. This base condition also utilizes optimized operations among project features to maximize timing and deliveries of water under the CERP1 condition. The second base condition (B3) does not include ERDO in the 2050 future without project condition, and does not include the optimized operations under the CERPA run.

The LOW Project decided to use the B2 condition based on the recommendation of the Interagency Modeling Center (IMC). The B2 condition most accurately represents how the project is expected to interact with other CERP components. The LOW Project also decided to consider how the project benefits might be affected by the removal of ERDO from the future without project condition (i.e., 2050B3) since implementation of ERDO is no longer expected to be implemented without CERP. In order to accomplish these comparisons, RECOVER conducted a two-part evaluation. First, the future with project alternatives (50B2W2, 50B2W4, 50B2W6) were compared to the 2050B2 condition to determine progress toward reaching system-wide restoration targets. Second, the future with project alternatives (50B3W2, 50B3W4, 50B3W6) were compared to the 2050B3 to determine what if any impact the removal of ERDO has on alternative performance.

## 3.2 Hydrologic Modeling Considered

RECOVER conducted its evaluation based on the following SFWMM scenarios:

- 2050 Future without CERP including ERDO (2050B2)
- 2050 Future Condition with each alternative in place (50B2W2, 50B2W4, 50B2W6)
- 2050 Future without CERP not including ERDO (2050B3)
- 2050 Future Condition with each alternative in place (50B3W2, 50B3W4, 50B3W6)

Results from this modeling are presented in Appendix A. Additional regional modeling information can be found at ftp://ftp.sfwmd.gov/pub/jabarne/LOW/.

The SFWMM output was used to evaluate CERP system-wide performance measures. When appropriate, specific stage and flow data were used to investigate specific changes in system-wide indicators and correlate it with specific project alternatives. The alternative plan performance was compared to the 2050 future without project condition and restoration targets. It is important to note that the restoration targets established for CERP system-wide performance measures were chosen based on full restoration rather than incremental project performance. In most cases, no single project will be able to meet restoration targets. Comparison of alternative plans to 2050B2 and 2050B3 conditions will be conducted as described above (Section 3.1).

## 3.3 Water Quality Information Considered

The LOWQM was run for the following scenarios:

- 2050 Future without CERP including ERDO (2050B2)

- 2050 Future Condition with each alternative in place (50B2W2, 50B2W4, 50B2W6)

Results from the LOWQM were also used to evaluate CERP system-wide performance measures. The same cautions regarding restoration targets and the effects of a single project discussed for hydrologic modeling output are also applicable to the evaluation of LOWQM results.

As with all models, the predictions from the two models used in this analysis, the SFWMM and the LOWQM, contain uncertainty. The sources of uncertainty include the boundary conditions (rainfall, temperature, etc.) and model assumptions. These issues were explored in Quantifying and Communicating Model Uncertainty for Decision Making in the Everglades, Report of the Comprehensive Everglades Restoration Plan's Model Uncertainty Workshop (Loucks et al. 2002). RECOVER has attempted to account for this uncertainty in its analysis by indicating improvements in LOWQM-based performance measures using an uncertainty analysis (Dilks and James 2002, 2006).

### 3.4 Additional Pending Modeling Results

Additional model results may be pursued by the LOW Project Team. When available, RECOVER will review these additional model results and provide modified and/or additional comments to the LOW Project Team on alternative plan performance where appropriate.

## 4.0 Consistency with the Comprehensive Plan

The planning objectives developed for the LOW Project are generally consistent with the objectives of the Comprehensive Plan (USACE and SFWMD 1999). The planning goal of this project is to attenuate peak flows and retain phosphorus before flowing into Lake Okeechobee by capturing, storing and treating basin runoff during periods when water levels in Lake Okeechobee are high or increasing. The water held in the project reservoirs would be released to Lake Okeechobee when lake levels decline to ecologically acceptable levels. The twelve objectives developed for the LOW Project presented in Table 2 directly correspond to specific CERP objective(s) contained in the Central and Southern Florida Project Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement (USACE and SFWMD 1999).

**Table 2. Summary of LOW Project objectives and corresponding CERP objectives**

| LOW Project Objectives | Corresponding CERP Objectives |
|---|---|
| Improve wetland habitat in the watershed | Increase habitat and functional quality<br>Improve native plant and animal species abundance and diversity |
| Improve upland habitat in the watershed | Increase habitat and functional quality<br>Improve native plant and animal species abundance and diversity |
| Improve deep/open water habitat in the watershed | Increase habitat and functional quality<br>Improve native plant and animal species abundance and diversity |
| Maximize tributary phosphorus reduction benefits | Increase habitat and functional quality<br>Improve native plant and animal species abundance and diversity |
| Improve in-lake water quality | Increase habitat and functional quality<br>Improve native plant and animal species abundance and diversity<br>Increase availability of fresh water for agricultural water supply |
| Provide for better management of releases to the Northern Estuaries | Increase habitat and functional quality<br>Improve native plant and animal species abundance and diversity<br>Reduce flood damages |
| Increase recreational opportunities in the watershed | Enhance economic and social well being<br>Provide recreational opportunities |
| Achieve project benefits as soon as possible | Optimize project performance and efficiency |
| Provide interim and long-term operational flexibility to adapt to information obtained during operation of the project and other CERP projects | Optimize project performance and efficiency<br>Implements adaptive management principles |
| Provide a cost-effective project | Optimize project performance and efficiency |
| Achieve reasonable incremental benefits | Optimize project performance and efficiency |

# 5.0 System-wide Performance of Alternative Plans

The following sections summarize performance of the project alternatives using the methodology described in section 3.1 of this report.

## 5.1 Lake Okeechobee

RECOVER's review of alternative plans focused on lake stages and nutrient concentrations within Lake Okeechobee. Based on these analyses, the project will provide substantial benefits to the lake.

The CERP system-wide performance measures for Lake Okeechobee stages, LO-1 through LO-3, target weekly mean lake stages within an optimum envelope, with no weeks > 17 feet or < 10 feet (Table 3). A reduction in the number of stage deviations from the optimum and a reduction in the frequency of events > 17 feet and < 10 feet are required to show improvement over the base conditions. The CERP system-wide performance measures for Lake Okeechobee nutrient levels, LO-4 and LO-6, target in-lake phosphorus concentrations < 40 parts per billion (ppb) and total nitrogen (TN):total phosphorus (TP) mass ratio in excess of 22:1. A reduction in TP concentrations is needed to show improvement over the base conditions.

**Table 3. Summary of CERP system-wide performance measures for Lake Okeechobee**

| Performance Measure Title | Performance Metric | Target |
|---|---|---|
| LO-1 Lake Okeechobee Extreme Low Lake Stage | number of weeks with stage < 10 feet NGVD | 0 weeks |
| LO-2 Lake Okeechobee Extreme High Lake Stage | number of weeks with stage > 17 feet NGVD | 0 weeks |
| LO-3 Lake Okeechobee Stage Envelope | Deviation from an optimum stage envelope in ft-weeks | 0 ft-weeks deviation above; 192 ft-weeks deviation below |
| LO-4Lake Okeechobee TP Concentration | In-lake TP Concentration | < 40 ppb |
| LO-6 Lake Okeechobee TN:TP Mass Ratio | TN to TP ratio (by weight) | > 22:1 |

*Extreme Low Lake Stage*

Extreme low water levels cause adverse effects to the littoral and near-shore areas of Lake Okeechobee by drying out the entire littoral zone, the shoreline fringing bulrush zone, and nearly all of the lake area that supports submerged plants. During such times, no habitat is available in the lake for reptiles, amphibians, wading birds, apple snails, or fish that depend on aquatic plant-dominated regions for successful foraging and recruitment. Extreme low stage also allows exotic plants such as torpedo grass and melaleuca to invade areas of the littoral zone where they did not formerly occur, displacing native vegetation (RECOVER 2006).

RECOVER has developed a performance standardization to express the ecological impacts that these events are expected to have on the lake. Based on recent observations of the impacts of just 15 weeks of stage below 10 feet during the 2001 drought, this value can be assigned as the worst case situation, knowing that it produced impacts that took multiple years to recover (e.g., lost apple snail populations, extensive woody vegetation in shoreline areas). This duration for <10 feet stage (15 weeks / year = 540 weeks in a 36-year model run) is set as the point equivalent to a score of 0 on the standardized scale. The target of 0 weeks with stage < 10 feet NGVD is taken as a score of 100 on the standardized scale.

All alternatives produced stages below 10 feet NGVD for between 35 and 44 weeks (Table 4). The 2050B2 alternative had the highest score, 94 followed by 50B2W2 at 93 and 50B2W4 and 50B2W6 were tied for the lowest score of 92 (Table 4, Figure 1). The range among the counts is greater than 25 percent, indicating that a significant difference exists between the highest and lowest scores. All of the project alternatives perform slightly worse than the future without project based on this performance measure. The general decreases in lake stage is likely due to the evapotranspiration losses experienced when water is stored in the project management features before being routed to the lake.

*Lake Okeechobee Extreme High Lake Stage*

Extreme high water levels cause adverse effects to the littoral and near-shore areas of Lake Okeechobee. Extreme high stage (above 17 ft NGVD) allows wind-driven waves to directly impact the littoral emergent plant and near-shore submerged plant communities, causing physical uprooting of plants. At extreme high stage, suspended solids from the mid-lake region (where sediments are soft mud) are transported to the shoreline regions, reducing light levels in the water column and depositing mud on the natural sand and peat sediment. These changes result in reduced growth of submerged plants, due to light limitation, and impacts to submerged plant germination, fish spawning, and macroinvertebrate communities. At extreme high stage, nutrient-rich water from the mid-lake region is also transported into the littoral zone where it causes changes in periphyton biomass and taxonomic structure and shifts in plant dominance including expansion of cattail (RECOVER 2006). All alternatives produced stages above 17 feet for 28 to 42 weeks (Table 4). As with the extreme low lake stages, RECOVER has developed a means to standardize performance and relate it to ecologic effects in the lake. In 1998 and 1999, nearly 100% of the lake's submerged plant community was physically uprooted and piled up on the western shoreline and over 100 m of littoral emergent vegetation was also uprooted – when stage was over 17 ft for just 16 and 7 weeks, respectively. This was the most severe case of high water damage documented on the lake during the last 30 years. Thus, this duration for >17 ft stage (average 11 weeks / year = 396 weeks in a 36 year model run) is set as the point equivalent to a score of 0 on the standardized scale. The target of 0 weeks with stage > 17 feet NGVD is taken as a score of 100 on the standardized scale. All of the project alternative plans show improvement over the 2050B2 condition (89) with alternative 50B2W6 having the highest score (93) (Figure 1, Table 4). The range of these counts is greater than 33 percent (Table 4) indicating that a significant difference exists between the highest and lowest scores.

*Lake Okeechobee Stage Envelope*

There are many benefits associated with seasonally variable water levels within the range of 12.5 ft (June-July low) and 15.5 ft (November-January high) on the plant/animal communities of Lake Okeechobee. Falling water levels in late winter to spring benefit wading birds by concentrating prey resources in the littoral zone where those birds forage (Smith et al. 1995), water levels near 12.5 ft benefit submerged plants and bulrush by providing optimal light levels for photosynthesis in the summer months (Havens et al. 2004), and variation in the prescribed range results in annual flooding and drying of upland areas of the littoral zone, which favors development of a diverse emergent plant community (Richardson et al. 1995; Keddy and Fraser 2000). All alternatives produced above stage envelope sums between 1072 and 1135 foot weeks (Table 4, Figure 1). This produced standardized scores between 39 and 43, with 2050B2 having the highest score of 43 and 50B2W4 and 50B2W6 tied for the lowest score of 39. The range among alternatives in foot-weeks were less than 6 percent between the highest and lowest scores (Table 4), indicating that a significant difference may not be determined.

The target for the below stage envelope is 192 ft-weeks. This is the score that would be obtained if all years had hydrographs within the optimal zone, except for once per decade with the stage falling to just below 11 ft for an average of 3 months. These periodic low stage events, which occurred at this approximate frequency and duration in the 1950s to 1970s (prior to implementation of high stage regulation schedules), are considered beneficial for the littoral zone because they allow for periodic exposure of seed banks, oxidation of accumulated organic material, and fires that are important to maintaining species diversity in the littoral zone. All alternatives produced below stage envelope sums between 989 and 1126 foot-weeks (Table 4) with standardized scores between 44 and 53 (Table 4 and Figure 1), with 50B2W6 having the highest score, 53, and 2050B2 having the lowest score, 44. The range among the foot-weeks was greater than 12 percent (Table 4), indicating that a significant difference exists between the highest and lowest scores.

**Table 4. Comparisons of alternatives based on in lake stage performance measures.**

| Description | 2050B2 | 50B2W2 | 50B2W4 | 50B2W6 | Range of Values (%) |
|---|---|---|---|---|---|
| Low Lake Stage: Weeks below 10 feet | 35 | 37 | 41 | 44 | -26% |
| Standardized Score | 94 | 93 | 92 | 92 | |
| High lake stage: Weeks above 17 feet | 42 | 34 | 35 | 28 | 33% |
| Standardized Score | 89 | 91 | 91 | 93 | |
| Above Stage Envelope: Foot-Weeks | 1072 | 1090 | 1136 | 1135 | -6% |
| Standardized Score | 43 | 42 | 39 | 39 | |
| Below Stage Envelope: Foot-Weeks | 1126 | 1011 | 1028 | 989 | 12% |
| Standardized Score | 44 | 51 | 50 | 53 | |

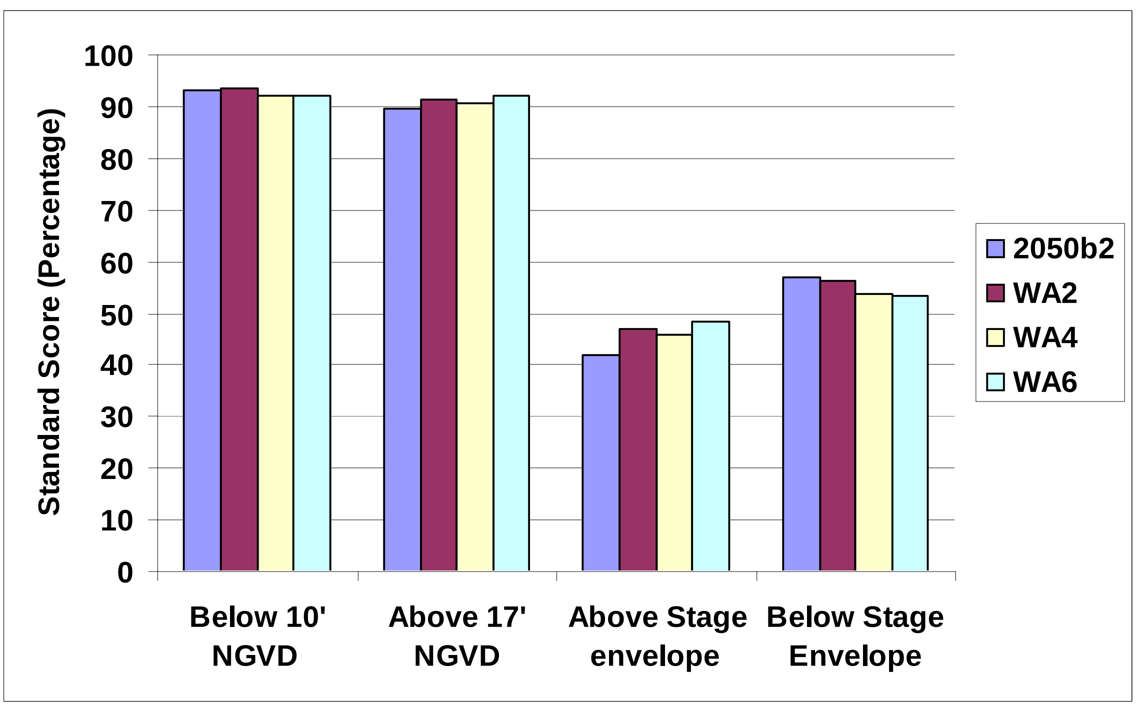

**Figure 1. Comparison of Alternatives 2050B2 (without project), 50B2W2, 50B2W4, and 50B2W6 for performance measures LO-1 (Low Lake Stage), LO-2 (High Lake Stage), and LO-3 (Above and Below Stage Envelope).**

*Lake Okeechobee Total Phosphorus (TP) Concentration*

The predrainage Lake Okeechobee was characterized by hydrologic inputs primarily from rainfall and inflow from tributaries draining wetlands, forest, and range lands. This resulted in relatively moderate phosphorus inputs to the lake and moderately eutrophic conditions in the ecosystem. This contrasts sharply with the present condition of high phosphorus inputs from agricultural lands and highly eutrophic lake conditions (RECOVER 2006). Using output for each alternative from the SFWMM and flow weighted TP input concentrations developed from the OSLOW model, the LOWQM simulated each alternative: 2050B2, 50B2W2, 50B2W4, and 50B2W6; 100 times using different sets of input parameters (see Dilks and James 2002, Dilks and James, in prep). The five year average concentrations were compared (Figure 2). Over the 25 year period of simulation, concentrations of TP were lowest for 50B2W6 in years 11-15 at 47 ppb with a standard error of 6.8 ppb. After years 1-5, the difference of TP between 2050B2 and 50B2W6 was 10 percent or greater (Table 5).

An Analysis of Covariance was conducted using the yearly predicted average values for all sets of simulations. The analysis indicated that all alternatives with the exception of 2050B2 had significant downward trends in phosphorus concentrations. In addition the trends were significantly different among the simulations with 50B2W6 having the greatest downward trend, followed by 50B2W4 and 50B2W2

**Table 5. Summary of In-lake TP concentrations for 5 year intervals.**

| Years | 2050B2 | 50B2W2 | 50B2W4 | 50B2W6 |
|---|---|---|---|---|
| 1-5 | 64 | 62 | 61 | 60 |
| 6-10 | 55 | 54 | 51 | 49 |
| 11-15 | 54 | 52 | 48 | 47 |
| 16-20 | 60 | 57 | 53 | 51 |
| 21-25 | 63 | 59 | 54 | 51 |

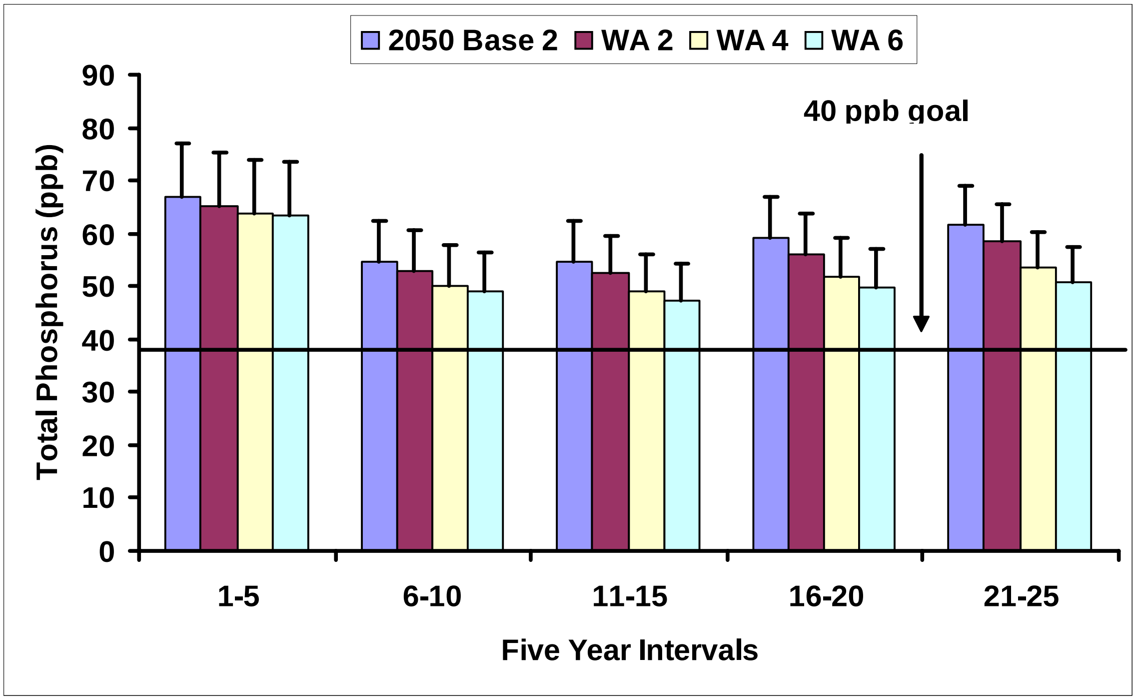


**Figure 2. Comparisons of TP concentrations predicted by the Lake Okeechobee Water Quality Model (LOWQM) for the 2050B2 (without project), 50B2W2, 50B2W4, and 50B2W6.**

*Lake Okeechobee Total Nitrogen (TN):Total Phosphorus Ratio.*

When the TN:TP mass ratio of lake water is below 22:1, bloom-forming cyanobacteria in Lake Okeechobee are favored over more desirable algae (Smith et al. 1995). Using output for each run from the SFWMM and flow weighted TP input concentrations developed from the OSLOW model, the LOWQM simulated each alternative: 2050B2, 50B2W2, 50B2W4, and 50B2W6; 100 times using different sets of input parameters (see Dilks and James 2002, Dilks and James, in prep). The five year average TN:TP ratios were compared (Figure 3). Over the 25 year period of simulation TN:TP ratios were highest for 50B2W6 in years 5-10 at 19.8 with a standard error of 11.4. After years 1-5 the difference of the TN:TP ratio between 2050B2 and 50B2W6 was 10 percent or greater.

An Analysis of Covariance was conducted using the yearly predicted average values for all sets of simulations. The analysis indicated that 2050B2 and 50B2W2 had significant downward trends in TN:TP ratio. In addition, 50B2W6 had the highest overall TN:TP ratio of 18.9 followed by 50B2W4 at 18.2.

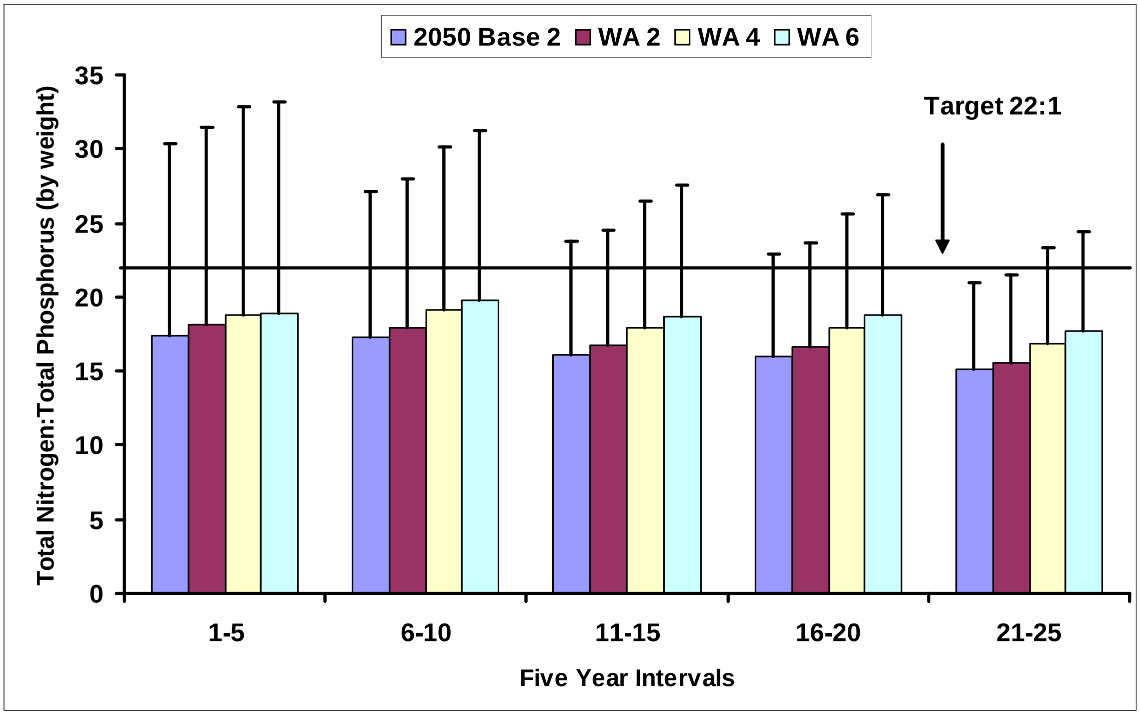


**Figure 3. Comparisons of TN:TP ratios predicted by the Lake Okeechobee Water Quality Model (LOWQM) for the 2050 Base 2 alternative, WA2, WA4, WA6.**

## 5.2 Caloosahatchee Estuary

RECOVER's review of alternative plans focused on freshwater discharges from the C-43 canal at the S-79 structure and regulatory releases from Lake Okeechobee via the S-77 structure. Based on these analyses, the project will provide substantial benefits to the area.

The CERP system-wide Caloosahatchee Estuary salinity envelope performance measure, NE-3, targets a mean monthly inflow between 450 and 2800 cfs during all months, with a low flow target of no months during October to July when the mean monthly inflow from the Caloosahatchee watershed, as measured at S-79, falls below a low flow limit of 450 cfs and the high flow target is no months with mean monthly flow greater than 2800 cfs, as measured at the S-79, from Lake Okeechobee regulatory releases in combination with flows from the Caloosahatchee River (C-43) basin. These predictive performance targets are summarized in Table 6. A reduction in the number of low flow and high flow events and a reduction in the frequency and duration of high and low flow events is required to show improvement over the base conditions.

**Table 6. Summary of CERP system-wide performance measure NE-3 predictive targets.**

| Performance Metric | Target |
|---|---|
| Low Flow Events | |
| Mean monthly flow at S-79 <450 cfs (July-October) | 0 |
| Number of consecutive months mean monthly flow at S-79 <450cfs | Alternative with fewest consecutive months is best |
| Number of consecutive years with mean monthly flows at S-79 <450 cfs | Alternative with fewest consecutive years is best |
| S-79 Flow Distribution | |
| Percent of mean monthly flows at S-79 450-800 cfs | 75% |
| Percent of mean monthly flows at S-79 800-2800 cfs | 25% |
| Moderate and Extreme High Flow Events | |
| Mean monthly flows at S-79 >2800 cfs | 0 (especially March-October) |
| Mean monthly flows at S-79 >4500 cfs | 0 (especially March-October) |
| Lake Okeechobee Regulatory Releases (measured at S-77RG) | |
| Number of days with LO regulatory releases | 0 |
| Daily volume of LO regulatory releases | 0 |
| Total volume of LO regulatory releases | 0 |

*Low Flow Events (<450 cfs)*

None of the alternatives based on the 2050B2 condition (50B2W2, 50B2W4, and 50B2W6), or the alternatives based on the 2050B3 condition (50B3W2, 50B3W4, and 50B3W6) showed a measurable change in the occurrence of flows less than 450 cfs between the months of October and July. An analysis of the distribution of consecutive month events shows a slight increase in one and two month low flow events, with a corresponding decrease in five month events; however, this difference is not expected to be ecologically significant due to the scale of the change.

*Flow Distribution at S-79*

The target of 75% of S-79 flows between 450-800 cfs and most of the remaining inflow between 800-2800 cfs has been found to be important for protecting and restoring estuarine resources while promoting species abundance and diversity (RECOVER 2006). The 2050B2 alternatives increase the number of months where flow is between 450 and 800 cfs in July, August and November (Figure 4). The 2050B3 alternatives also consistently show increases of releases in the desired ranges (Figure 5). The increases that occur during the March-October period have been identified as most beneficial to indicator species communities in the Caloosahatchee Estuary with regard to SAV and juvenile oyster recruitment and survival.

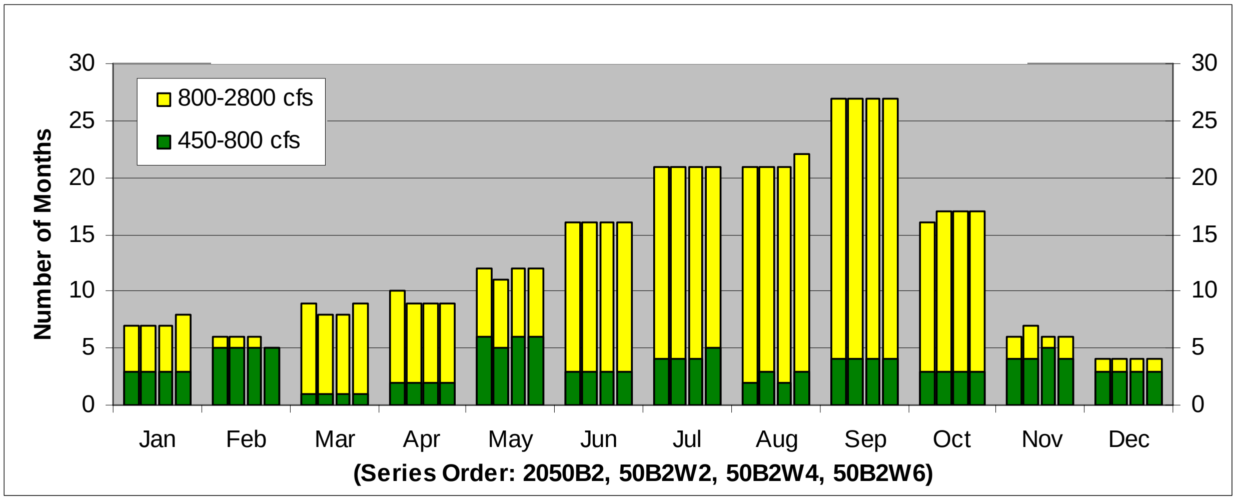


**Figure 4. Number of months of mean monthly flows at S-79 within the desirable 450-2800 cfs flow range for 2050B2 alternatives.**

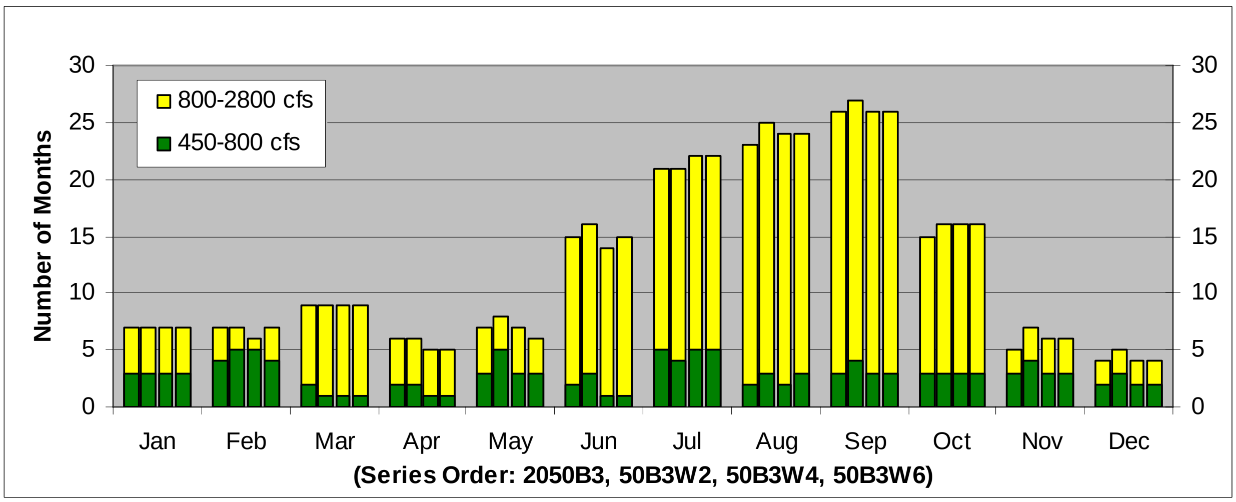


**Figure 5. Number of months of mean monthly flows at S-79 within the desirable 450-2800 cfs flow range for 2050B3 alternatives.**

*Moderate and Extreme High Flow Events*

Moderate and extreme high flow events in the Caloosahatchee estuary (>2800 cfs and >4500 cfs, respectively) directly impact estuarine salinities and ecosystem indicators such as the American oyster and SAV. Reduction in these high volume releases, especially during the period from March to October, may lead to decreases in mass mortality (salinity < 3 ppt) as well as poor spat production and excessive valve closure (salinity < 14ppt) in the oyster population (RECOVER 2006).

All alternatives based on the 2050B2 condition measurably reduce the number of months and number of consecutive months where high flow events occurred, especially where flows >4500 cfs occur. All alternatives substantially reduced the number of months with flows >4500 cfs between March and October compared to 2050B2, with the greatest percent reduction occurring in 50B2W6 (20%), followed by 50B2W2 (13%) and 20B2W4 (10%). Table 7 summarizes the reductions in high mean monthly flows >2800 cfs, and extreme high mean monthly flows >4500 cfs. In some cases, the reduction in extreme high flows moved events into the next severity classification (flows >2800 cfs). Therefore, while the number of mean monthly flows between 2800 and 4500 cfs may appear to increase in some months due to the project alternatives (Figure 6), this increase occurs with the decrease of extreme high flow events, which are more harmful to the indicator species in the estuary. The overall reduction in moderate and extreme high flow events >2800 cfs between March and October are similar for all alternatives. The 2050B3 alternative results are similar and show consistent reductions in extreme high flow events (Figure 7).

In addition to an overall reduction in moderate and extreme high mean monthly flows, all 2050B2 and 2050B3 alternatives show a decrease in the number of consecutive months of flows >4500 cfs, with no periods of greater than 4 months of consecutive high flow events compared to 2050B2 and 2050B3, respectively. All alternatives also reduced the number of consecutive months of high flow >2800 cfs.

**Table 7. Summary of moderate and extreme high mean monthly flows for 2050B2 and 2050B3 alternatives. Percent change indicates difference between the modeled alternative and the 2050 future without project condition.**

| Alternative | Months >2800 cfs | Percent Change | Months >4500 cfs | Percent Change |
|---|---|---|---|---|
| 2050B2 | 68 | | 30 | |
| 50B2W2 | 67 | -1% | 26 | -13% |
| 50B2W4 | 66 | -3% | 27 | -10% |
| 50B2W6 | 65 | -4% | 24 | -20% |
| 2050B3 | 83 | | 38 | |
| 50B3W2 | 78 | -6% | 33 | -13% |
| 50B3W4 | 78 | -6% | 35 | -8% |
| 50B3W6 | 77 | -7% | 33 | -13% |

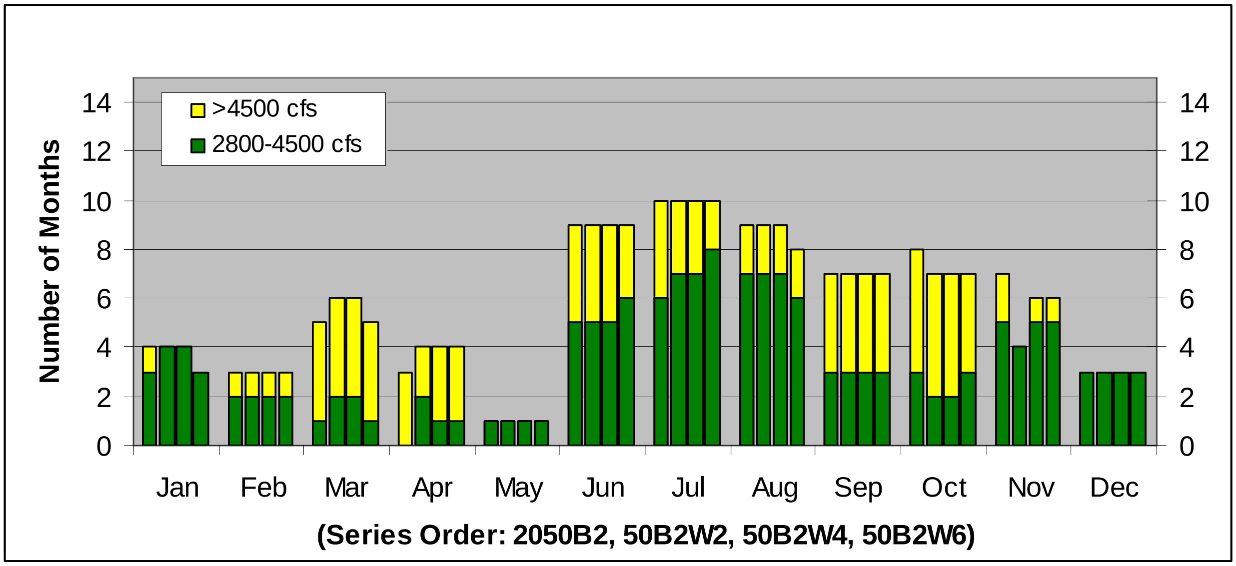


**Figure 6.** **Number of months of mean monthly flows at S-79 greater than 2800 cfs for 2050B2 alternatives.**

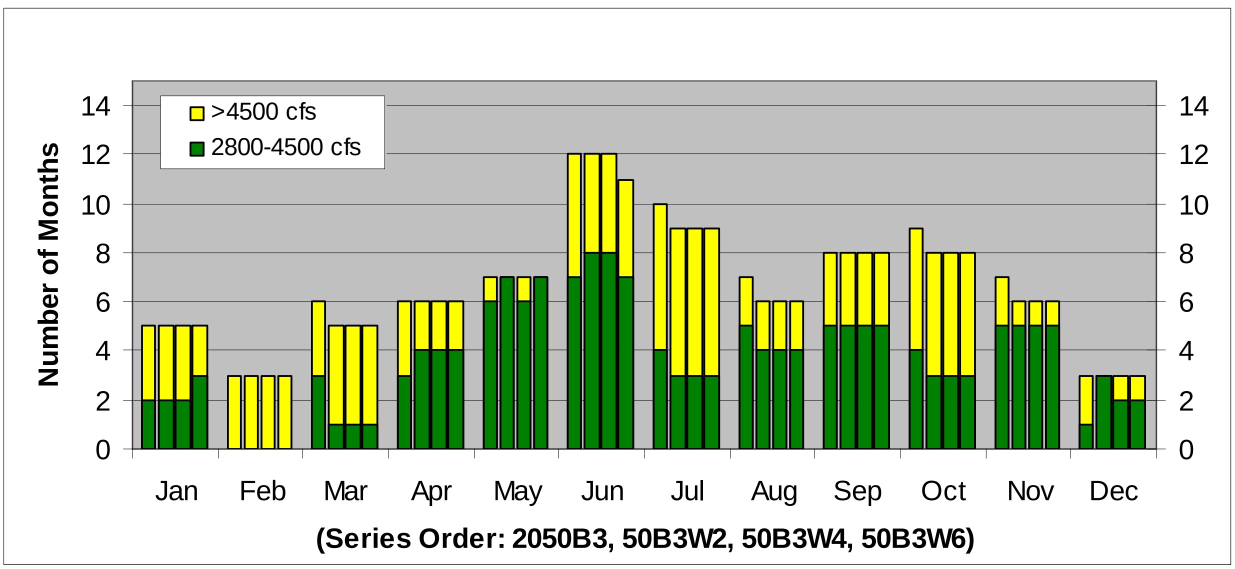


**Figure 7.** **Number of months of mean monthly flows at S-79 greater than 2800 cfs for 2050B3 alternatives.**

*LO Regulatory Releases*

LO regulatory releases for flood protection most often occur in the spring and beginning of the wet season (June-October), when newly settled juvenile oysters are most susceptible to fluctuations in salinity (RECOVER 2006). The eventual elimination of LO regulatory releases is the CERP system-wide restoration target and is desirable to maintain stable salinity conditions in the estuary. Figures 8 and 9 provide a summary of performance related to LO regulatory releases for the 2050B2 and 2050B3 alternatives. All 2050B2 alternatives show a measurable reduction in the number of Lake Okeechobee regulatory releases compared to 2050B2 (13% for 50B2W6, 10% for 50B2W2 and 8% for 50B2W4) as well as a reduction in the total discharge volume of those releases (14% for 50B2W6, 11% for 50B2W2 and 8% for 50B2W4) compared to 2050B2 (Figure 8). All 2050B3 alternatives also show a measurable reduction in the number of releases compared to 2050B3 (11% for 50B3W6, 9% for 50B3W2 and 7% for 50B3W4) as well as a reduction in the discharge volume of those releases (12% for 50B3W6, 10% for 50B3W2 and 8% for 50B3W4) compared to 2050B3 (Figure 9).

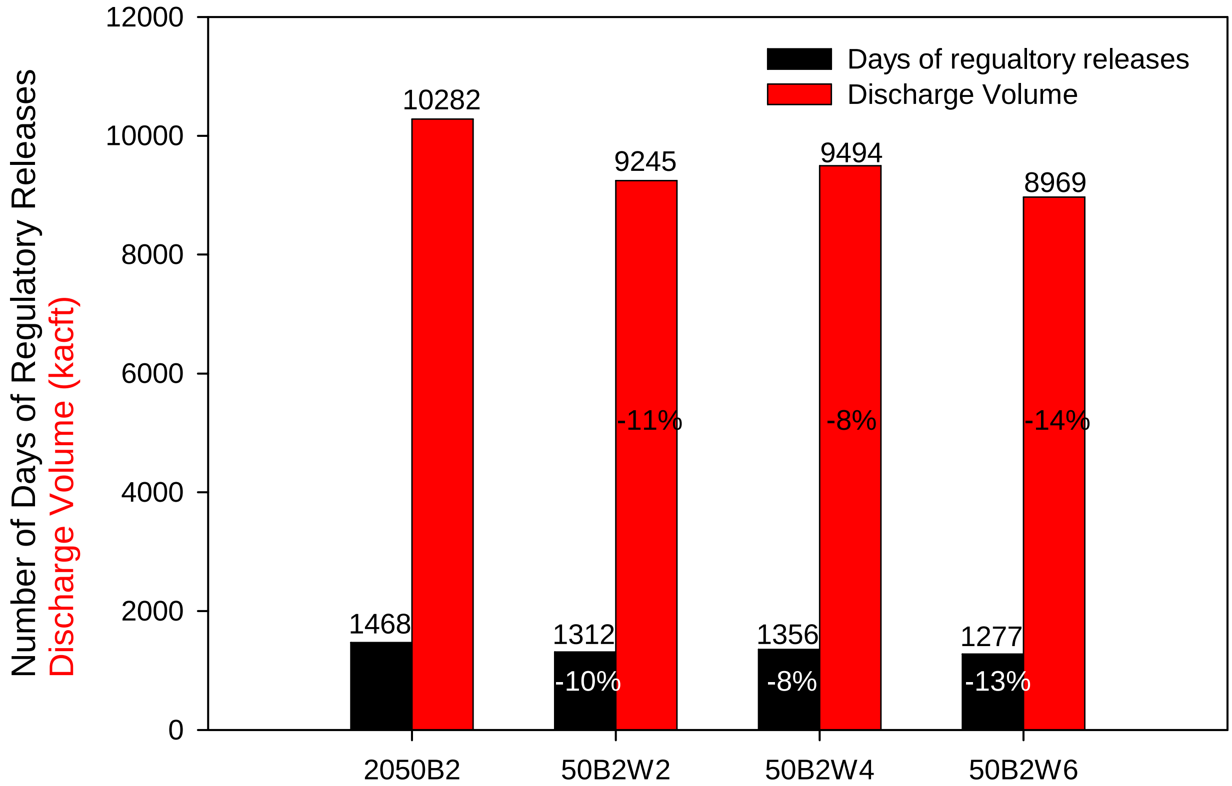


**Figure 8. Number of days of regulatory releases from Lake Okeechobee via S77 (black) and the discharge volume over period of record (kacft) via S77 (red). % indicates the percent change from 2050B2. Numbers above the bars are the actual values.**

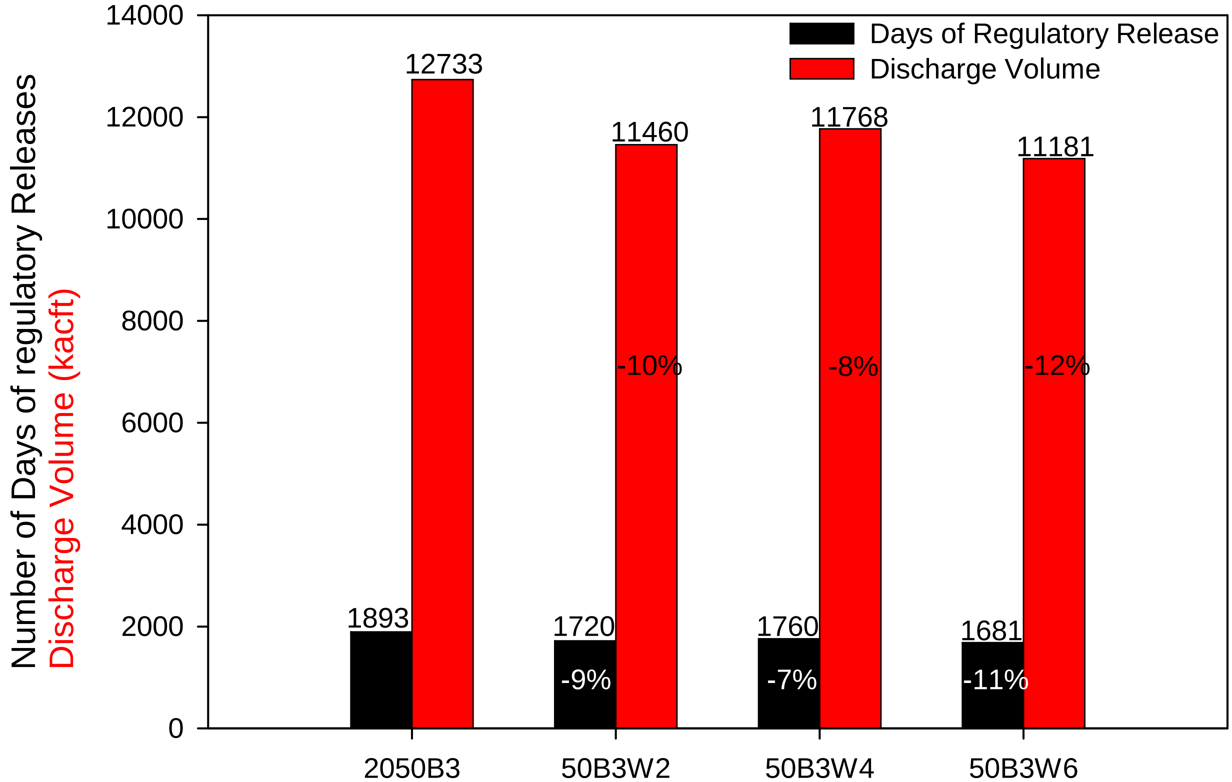


**Figure 9. Number of days of regulatory releases from Lake Okeechobee via S77 (black) and the discharge volume over period of record (kacft) via S77 (red). % indicates the percent change from 2050B3. Numbers above the bars are the actual values.**

*Ecological Impact for the Caloosahatchee Estuary*

The 2050B2 and 2050B3 alternatives show no measurable reduction in low flow events; however, the low flow events (i.e., higher salinities) have a far less significant impact on oysters than high flow events (i.e., lower salinities) because oysters are more tolerant to high salinities than low salinities. Oysters grow best at a salinity of 14 to 28 ppt, but adult mortality occurs at salinities below 3 ppt and spawning is inhibited at salinities less than 7.5 ppt (Volety et al. 2003). While there was little reduction in low flow events, the reduction of high flow events and the reduction in the duration of the high flow events due to the project will provide significant benefits to the area. When S-79 discharges exceed 4000 cfs, salinities drop below 3 ppt upstream of Shell Point which can limit population survival and abundance of oysters in this region (Volety et al. 2003). Oysters are a valued ecosystem component (VEC) and studies have shown that a greater abundance of decapods and fishes were associated with clusters of live oyster compared to dead oyster clusters, while the structure provided by both living and dead oyster shells supported a greater abundance than no shells (Volety et al. 2003). Therefore, the reduction of high flow events, thereby reducing low salinity events affecting oysters, will lead to increased diversity and abundance of estuarine fauna, one of CERP's primary goals.

The differences between the 2050B2 alternatives and 2050B3 alternatives demonstrate that additional environmental benefits are expected to the Caloosahatchee estuary due to the increased reduction of moderate and extreme high mean monthly flows under the 2050B3 conditions.

### 5.3 St. Lucie Estuary

RECOVER's review of alternative plans focused on freshwater discharges from the C-44 canal at the S-80 structure and regulatory releases from Lake Okeechobee. Based on these analyses, the project will provide substantial benefits to the area.

The CERP system-wide St. Lucie Estuary salinity envelope performance measure, NE-1, targets a mean monthly inflow below 350 cfs for no more than 207 months in a 36 year period, no more than 18 months of mean monthly flows between 2000 and 3000 cfs, no more than 5 months of mean monthly flows greater than 3000 cfs and no regulatory discharge events from Lake Okeechobee. These predictive performance targets are summarized in Table 8. A reduction in the number of low flow and high flow events and a reduction in the frequency and duration of high and low flow events is required to show improvement over the base conditions.

**Table 8. Summary of CERP system-wide performance measure NE-1 performance targets.**

| Performance Metric | Target |
|---|---|
| Number of months with mean monthly flow <350cfs | < 207 months |
| Number of allowable LO regulatory discharges | 0 events |
| Number of months with mean monthly flow between 2,000 and 3,000 cfs | < 18 months |
| Number of months with mean monthly flow between >3,000 cfs | < 5 months |
| Number of 14-day moving averages with flow >2,000 cfs (from the local basin) | < 28 months |
| Number of 14-day moving averages with flow >2,000 cfs (from LO regulatory releases) | < 0 months |

*Low Flow Events (<350 cfs)*

None of the alternatives based on the 2050B2 condition (50B2W2, 50B2W4, and 50B2W6), or the alternatives based on the 2050B3 condition (50B3W2, 50B3W4, and 50B3W6), showed a measurable change in the occurrence of flows less than 350 cfs. All alternatives were below the target of less than 207 months with flows <350cfs.

*High flow events based on mean monthly flow*

Large volume releases to the St Lucie Estuary disturb natural salinity patterns, transport large organic loads to the estuaries, and deliver sediments and muck deposits. Each of these impacts the productivity, population distribution and community health of indicator species within the estuary. The performance measure flow targets stated previously are set to maintain estuarine conditions for two indicator species: shoal grass (*Halodule wrightii*) and the American oyster (*Crassostrea virginica*; RECOVER 2006). For the St. Lucie Estuary, all alternatives based on the 2050B2 condition measurably reduce the number of months that exceed the high flow targets (2000 to 3000 cfs and >3000 cfs, Figure 10). Alternative 50B2W4 had the greatest reduction

(11%) in the number of flows between 2000 and 3000 cfs, followed by 50B2W2 (9%) and 50B2W6 (4%; Figure 10). Alternatives 50B2W2 and 50B2W6 had the greatest reductions (14%) in mean monthly flows >3000 cfs followed by 50B2W4 with a 5% reduction from 2050B2 (Figure 10). All alternatives based on the 2050B3 condition also reduce the number of months that exceed the high flows >3000 cfs (Figure 11). Table 9 summarizes the reductions in high mean monthly flows between 2000 and 3000 cfs and extreme high mean monthly flows >3000 cfs. It is important to note that although some 2050B3 alternatives appear to increase the number of mean monthly flows between 2000-3000 cfs, these are instances where flows >3000 cfs have been lowered from extreme high flows to high flows. This reduction in severity of flow is desirable to maintain more stable salinity requirements in the estuary.

**Table 9. Summary of high mean monthly flows for 2050B2 and 2050B3 alternatives. Percent change indicates difference between the modeled alternative and the 2050 future without project condition.**

| Alternative | Months 2000-3000 cfs | Percent Change | Months >3000 cfs | Percent Change |
|---|---|---|---|---|
| 2050B2 | 45 | | 22 | |
| 50B2W2 | 41 | -9% | 19 | -14% |
| 50B2W4 | 40 | -11% | 21 | -5% |
| 50B2W6 | 43 | -4% | 19 | -14% |
| 2050B3 | 44 | | 26 | |
| 50B3W2 | 48 | +9% | 19 | -27% |
| 50B3W4 | 48 | +9% | 20 | -23% |
| 50B3W6 | 44 | 0% | 18 | -31% |

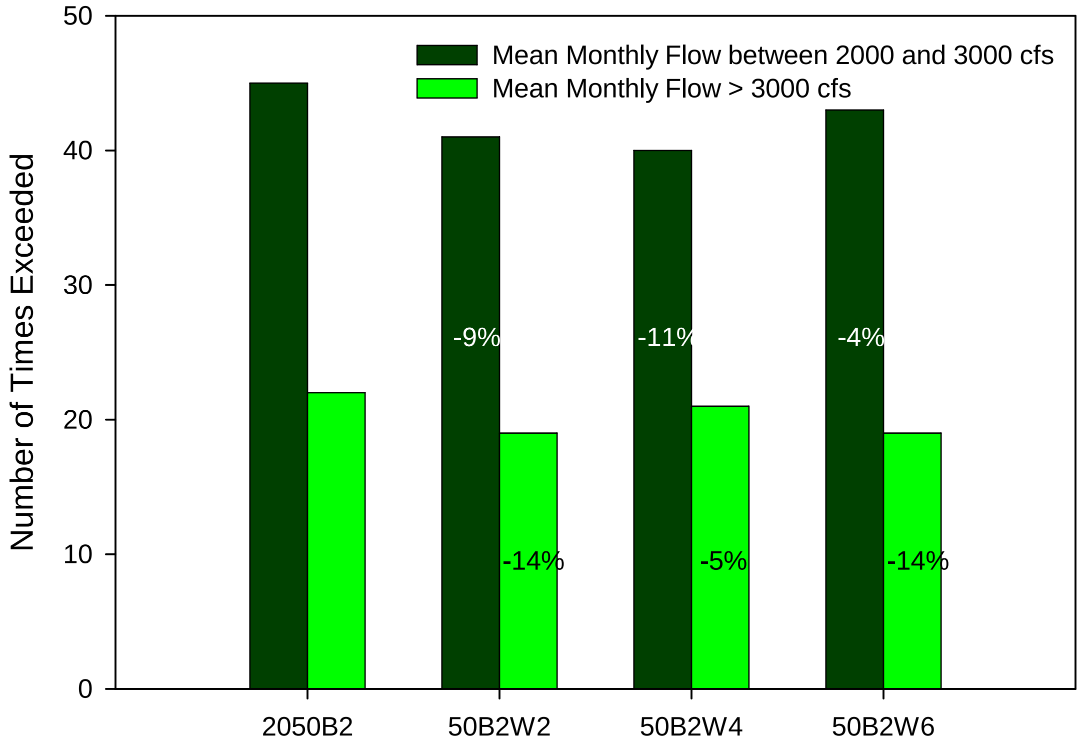


**Figure 10. Number of times mean monthly flow exceeded. % indicates the percent change from 2050B2.**

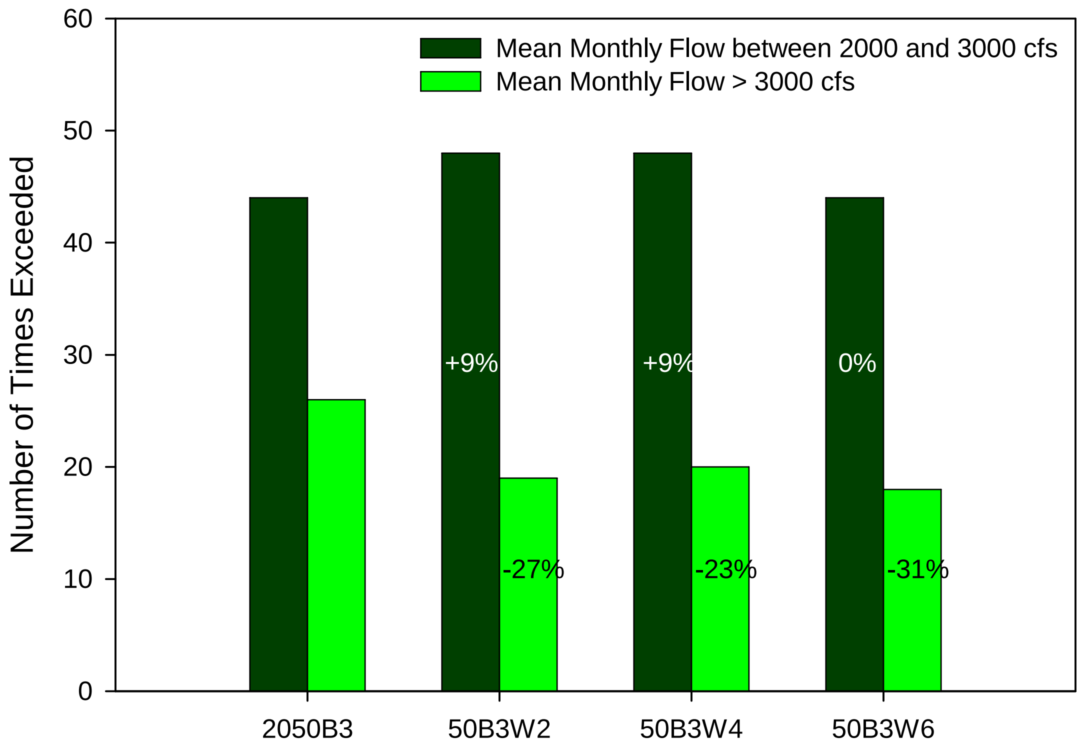


**Figure 11. Number of times mean monthly flow exceeded. % indicates the percent change from 2050B3.**

*High flow events based on 14-day moving average flow*

The analysis of 14-day moving average flows provides additional information to evaluate large pulse releases of freshwater to the estuaries. The 14-day period is critical to the development of oysters and SAV in the estuary (RECOVER 2006). The 2050B2 alternatives greatly reduce the number of times the 14-day moving average flow is greater than 2000 cfs from local basins (6 % for all alternatives), as well as from Lake Okeechobee releases (29% for 50B2W6, 16% for 50B2W2 and 7% for 50B2W4, Figure 12). The reduction in local basin flows to the St. Lucie Estuary is thought to be a side effect of lowered LO stages. Runoff that may have been sent to the estuary when LO stages were high is now being routed back to LO. The 2050B3 alternatives provide similar reductions in local and LO induced 14-day periods with Flows > 200 cfs (Figure 13).

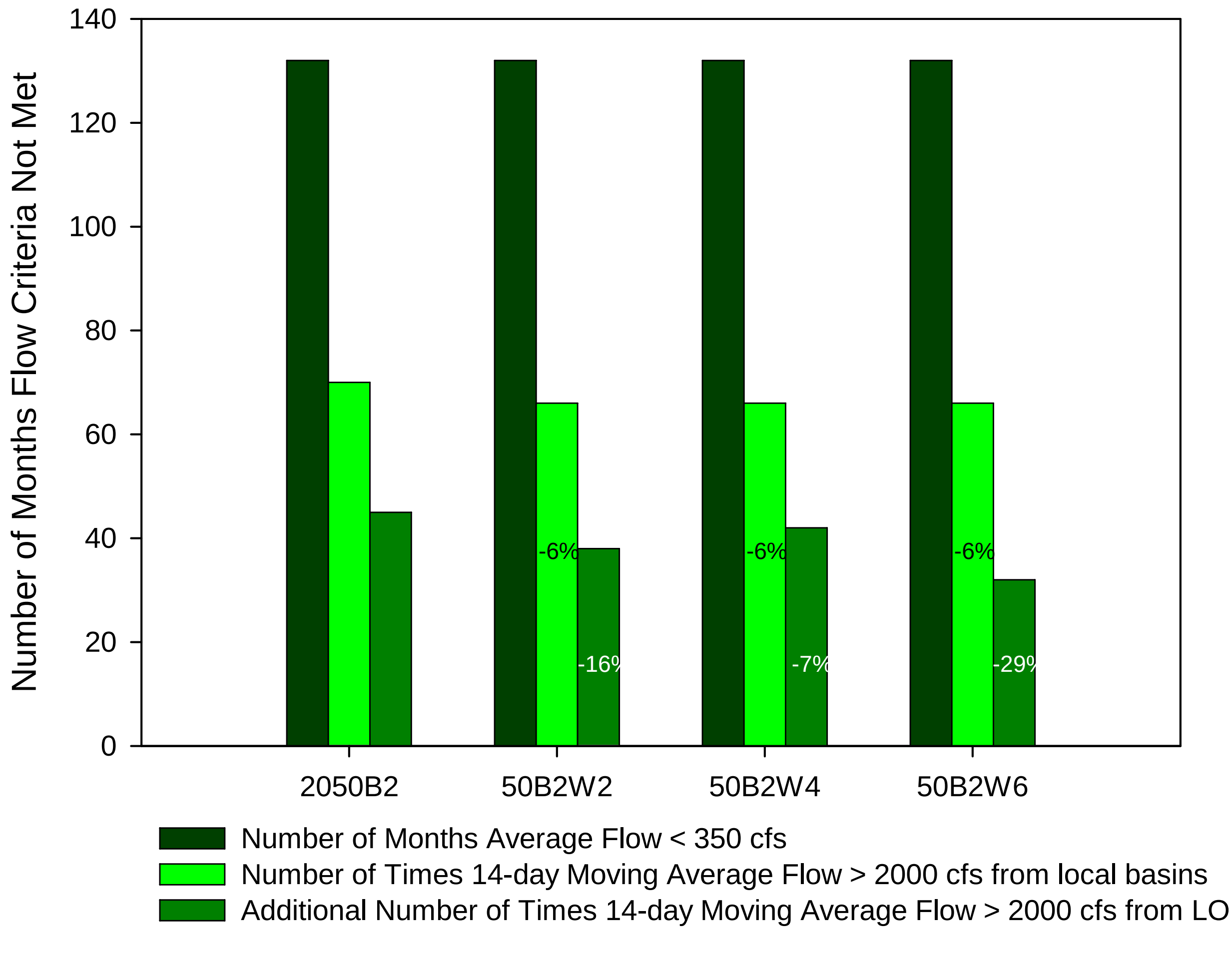


**Figure 12. Number of months flow criteria not met. % indicates the percent change from 2050B2. No % indicates there was no change in flow compared to 2050B2.**

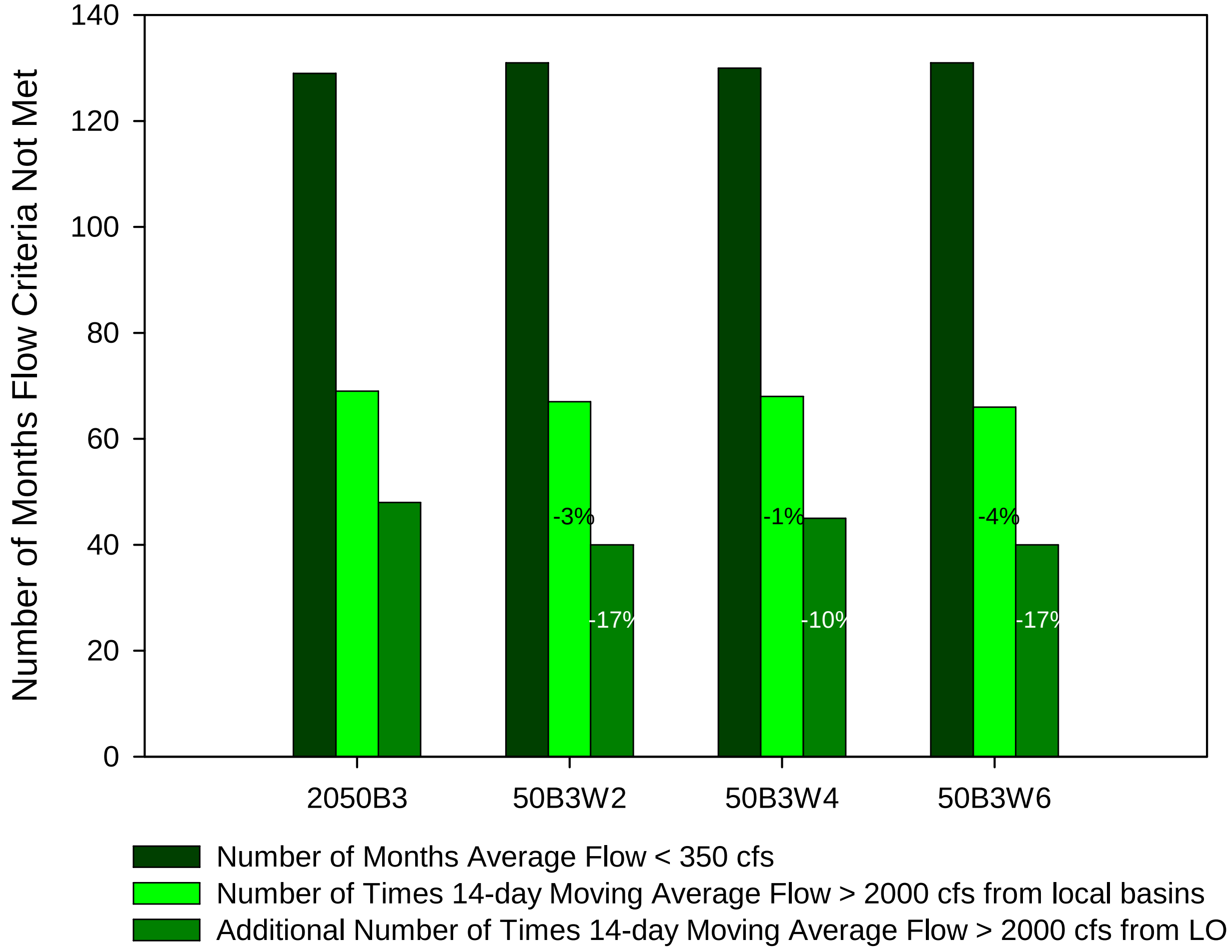


**Figure 13. Number of months flow criteria not met. % indicates the percent change from 2050B3. No % indicates there was no change in flow compared to 2050B3.**

*Lake Okeechobee Regulatory Releases*

The LOW project primarily affects water storage related to LO and is expected to impact the frequency and severity of regulatory releases from Lake Okeechobee. In addition to the previous analysis which evaluated how many 14-day periods of flow >2000 cfs could be attributed to LOW regulatory releases, RECOVER also evaluated the number of days with LO regulatory releases from the S-308 structure. The average volume of releases from S-308, and the total volume of releases over the POR were analyzed and are summarized in Figures 14 and 15. All 2050B2 alternatives show a measurable reduction in the number of days with Lake Okeechobee regulatory releases compared to 2050B2 (13% for 50B2W6, 10% for 50B2W2 and 8% for 50B2W4) as well as a reduction in the discharge volume of those releases (14% for 50B2W6, 11% for 50B2W2 and 9% for 50B2W4) compared to 2050B2 (Figure 14). All 2050B3 alternatives also show a measurable reduction in the number of Lake Okeechobee regulatory releases compared to 2050B3 (10% for 50B3W6, 9% for 50B3W2 and 7% for 50B3W4) as well as a reduction in the discharge volume of those releases (12% for 50B3W6, 10% for 50B3W2 and 8% for 50B3W4) compared to 2050B3 (Figure 15). The eventual elimination of LO regulatory releases is desirable to maintain stable salinity conditions in the estuary.

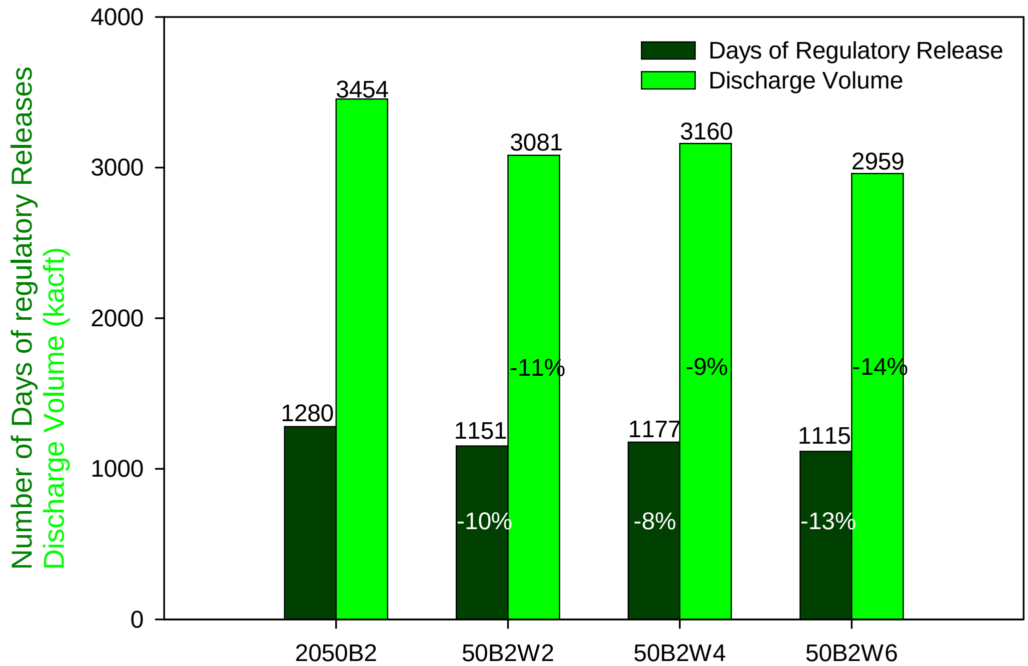


**Figure 14. Number of days of regulatory releases from Lake Okeechobee via S308 (dark green) and the discharge volume over period of record (kacft) via S308 (light green). % indicates the percent change from 2050B2. Numbers above the bars are the actual values.**

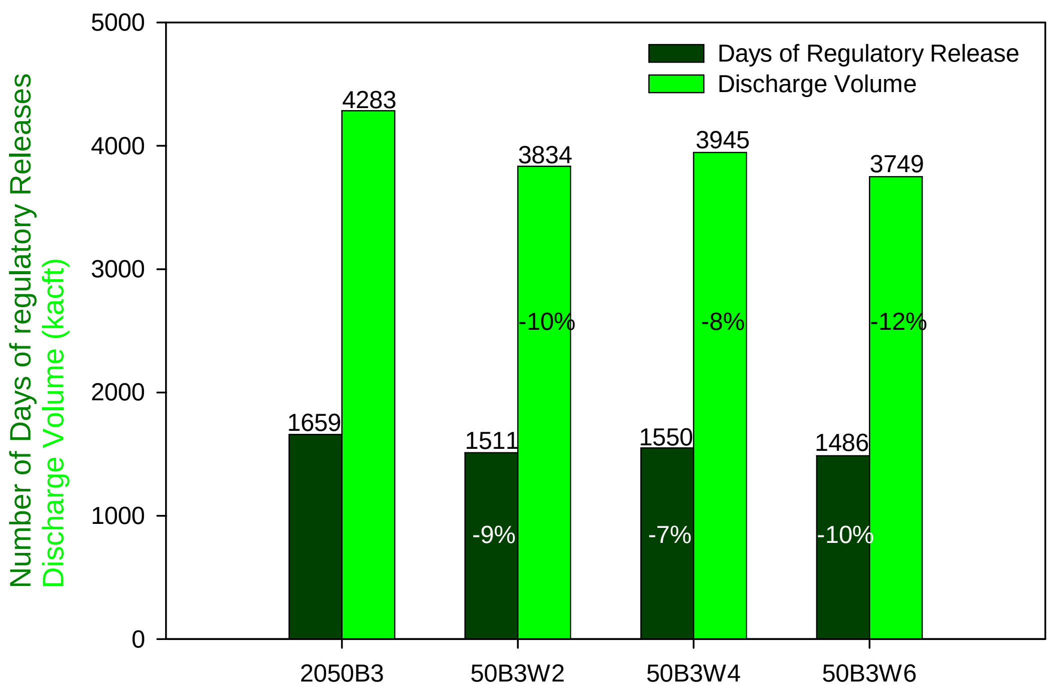

**Figure 15. Number of days of regulatory releases from Lake Okeechobee via S308 (dark green) and the discharge volume over period of record (kacft) via S308 (light green). % indicates the percent change from 2050B3. Numbers above the bars are the actual values.**

*Ecological Impact for the St. Lucie Estuary*

The alternatives show no measurable reduction in low flow events; however, the low flow events (i.e., higher salinities) have a far less significant impact on oysters than high flow events (i.e., lower salinities) because oysters are more tolerant to high salinities than low salinities. The salinity target for the St. Lucie Estuary is to reestablish a salinity range most favorable to juvenile marine fish, shellfish, oysters and submerged aquatic vegetation. This is estimated at 12 to 20 ppt for oysters, which has been chosen as a Valued Ecosystem Component (Volety et al. 2003). While there was little reduction in low flow events, the reduction of high flow events and reduction in the number of the high flow events due to the project will provide significant benefits to the area. The reduction of high flow events, thereby reducing low salinity events affecting oysters, will lead to increased diversity and abundance of estuarine fauna, one of CERP's primary goals.

## 5.4 Greater Everglades Wetlands

RECOVER's review of alternative plans focused on the timing and delivery of water to the Greater Everglades Wetlands. Based on these analyses, the project as a stand alone effort is not expected to provide substantial benefits to the area.

The CERP system-wide performance measures for dry events in Shark River Slough, GE-1, inundation pattern, GE-2; and extreme high/low water events, GE-3, were used to analyze the project alternatives. A change in the number of events and/or frequency and duration of events toward targets is required to show improvement over the base conditions.

*Dry Events in Shark River Slough*

South Shark Slough showed one additional dry down event in alternative 50B2W2, but the overall duration of inundation did not change for the area. This small effect seen far from the project in the southern part of the system is considered to be an artifact of modeling the Lake Okeechobee project as a next added increment and is not considered to be relevant to showing project benefits.

*Inundation Pattern in the Greater Everglades Wetlands*

Improvements to inundation pattern were seen in several indicator regions in Water Conservation Areas as a result of the project alternatives (for both the 2050B2 and 2050B3 alternatives). Alternative 50B2W6 performed slightly better than 50B2W4 and 50B2W2. Areas showing the most improvement were Lostman's Slough, Ochopee Marl Marsh and Craighead basin. Alternative plans 50B2W4 and 50B2W6 also provided slight benefit to WCA-3B, WCA-3A Sawgrass and Taylor Slough. Detailed model results and analyses are contained in Appendix A

*Extreme high and low water events*

As might be expected, favorable reductions in extreme low and high water events were seen in northern WCA-3A but were not so visible in the southern part of the system. This analysis appears to reinforce the underlying concept central to CERP that the more storage an alternative has, the easier it is to attenuate extreme hydrologic conditions in the natural areas. Detailed model results and analyses are contained in Appendix A

## 5.5 Water Supply, Flood Damage Reduction, and Saltwater Intrusion

*Lake Okeechobee Service Area (LOSA)*

RECOVER's review of project alternatives focused on the CERP goal to provide at least a 1-in-10 level of service as indicated by simulations by the SFWMM in which three or less water years in the 36-year simulation period have water shortages with significant supply-side management cutbacks occurring. The severity and duration of any water restrictions above those that might be expected when drought levels exceed a 1-in-10 severity should be minimized.

CERP system-wide Performance Measure WS-1, Frequency, Duration, and Severity of Water Restrictions for LOSA, targets no more than three years with water restrictions in the simulation period, no more than 8 months with water shortages (duration), and the sum of the severity scores for the simulation period is less than or equal to seven.

Tables 10 and 11 summarize the alternative performance for WS-1. All of the 2050B2 alternatives (2050B2, 50B2W2, 50B2W4, and 50B2W6) provide a reduction in performance, and a worsening in the duration and severity of droughts, as compared to the 2050B2 condition. 50B2W2 performs slightly better than the other alternatives in frequency, duration, and severity performance. The 2050B3 alternatives performed similarly, with 50B3W2 again performing slightly better than the other alternatives. In reviewing the performance measure graphics and additional SFWMD output, the reduction in LOSA performance is primarily caused by an increase in the severity and duration of drought events. The most likely cause is the lower levels in Lake Okeechobee prior to the construction of other CERP features (ASR) that would offset the impacts. Slight modifications to the Lake operations might mitigate the impacts observed. There is also an indication that there are Savings Clause concerns in LOSA that may need to be addressed.

**Table 10. Summary of LOSA Water Supply Performance for 2050B2 Alternatives**

| | 2050B2 | 50B2W2 | 50B2W4 | 50B2W6 |
|---|---|---|---|---|
| Years w/ water shortage | 12 | 12 | 13 | 13 |
| Duration (months) | 45 | 48 | 49 | 49 |
| Severity (score) | 25 | 26 | 27 | 27 |

**Table 11. Summary of LOSA Water Supply Performance for 2050B3 Alternatives**

| | 2050B3 | 50B3W2 | 50B3W4 | 50B3W6 |
|---|---|---|---|---|
| # Years w/ water shortage | 12 | 12 | 12 | 12 |
| Duration (months) | 35 | 38 | 39 | 40 |
| Severity (score) | 21 | 21 | 21 | 22 |

*Lower East Coast Service Area (LECSA)*

RECOVER's review of project alternatives focused on the CERP goal to provide at least a 1-in-

10 level of service as indicated by simulations by the SFWMM in which three or less water years in the 36-year simulation period have water shortages with significant supply-side management cutbacks occurring. The severity and duration of any water restrictions above those that might be expected when drought levels exceed a 1-in-10 severity should be minimized.

CERP system-wide Performance Measure WS-2, Frequency, Duration, and Severity of Water Restrictions for the LECSA, targets no more than three years with regionally significant water restrictions in the simulation period, no more than 18 months with water shortages (duration) and all water shortages be Phase 1 (severity).

Tables 12 and 13 summarize the alternative performance for WS-2. All of the 2050B2 alternatives exhibit reduced performance when compared to the future without project condition. 50B2W2 performs slightly better than the other alternatives in all service areas. The 2050B3 alternatives performed similarly to the 2050B3 levels of service for frequency, duration, and severity with 50B3W2 again performing slightly better than the other alternatives. The reduced performance for the 2050B2 alternatives compared to the 2050B2 condition indicate that there may be Savings Clause concerns in LECSA that need to be addressed.

**Table 12. Summary of LECSA Water Supply Performance for 2050B2 Alternatives**

| | 2050B2 | 50B2W2 | 50B2W4 | 50B2W6 |
|---|---|---|---|---|
| Service Area 1 | | | | |
| Years w/ water shortages | 7 | 8 | 9 | 9 |
| Duration (months) | 53 | 57 | 64 | 64 |
| Severity | Yes | Yes | Yes | Yes |
| Service Area 2 | | | | |
| Years w/ water shortages | 23 | 24 | 24 | 24 |
| Duration (months) | 132 | 134 | 137 | 137 |
| Severity (all Phase 1 cutbacks) | No | No | No | No |
| Service Area 3 | | | | |
| Years w/ water shortages | 7 | 8 | 9 | 9 |
| Duration (months) | 55 | 59 | 65 | 65 |
| Severity | No | No | No | No |
| North Palm Beach County Service Area | | | | |
| Years w/ water shortages | 8 | 9 | 10 | 10 |
| Duration (months) | 50 | 54 | 61 | 61 |
| Severity | Yes | Yes | Yes | Yes |

**Table 13. Summary of LECSA Water Supply Performance for 2050B3 Alternatives**

| | 2050B3 | 50B3W2 | 50B3W4 | 50B3W6 |
|---|---|---|---|---|
| Service Area 1 | | | | |
| Years w/ water shortages | 7 | 7 | 7 | 7 |
| Duration (months) | 56 | 55 | 56 | 56 |
| Severity | Yes | Yes | Yes | Yes |
| Service Area 2 | | | | |
| Years w/ water shortages | 27 | 27 | 27 | 28 |
| Duration (months) | 152 | 151 | 152 | 155 |
| Severity (all Phase 1 cutbacks) | Yes | Yes | Yes | Yes |
| Service Area 3 | | | | |
| Years w/ water shortages | 6 | 6 | 6 | 6 |
| Duration (months) | 47 | 46 | 47 | 47 |
| Severity | Yes | Yes | Yes | Yes |
| North Palm Beach County Service Area | | | | |
| Years w/ water shortages | 6 | 6 | 6 | 6 |
| Duration (months) | 43 | 42 | 43 | 43 |
| Severity | Yes | Yes | Yes | Yes |

*LECSA Saltwater Intrusion*

RECOVER's evaluation of the project alternatives focused on the CERP goal to protect the Biscayne aquifer from saltwater intrusion by maintaining sufficient water levels behind coastal water control structures. Analysis of CERP system-wide performance measures for saltwater intrusion (WS-4 and WS-5) showed no difference between the modeled alternatives and the future without project condition for both the 2050B2 and 2050B3 Scenarios. Detailed model results and analyses are contained in Appendix A.

*LECSA Flood Control*

RECOVER's evaluation of the project alternatives focused on the CERP goal to continue to provide conditions that will allow for the continued cultivation of avocado and tropical fruit tree crops in the southern Miami-Dade agricultural area. Analysis of CERP system-wide performance measures for water levels in the South Miami Dade Agricultural Area (WS-3) indicates no difference between the modeled alternatives and the future without project condition for both the 2050B2 and 2050B3 scenarios. Detailed model results and analyses are contained in Appendix A.

The difference between the simulated 2000B2/200B3 stages versus the stages provided by the project alternative plans and the future without project condition gives an indication that there are Savings Clause concerns in the LECSA that need to be addressed. Changes to the South Dade Conveyance System (SDCS) operational assumptions in all the modeled runs could correct the problem.

## 5.6 Evaluation of Effects on Habitat Heterogeneity, Spatial Extent, Habitat Connectivity, and Sheetflow

The defining characteristics of the Everglades included habitat heterogeneity, a large spatial extent, and vast acres of sheet flow (connectedness or connectivity). Restoring these characteristics is an overall goal of the CERP.

Habitat heterogeneity will be improved by the Lake Okeechobee Watershed project because amount of water stored and released in ways that replicate the natural seasonal patterns is expected to compensate for the water previously stored and released by the much larger natural wetland system. Alternatives that contain the largest amounts of storage are expected to best improve the ability of water managers to closely mimic the seasonal high and low flows needed to optimize the health of ridge and slough, sawgrass, marl, and slough habitats and support the native abundance of wildlife dependent upon them. Greater storage is expected to provide additional fresh water flows to estuaries to compensate for the volumes of water they no longer receive due to current water management practices (loss of spatial extent).

In the Everglades ecosystem, half of the spatial extent of wetlands was lost by the time the C&SF project began to take a second look at its impacts. CERP is charged with making a concerted effort to recognize and, where possible, protect remaining wetlands within and between project boundaries. Otherwise, the cumulative effect of losses, each of which may appear small and isolated to single projects, may accumulate over time and add up to serious losses for the system as a whole.

One of the fundamental principles of the CERP is, above all else, to do no harm. While compromises must be made in order to artificially replace the water treatment and storage the Everglades once provided, CERP must avoid compromising highly functional natural wetlands and streams such as those in the Fisheating Creek area that provide not only hydrologic and water quality benefits, but high quality habitat for wildlife as well.

The current alternatives can offset the loss of spatial extent of wetlands to some degree since all of the LOW project alternatives include a wetland restoration component of approximately 3500 acres. Additionally, loss of spatial extent could be further offset if water storage facilities are designed and operated appropriately. Unfortunately, the goals of managing water storage facilities can compete and managers may have to choose between maximizing water quality, actively managing periphyton and emergent and submergent vegetation, or providing maximum environmental benefit, operating the features more as created wetlands. For this project, water quality appears to take precedence in the management of the storage facilities. If that is true, habitat values will be lower than they could be.

Given South Florida's projected population growth, any lands not included in the project alternatives or maintained as public lands will likely be developed consistent with surrounding land use patterns. CERP must make a concerted effort to recognize and, where possible, protect the wetlands within and between project boundaries throughout the south Florida ecosystem. Otherwise, the cumulative effect of losses, each of which may appear small and isolated to single projects may accumulate over time and add up to serious losses for the system as a whole.

Sheetflow patterns will be improved with the Lake Okeechobee project as illustrated by the reduction in the number of extreme high and low water events in parts of the Everglades near the project (particularly the northern parts of WCA-3A and the Big Cypress, Ochopee regions.)

Fewer floods and drydowns, when accompanied by improved hydroperiods, means water is flowing in a more normal, less exaggerated, pattern. It is unlikely any project can increase the spatial extent of sheetflow, but improving the hydropatterns in the remaining natural areas is very important for the health of tree islands, for maintaining the ridge and slough habitat, and for protecting wildlife species from extreme events beyond what would naturally occur.

### 5.7 Interaction with Other Projects

While each CERP project is considered as a stand-alone component, it is important to remember that the interactions among projects will ultimately determine CERP's restoration success for the South Florida ecosystem. With this in mind, RECOVER sought to understand how surrounding projects might interact with the LOW project to maximize system benefits. The primary projects identified include Aquifer Storage and Recovery (ASR), C-43 Basin Storage Reservoir, and North Lake Storage. The LOW project clearly demonstrates its ability to lower LO stages, thereby reducing the number of LO regulatory releases to the Caloosahatchee and St. Lucie Estuaries. The project also has the unintended side effect of increasing the number of deviations below the ideal LO stage envelope. The advent of ASR, or similar storage option, will help to attenuate this impact by capturing water later in the wet season when LOW project reservoirs are at capacity and returning that volume of water to the lake during dry periods without the ET and seepage losses associated with traditional reservoirs. North of lake storage will also provide an avenue to store water during periods of high lake stages to return at a later date. It will be very important to optimize operations to most efficiently take advantage of these multiple storage capabilities. Additionally, low flows to the Caloosahatchee Estuary (via S-79), which the LOW project did not affect, will be addressed through the C-43 Basin Storage Reservoir (Phase 1 and Phase 2) as it collects basin and LO releases to deliver to the estuary during the dry season. The combined effect of these two projects, LOW reducing the number of LO regulatory releases and the C-43 Basin Storage Reservoir providing water to the estuary during the dry season, is expected to meet estuary restoration goals.

### 5.8 Ability of Project Alternatives to address Planning and Scientific Uncertainties (CERP Adaptive Management)

As with other ecosystem restoration projects throughout the nation, every potential restoration action carries with it an amount of uncertainty and risk. In the case of the LOW project, this uncertainty has been identified and project alternatives have been formulated to address and alleviate those uncertainties. In general, uncertainties related to large scale restoration can be categorized as scientific uncertainties and planning uncertainties.

*Scientific Uncertainty*

With scientific uncertainty, there is uncertainty regarding the environmental response corresponding to a specific action. With regard to the LOW Project, there is little uncertainty that decreased regulatory releases to the estuaries will improve habitat for desirable indicator species (SAV, oysters, and estuarine fishes) if the timing and distribution of flows meets seasonal targets. It is expected that obtaining more natural flow regimes will benefit target species populations directly by decreasing extreme salinity fluxes.

Similarly, there is little uncertainty that the reduction in the occurrence of extreme high and low LO stages will improve littoral zone health and potentially species diversity in the Lake, assuming that if conditions for habitat are optimized, vegetation and corresponding animal taxa will follow. There is, however, uncertainty regarding the exact water quality benefits provided by restoring littoral habitat. Nutrient uptake and assimilation rates vary between species and habitat types. Without more spatially and temporally explicit experimental evidence total water quality benefits are based on extrapolations from known conditions. Additional uncertainties arise due to interannual variability. The effects of carry over from one year to the next can be highly uncertain. Multiple variables drive system dynamics and until the sensitivity of PMs to parameter estimates is characterized/refined, large uncertainties in total project benefits will exist. Given the scientific uncertainties mentioned, it will be necessary for future scientific findings regarding the effects of littoral zone health on water quality to be incorporated in project operations. Additionally, in order for the project to quantify water quality benefits due to littoral zone improvements post-implementation, assessment activities will need to include associated monitoring activities at appropriate spatial and temporal scales.

*Planning Uncertainties*

The LOW project has identified several planning uncertainties surrounding their alternative plans:

- The potential for additional water quality features at some future date to meet state water quality mandates
- Land availability/suitability for project features
- BMP performance to achieve nutrient load reduction targets
- Effects of reduced flow (85%) in Fish Eating Creek (i.e. effects on surrounding natural areas, endangered species, and stream morphology)

Given these uncertainties, RECOVER offers the following considerations for the project team to take into account during alternative selection and detailed design of project features:

- An alternative with suitable land adjacent, for additional water quality treatment features at a later date, is preferable to an alternative with no additional suitable land in close proximity.
- An alternative with the ability to reduce nutrient loading to a greater extent is preferred in the event that BMPs do not lower nutrient loads to the extent expected.
- An alternative that does not include disturbance or massive flow reductions in Fisheating Creek is preferred.

# 6.0 Opportunities for Alternative Plan Improvements and Other Considerations

As part of the responsibilities given to RECOVER, this section presents suggested improvements to the alternative plans, which, where possible, are intended to improve the project's performance or enhance benefits to the natural system. These suggested improvements to the alternative plans should be considered by the project during the design of the final plan or reevaluation of alternative plans when appropriate. There were two primary opportunities to improve project performance. First, the project team should strive to optimize operations to coordinate with other storage features such as ASR and North of Lake Storage in order to increase benefits to LO (i.e. fewer deviations from the LO stage envelope) and estuaries (i.e.

fewer regulatory releases, especially during sensitive periods for key indicator species). Second, the project team should determine whether or not savings clause issues are a consideration for water supply in the LOSA and LECSA. The CERP project assurances team is the appropriate body to answer this question for the project. Points of contact for the project assurances team are Eric Bush, Corps, and Brenda Mills, SFWMD.

## 7.0 Conclusions

RECOVER's system-wide evaluation indicates that the project is likely to have the following effects compared to the future without project condition:

- Reducing LO in-lake nutrient concentrations, increasing in-lake TN:TP ratios, decreasing the occurrence of extreme high lake stages, and increasing the occurrence of extreme low lake stages.
- Decreasing the frequency and duration of moderate and extreme high flows to the Caloosahatchee Estuary via S-79 and reducing the frequency and severity of LO regulatory releases via S-77.
- Decreasing the frequency of moderate and extreme high flows to the St. Lucie Estuary and reducing the frequency and severity of LO regulatory releases via S-308.
- Increasing the spatial extent of contiguous wetlands through wetland reconstruction (appx 3500 acres).
- Decreasing level of service for water supply in the LOSA and LECSA for frequency, duration, and severity of cutbacks.

All project alternatives (50B2W2, 50B2W4, and 50B2W6) show improved performance over the future without project condition with 50B2W6 generally providing the largest increases in performance.

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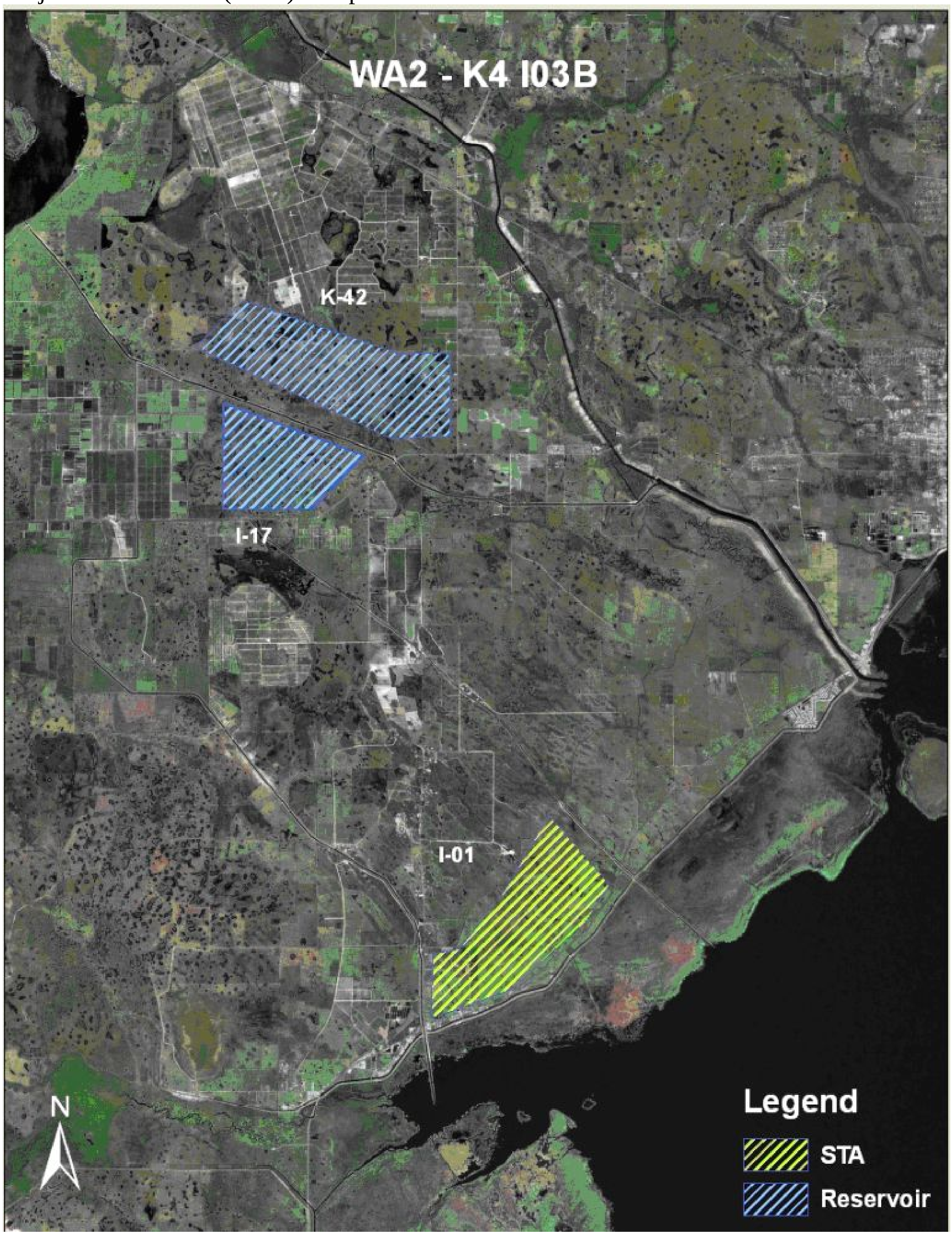
## Attachment A: Final Array of LOW Project Alternatives - Performance & Cost Summary

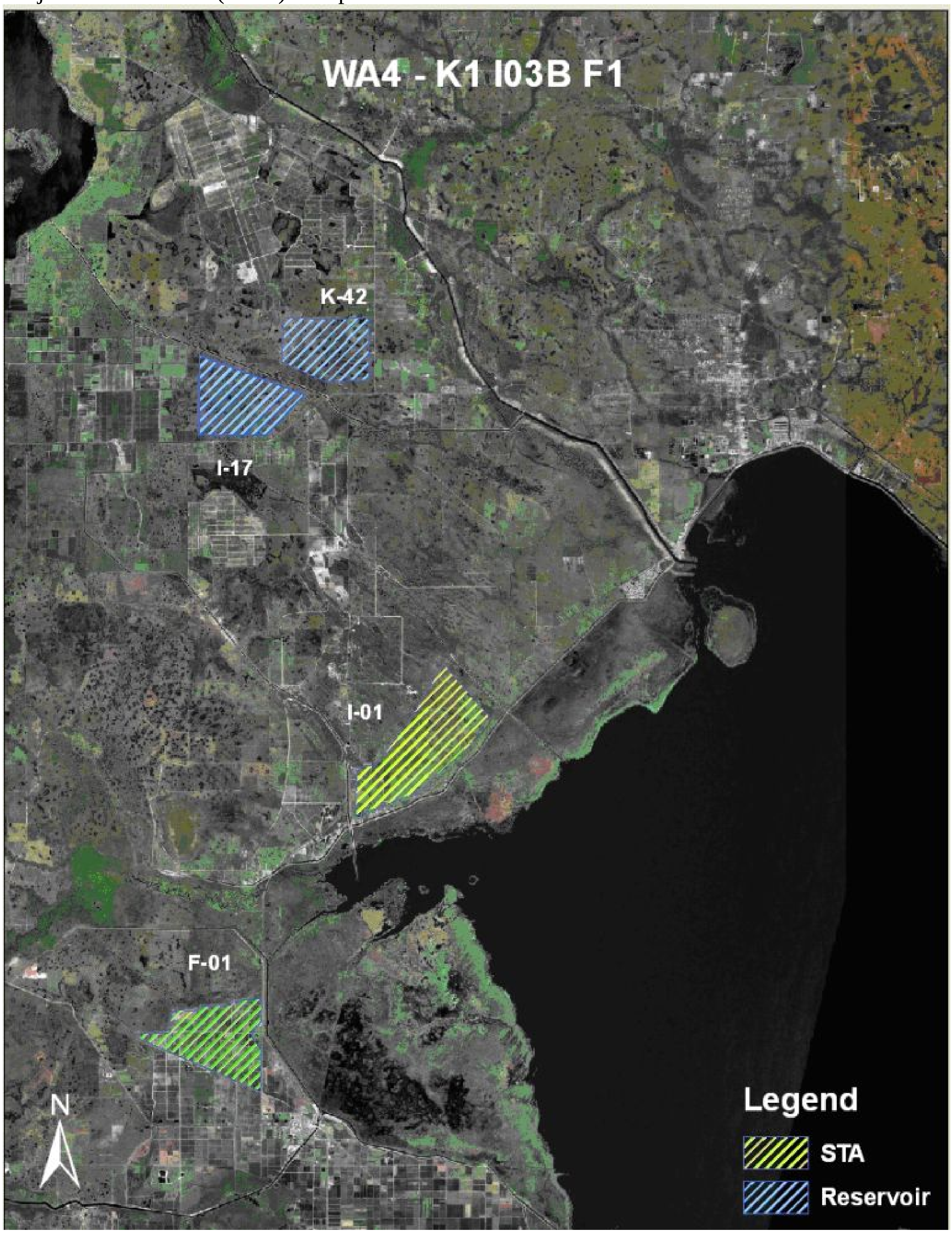
(Updated March 6, 2006)

| WA ID | Management Measures | Reservoirs | | | STA's | WA Performance & Cost Summary | | |
|---|---|---|---|---|---|---|---|---|
| | | Size (acres) | Depth (ft) | Storage capacity (AF) | Size (acres) | Total Area (acres) | Total Storage (AF) | Total P load reduction (mtons/yr) |
| WA02 | K-42 Reservoir | 10,281 | 16 | 161,263 | | 23,741 | 240,823 | 62.0 |
| | I-17 Reservoir | 5,416 | 16 | 79,560 | | | | |
| | I-01 STA | | | | 8,044 | | | |
| WA04 | K-42 Reservoir | 5,110 | 16 | 74,216 | | 24,930 | 153,776 | 92.6 |
| | I-17 Reservoir | 5,416 | 16 | 79,560 | | | | |
| | I-01 STA | | | | 8,044 | | | |
| | F-01 STA | | | | 6,360 | | | |
| WA06 | T-26 Reservoir | 1,984 | 18 | 32,000 | | 37,619 | 288,823 | 124.6 |
| | T-30B Reservoir | 779 | 14 | 8,000 | | | | |
| | T-30D Reservoir | 780 | 14 | 8,000 | | | | |
| | T-01 STA | | | | 3,975 | | | |
| | K-42 Reservoir | 10,281 | 16 | 161,263 | | | | |
| | I-17 Reservoir | 5,416 | 16 | 79,560 | | | | |
| | I-01 STA | | | | 8,044 | | | |
| | F-01 STA | | | | 6,360 | | | |

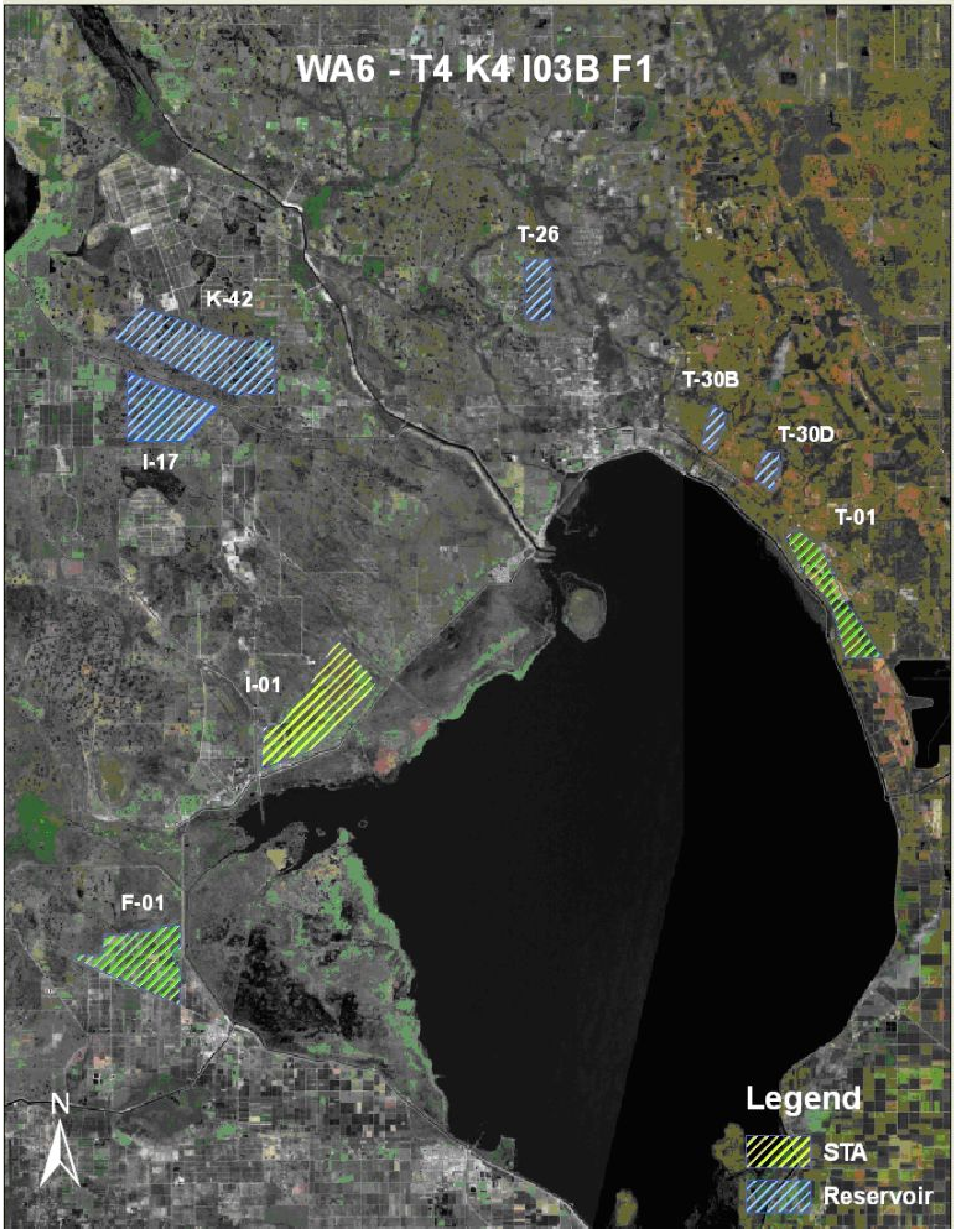
Project Alternative 1 (WA2) Footprints



Project Alternative 2 (WA4) Footprints



Project Alternative 3 (WA6) Footprint



# Appendix A: Detailed Model Information and Evaluations

## Lake Okeechobee

**Table 14. Summary of In-lake TP concentrations for 5 year intervals.**

| Years | 2050B2 | 50B2W2 | 50B2W4 | 50B2W6 |
|---|---|---|---|---|
| 1-5 | 64 | 62 | 61 | 60 |
| 6-10 | 55 | 54 | 51 | 49 |
| 11-15 | 54 | 52 | 48 | 47 |
| 16-20 | 60 | 57 | 53 | 51 |
| 21-25 | 63 | 59 | 54 | 51 |

## Northern Estuaries

**Table 15. Summary of moderate and extreme high mean monthly flows for 2050B2 and 2050B3 alternatives. Percent change indicates difference between the modeled alternative and the 2050 future without project condition.**

| Alternative | Months >2800 cfs | Percent Change | Months >4500 cfs | Percent Change |
|---|---|---|---|---|
| 2050B2 | 68 | | 30 | |
| 50B2W2 | 67 | -1% | 26 | -13% |
| 50B2W4 | 66 | -3% | 27 | -10% |
| 50B2W6 | 65 | -4% | 24 | -20% |
| 2050B3 | 83 | | 38 | |
| 50B3W2 | 78 | -6% | 33 | -13% |
| 50B3W4 | 78 | -6% | 35 | -8% |
| 50B3W6 | 77 | -7% | 33 | -13% |

**Table 16. LO Regulatory Releases to the Caloosahatchee Estuary for 2050B2 Alternatives**

| | 2050B2 | 50B2W2 | 50B2W4 | 50B2W6 |
|---|---|---|---|---|
| Days of RG releases | 1468 | 1312 | 1356 | 1277 |
| Discharge volume over POR (kacft) | 10282 | 9245 | 9494 | 8969 |
| Delta | | 1037 | 788 | 1313 |

**Table 17. LO Regulatory Releases to the Caloosahatchee Estuary for 2050B3 Alternatives**

| | 2050B3 | 50B3W2 | 50B3W4 | 50B3W6 |
|---|---|---|---|---|
| Days of RG releases | 1893 | 1720 | 1760 | 1681 |
| Discharge volume over POR (kacft) | 12733 | 11460 | 11768 | 11181 |
| Delta | | 1274 | 966 | 1553 |

**Table 18. Summary of high mean monthly flows for 2050B2 and 2050B3 alternatives. Percent change indicates difference between the modeled alternative and the 2050 future without project condition.**

| Alternative | Months 2000-3000 cfs | Percent Change | Months >3000 cfs | Percent Change |
|---|---|---|---|---|
| 2050B2 | 45 | | 22 | |
| 50B2W2 | 41 | -9% | 19 | -14% |
| 50B2W4 | 40 | -11% | 21 | -5% |
| 50B2W6 | 43 | -4% | 19 | -14% |
| 2050B3 | 44 | | 26 | |
| 50B3W2 | 48 | +9% | 19 | -27% |
| 50B3W4 | 48 | +9% | 20 | -23% |
| 50B3W6 | 44 | 0% | 18 | -31% |

**Table 19. LO Regulatory Releases to the St. Lucie Estuary for 2050B2 Alternatives**

| | 2050B2 | 50B2W2 | 50B2W4 | 50B2W6 |
|---|---|---|---|---|
| Days of RG releases | 1280 | 1151 | 1177 | 1115 |
| Discharge volume over POR (kacft) | 3454 | 3081 | 3160 | 2959 |
| Delta | | 372 | 293 | 494 |

**Table 20. LO Regulatory Releases to the St. Lucie Estuary for 2050B3 Alternatives**

| | 2050B3 | 50B3W2 | 50B3W4 | 50B3W6 |
|---|---|---|---|---|
| Days of RG releases | 1659 | 1511 | 1550 | 1486 |
| Discharge volume over POR (kacft) | 4283 | 3834 | 3945 | 3749 |
| Delta | | 449 | 338 | 534 |

**Greater Everglades (GE)**

**Table 21. Summary of GE-1 Dry Events in Shark River Slough**

| | NSM_S4 | 2000B2 | 2050B2 | 50B2W2 | 50B2W4 | 50B2W6 |
|---|---|---|---|---|---|---|
| IR 129 NE Shark Slough | | | | | | |
| Number of Dry Events | 9 | 18 | 15 | 16 | 16 | 16 |
| Average Duration of Dry Events (Weeks) | 10 | 15 | 16 | 15 | 15 | 15 |
| IR 130 Mid Shark Slough | | | | | | |
| Number of Dry Events | 7 | 16 | 13 | 13 | 13 | 13 |
| Average Duration of Dry Events (Weeks) | 18 | 15 | 15 | 15 | 15 | 15 |
| IR 131 SW Shark Slough | | | | | | |
| Number of Dry Events | 9 | 19 | 15 | 15 | 15 | 15 |
| Average Duration of Dry Events (Weeks) | 18 | 16 | 14 | 14 | 14 | 14 |
| IR 132 South Shark Slough | | | | | | |
| Number of Dry Events | 12 | 25 | 16 | 16 | 16 | 16 |
| Average Duration of Dry Events (Weeks) | 15 | 13 | 13 | 13 | 13 | 13 |

**Table 22. Summary of GE-2 Inundation Events for the Greater Everglades Wetlands**

| | NSM_S4 | 2000B2 | 2050B2 | 50B2W2 | 50B2W4 | 50B2W6 |
|---|---|---|---|---|---|---|
| IR 100 WCA-1 North | | | | | | |
| Number of Inundation Events | 16 | 26 | 29 | 29 | 29 | 29 |
| Average Duration of Inundation Events (Weeks) | 109 | 66 | 54 | 54 | 54 | 54 |
| Percent Period of Record of Inundation Events | 93 | 92 | 84 | 84 | 84 | 84 |
| IR 101 WCA-1 Central | | | | | | |
| Number of Inundation Events | 19 | 5 | 9 | 9 | 9 | 9 |
| Average Duration of Inundation Events (Weeks) | 88 | 372 | 199 | 199 | 199 | 199 |
| Percent Period of Record of Inundation Events | 90 | 99 | 96 | 96 | 96 | 96 |
| IR 102 WCA-1 South | | | | | | |
| Number of Inundation Events | 16 | 2 | 5 | 5 | 5 | 5 |
| Average Duration of Inundation Events (Weeks) | 105 | 935 | 371 | 371 | 371 | 371 |
| Percent Period of Record of Inundation Events | 90 | 100 | 99 | 99 | 99 | 99 |
| IR 110 WCA-2A North | | | | | | |
| Number of Inundation Events | 18 | 30 | 18 | 18 | 18 | 18 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Average Duration of Inundation Events (Weeks) | 93 | 49 | 93 | 93 | 93 | 93 |
| Percent Period of Record of Inundation Events | 90 | 78 | 89 | 89 | 89 | 89 |
| IR 111 WCA-2A South | | | | | | |
| Number of Inundation Events | 14 | 15 | 14 | 14 | 14 | 14 |
| Average Duration of Inundation Events (Weeks) | 121 | 116 | 121 | 121 | 121 | 121 |
| Percent Period of Record of Inundation Events | 91 | 93 | 91 | 91 | 91 | 91 |
| IR 112 WCA-2B North | | | | | | |
| Number of Inundation Events | 15 | 16 | 13 | 13 | 13 | 13 |
| Average Duration of Inundation Events (Weeks) | 114 | 107 | 127 | 127 | 127 | 127 |
| Percent Period of Record of Inundation Events | 91 | 92 | 89 | 88 | 88 | 89 |
| IR 113 WCA-2B South | | | | | | |
| Number of Inundation Events | 14 | 12 | 11 | 11 | 11 | 11 |
| Average Duration of Inundation Events (Weeks) | 121 | 142 | 151 | 151 | 151 | 151 |
| Percent Period of Record of Inundation Events | 90 | 91 | 89 | 89 | 89 | 88 |
| IR 114 WCA-3A NW Corner | | | | | | |
| Number of Inundation Events | 15 | 22 | 17 | 16 | 17 | 16 |
| Average Duration of Inundation Events (Weeks) | 115 | 74 | 101 | 107 | 101 | 107 |
| Percent Period of Record of Inundation Events | 92 | 86 | 92 | 92 | 92 | 92 |
| IR 115 WCA-3A North | | | | | | |
| Number of Inundation Events | 18 | 19 | 17 | 17 | 17 | 17 |
| Average Duration of Inundation Events (Weeks) | 93 | 88 | 99 | 99 | 99 | 99 |
| Percent Period of Record of Inundation Events | 89 | 90 | 90 | 90 | 90 | 90 |
| IR 116 WCA-3A NE | | | | | | |
| Number of Inundation Events | 24 | 14 | 9 | 9 | 9 | 9 |
| Average Duration of Inundation Events (Weeks) | 65 | 121 | 199 | 199 | 199 | 199 |
| Percent Period of Record of Inundation Events | 83 | 91 | 96 | 96 | 96 | 96 |
| IR 117 WCA-3A NW | | | | | | |
| Number of Inundation Events | 13 | 11 | 11 | 11 | 11 | 11 |
| Average Duration of Inundation Events (Weeks) | 134 | 161 | 159 | 159 | 159 | 159 |
| Percent Period of Record of Inundation Events | 93 | 95 | 93 | 93 | 93 | 93 |

| | | | | | | |
|---|---|---|---|---|---|---|
| IR 118 WCA-3A Alley North | | | | | | |
| Number of Inundation Events | 16 | 13 | 16 | 16 | 16 | 16 |
| Average Duration of Inundation Events (Weeks) | 106 | 129 | 104 | 104 | 104 | 104 |
| Percent Period of Record of Inundation Events | 90 | 90 | 89 | 89 | 89 | 89 |
| IR 119 WCA-3A East | | | | | | |
| Number of Inundation Events | 14 | 8 | 11 | 11 | 11 | 11 |
| Average Duration of Inundation Events (Weeks) | 123 | 226 | 158 | 158 | 158 | 158 |
| Percent Period of Record of Inundation Events | 92 | 97 | 93 | 93 | 93 | 93 |
| IR 120 WCA-3A West | | | | | | |
| Number of Inundation Events | 10 | 15 | 14 | 14 | 14 | 14 |
| Average Duration of Inundation Events (Weeks) | 177 | 115 | 123 | 123 | 123 | 123 |
| Percent Period of Record of Inundation Events | 94 | 92 | 92 | 92 | 92 | 92 |
| IR 121 WCA-3A North Central | | | | | | |
| Number of Inundation Events | 13 | 11 | 12 | 13 | 13 | 13 |
| Average Duration of Inundation Events (Weeks) | 133 | 160 | 145 | 134 | 134 | 134 |
| Percent Period of Record of Inundation Events | 93 | 94 | 93 | 93 | 93 | 93 |
| IR 122 WCA-3A Gap | | | | | | |
| Number of Inundation Events | 13 | 15 | 18 | 18 | 18 | 18 |
| Average Duration of Inundation Events (Weeks) | 134 | 115 | 95 | 95 | 95 | 95 |
| Percent Period of Record of Inundation Events | 93 | 92 | 92 | 92 | 92 | 92 |
| IR 123 WCA-3A South Central | | | | | | |
| Number of Inundation Events | 17 | 12 | 17 | 17 | 17 | 17 |
| Average Duration of Inundation Events (Weeks) | 99 | 145 | 97 | 97 | 97 | 97 |
| Percent Period of Record of Inundation Events | 90 | 93 | 88 | 88 | 88 | 88 |
| IR 124 WCA-3A South | | | | | | |
| Number of Inundation Events | 17 | 9 | 14 | 14 | 14 | 14 |
| Average Duration of Inundation Events (Weeks) | 100 | 202 | 123 | 123 | 123 | 123 |
| Percent Period of Record of Inundation Events | 91 | 97 | 92 | 92 | 92 | 92 |
| IR 125 WCA-3B North | | | | | | |
| Number of Inundation Events | 16 | 10 | 18 | 17 | 16 | 16 |
| Average Duration of Inundation Events (Weeks) | 107 | 179 | 94 | 100 | 106 | 106 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Percent Period of Record of Inundation Events | 92 | 95 | 90 | 90 | 91 | 91 |
| IR 126 WCA-3B West | | | | | | |
| Number of Inundation Events | 14 | 10 | 16 | 15 | 15 | 15 |
| Average Duration of Inundation Events (Weeks) | 125 | 177 | 106 | 112 | 112 | 113 |
| Percent Period of Record of Inundation Events | 93 | 94 | 90 | 90 | 90 | 90 |
| IR 127 Pennsuco Wetlands | | | | | | |
| Number of Inundation Events | 11 | 20 | 21 | 20 | 20 | 19 |
| Average Duration of Inundation Events (Weeks) | 160 | 72 | 70 | 74 | 73 | 77 |
| Percent Period of Record of Inundation Events | 94 | 77 | 79 | 79 | 78 | 78 |
| IR 128 WCA-3B East | | | | | | |
| Number of Inundation Events | 11 | 16 | 19 | 19 | 19 | 19 |
| Average Duration of Inundation Events (Weeks) | 161 | 97 | 81 | 81 | 81 | 81 |
| Percent Period of Record of Inundation Events | 95 | 83 | 82 | 82 | 82 | 82 |
| IR 129 NE Shark Slough | | | | | | |
| Number of Inundation Events | 10 | 19 | 16 | 17 | 17 | 17 |
| Average Duration of Inundation Events (Weeks) | 179 | 85 | 102 | 96 | 96 | 96 |
| Percent Period of Record of Inundation Events | 95 | 86 | 87 | 87 | 87 | 87 |
| IR 130 Mid Shark Slough | | | | | | |
| Number of Inundation Events | 8 | 17 | 14 | 14 | 14 | 14 |
| Average Duration of Inundation Events (Weeks) | 219 | 96 | 120 | 120 | 120 | 120 |
| Percent Period of Record of Inundation Events | 93 | 88 | 90 | 90 | 90 | 90 |
| IR 131 SW Shark Slough | | | | | | |
| Number of Inundation Events | 10 | 20 | 16 | 16 | 16 | 16 |
| Average Duration of Inundation Events (Weeks) | 171 | 78 | 104 | 104 | 104 | 104 |
| Percent Period of Record of Inundation Events | 91 | 84 | 89 | 89 | 89 | 89 |
| IR 132 South Shark Slough | | | | | | |
| Number of Inundation Events | 13 | 26 | 17 | 17 | 17 | 17 |
| Average Duration of Inundation Events (Weeks) | 130 | 59 | 98 | 98 | 98 | 98 |
| Percent Period of Record of Inundation Events | 90 | 83 | 89 | 89 | 89 | 89 |
| IR 133 Taylor Slough | | | | | | |
| Number of Inundation Events | 31 | 35 | 30 | 30 | 30 | 31 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Average Duration of Inundation Events (Weeks) | 40 | 37 | 44 | 44 | 44 | 42 |
| Percent Period of Record of Inundation Events | 67 | 70 | 70 | 70 | 70 | 70 |
| IR 140 Lostman's Slough | | | | | | |
| Number of Inundation Events | 25 | 33 | 36 | 37 | 36 | 37 |
| Average Duration of Inundation Events (Weeks) | 59 | 39 | 31 | 30 | 31 | 30 |
| Percent Period of Record of Inundation Events | 79 | 69 | 60 | 60 | 60 | 60 |
| IR 141 Ochopee Marl Marsh | | | | | | |
| Number of Inundation Events | 23 | 31 | 25 | 26 | 26 | 26 |
| Average Duration of Inundation Events (Weeks) | 66 | 39 | 56 | 54 | 54 | 54 |
| Percent Period of Record of Inundation Events | 81 | 64 | 75 | 75 | 75 | 75 |
| IR 143 West Perrine Marl Marsh | | | | | | |
| Number of Inundation Events | 29 | 29 | 29 | 29 | 29 | 29 |
| Average Duration of Inundation Events (Weeks) | 13 | 12 | 12 | 12 | 12 | 12 |
| Percent Period of Record of Inundation Events | 20 | 19 | 19 | 19 | 19 | 19 |
| IR 144 Craighead Basin | | | | | | |
| Number of Inundation Events | 32 | 34 | 34 | 33 | 33 | 33 |
| Average Duration of Inundation Events (Weeks) | 24 | 24 | 24 | 24 | 24 | 24 |
| Percent Period of Record of Inundation Events | 41 | 43 | 43 | 43 | 43 | 43 |
| IR 145 East Perrine Marl Marsh | | | | | | |
| Number of Inundation Events | 37 | 42 | 35 | 35 | 35 | 35 |
| Average Duration of Inundation Events (Weeks) | 25 | 20 | 18 | 18 | 18 | 18 |
| Percent Period of Record of Inundation Events | 50 | 44 | 34 | 34 | 34 | 34 |
| IR 146 Model Lands Marl Marsh | | | | | | |
| Number of Inundation Events | 42 | 45 | 41 | 41 | 41 | 41 |
| Average Duration of Inundation Events (Weeks) | 25 | 12 | 12 | 12 | 12 | 12 |
| Percent Period of Record of Inundation Events | 55 | 28 | 26 | 26 | 26 | 26 |
| IR 147 Rocky Glades East | | | | | | |
| Number of Inundation Events | 31 | 39 | 32 | 34 | 34 | 33 |
| Average Duration of Inundation Events (Weeks) | 42 | 16 | 33 | 31 | 31 | 32 |
| Percent Period of Record of Inundation Events | 69 | 34 | 57 | 57 | 57 | 57 |

| | | | | | | |
|---|---|---|---|---|---|---|
| IR 148 Rocky Glades West | | | | | | |
| Number of Inundation Events | 24 | 33 | 30 | 30 | 30 | 30 |
| Average Duration of Inundation Events (Weeks) | 62 | 29 | 41 | 40 | 40 | 40 |
| Percent Period of Record of Inundation Events | 80 | 51 | 65 | 65 | 65 | 65 |
| IR 160 Rotenberger WMA | | | | | | |
| Number of Inundation Events | 14 | 17 | 14 | 13 | 14 | 13 |
| Average Duration of Inundation Events (Weeks) | 125 | 104 | 127 | 137 | 127 | 137 |
| Percent Period of Record of Inundation Events | 93 | 94 | 95 | 95 | 95 | 95 |
| IR 170 Holey Land WMA | | | | | | |
| Number of Inundation Events | 27 | 8 | 9 | 9 | 9 | 9 |
| Average Duration of Inundation Events (Weeks) | 55 | 224 | 201 | 201 | 201 | 201 |
| Percent Period of Record of Inundation Events | 79 | 96 | 97 | 97 | 97 | 97 |
| IR 180 NE Cypress | | | | | | |
| Number of Inundation Events | 36 | 17 | 17 | 17 | 17 | 17 |
| Average Duration of Inundation Events (Weeks) | 26 | 5 | 5 | 5 | 5 | 5 |
| Percent Period of Record of Inundation Events | 50 | 5 | 5 | 5 | 5 | 5 |
| IR 181 Mullet Slough | | | | | | |
| Number of Inundation Events | 24 | 36 | 36 | 36 | 36 | 36 |
| Average Duration of Inundation Events (Weeks) | 63 | 33 | 33 | 33 | 33 | 33 |
| Percent Period of Record of Inundation Events | 81 | 63 | 63 | 63 | 63 | 63 |
| IR 182 Dwarf Cypress | | | | | | |
| Number of Inundation Events | 28 | 43 | 44 | 44 | 44 | 44 |
| Average Duration of Inundation Events (Weeks) | 51 | 22 | 21 | 21 | 21 | 21 |
| Percent Period of Record of Inundation Events | 76 | 50 | 50 | 50 | 50 | 50 |
| IR 183 Roberts Lake Cypress Strand | | | | | | |
| Number of Inundation Events | 30 | 40 | 41 | 41 | 41 | 41 |
| Average Duration of Inundation Events (Weeks) | 48 | 29 | 27 | 27 | 27 | 27 |
| Percent Period of Record of Inundation Events | 77 | 62 | 60 | 60 | 60 | 60 |
| IR 190 WCA-3A Sawgrass | | | | | | |
| Number of Inundation Events | 26 | 19 | 10 | 11 | 11 | 11 |
| Average Duration of Inundation Events (Weeks) | 55 | 84 | 182 | 166 | 165 | 166 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Percent Period of Record of Inundation Events | 77 | 86 | 97 | 97 | 97 | 97 |

**Table 23. Summary of GE-3 High and Low Water Stages for Greater Everglades Wetlands**

| | NSM_S4 | 2000B2 | 2050B2 | 50B2W2 | 50B2W4 | 50B2W6 |
|---|---|---|---|---|---|---|
| IR 100 WCA-1 North (2.5, -1.0) | | | | | | |
| Number of Low Events | 1 | 1 | 2 | 2 | 2 | 2 |
| Average Duration of Low Events (Weeks) | 1 | 1 | 5 | 5 | 5 | 5 |
| Percent Period of Record of Low Events (Weeks) | 0 | 0 | 1 | 1 | 1 | 1 |
| Number of High Events | 0 | 10 | 0 | 0 | 0 | 0 |
| Average Duration of High Events (Weeks) | 0 | 1 | 0 | 0 | 0 | 0 |
| Percent Period of Record of High Events (Weeks) | 0 | 1 | 0 | 0 | 0 | 0 |
| IR 101 WCA-1 Central (2.5, -1.0) | | | | | | |
| Number of Low Events | 1 | 0 | 0 | 0 | 0 | 0 |
| Average Duration of Low Events (Weeks) | 5 | 0 | 0 | 0 | 0 | 0 |
| Percent Period of Record of Low Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of High Events | 0 | 29 | 11 | 11 | 11 | 11 |
| Average Duration of High Events (Weeks) | 0 | 2 | 2 | 2 | 2 | 2 |
| Percent Period of Record of High Events (Weeks) | 0 | 3 | 1 | 1 | 1 | 1 |
| IR 102 WCA-1 South (2.5, -1.0) | | | | | | |
| Number of Low Events | 1 | 0 | 0 | 0 | 0 | 0 |
| Average Duration of Low Events (Weeks) | 2 | 0 | 0 | 0 | 0 | 0 |
| Percent Period of Record of Low Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of High Events | 0 | 38 | 32 | 32 | 32 | 32 |
| Average Duration of High Events (Weeks) | 0 | 17 | 14 | 14 | 14 | 14 |
| Percent Period of Record of High Events (Weeks) | 0 | 34 | 24 | 24 | 24 | 24 |
| IR 110 WCA-2A North (2.5, -1.0) | | | | | | |
| Number of Low Events | 5 | 11 | 7 | 8 | 8 | 8 |
| Average Duration of Low Events (Weeks) | 3 | 7 | 4 | 4 | 4 | 4 |
| Percent Period of Record of Low Events (Weeks) | 1 | 4 | 2 | 2 | 2 | 2 |
| Number of High Events | 0 | 0 | 1 | 1 | 1 | 1 |
| Average Duration of High Events (Weeks) | 0 | 0 | 1 | 1 | 1 | 1 |
| Percent Period of Record of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| IR 111 WCA-2A South (2.5, -1.0) | | | | | | |
| Number of Low Events | 5 | 2 | 7 | 7 | 7 | 7 |
| Average Duration of Low Events (Weeks) | 2 | 5 | 4 | 4 | 4 | 4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Percent Period of Record of Low Events (Weeks) | 1 | 1 | 1 | 1 | 1 | 1 |
| Number of High Events | 0 | 9 | 8 | 8 | 7 | 8 |
| Average Duration of High Events (Weeks) | 0 | 1 | 2 | 2 | 3 | 2 |
| Percent Period of Record of High Events (Weeks) | 0 | 1 | 1 | 1 | 1 | 1 |
| IR 112 WCA-2B North (2.5, -1.0) | | | | | | |
| Number of Low Events | 2 | 3 | 5 | 5 | 5 | 5 |
| Average Duration of Low Events (Weeks) | 3 | 3 | 4 | 4 | 4 | 4 |
| Percent Period of Record of Low Events (Weeks) | 0 | 1 | 1 | 1 | 1 | 1 |
| Number of High Events | 0 | 7 | 22 | 22 | 22 | 22 |
| Average Duration of High Events (Weeks) | 0 | 4 | 3 | 3 | 3 | 3 |
| Percent Period of Record of High Events (Weeks) | 0 | 1 | 3 | 3 | 3 | 3 |
| IR 113 WCA-2B South (2.5, -1.0) | | | | | | |
| Number of Low Events | 2 | 11 | 15 | 15 | 14 | 13 |
| Average Duration of Low Events (Weeks) | 4 | 8 | 8 | 8 | 8 | 9 |
| Percent Period of Record of Low Events (Weeks) | 0 | 5 | 6 | 6 | 6 | 6 |
| Number of High Events | 0 | 37 | 24 | 24 | 25 | 24 |
| Average Duration of High Events (Weeks) | 0 | 26 | 50 | 50 | 48 | 50 |
| Percent Period of Record of High Events (Weeks) | 0 | 52 | 65 | 64 | 64 | 64 |
| IR 114 WCA-3A NW Corner (2.5, -1.0) | | | | | | |
| Number of Low Events | 3 | 9 | 5 | 5 | 5 | 5 |
| Average Duration of Low Events (Weeks) | 6 | 7 | 6 | 5 | 5 | 5 |
| Percent Period of Record of Low Events (Weeks) | 1 | 3 | 2 | 1 | 1 | 1 |
| Number of High Events | 0 | 1 | 1 | 1 | 1 | 1 |
| Average Duration of High Events (Weeks) | 0 | 1 | 6 | 6 | 6 | 6 |
| Percent Period of Record of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| IR 115 WCA-3A North (2.0, -1.0) | | | | | | |
| Number of Low Events | 9 | 11 | 8 | 7 | 7 | 8 |
| Average Duration of Low Events (Weeks) | 4 | 4 | 4 | 5 | 5 | 4 |
| Percent Period of Record of Low Events (Weeks) | 2 | 2 | 2 | 2 | 2 | 2 |
| Number of High Events | 0 | 4 | 8 | 8 | 8 | 8 |
| Average Duration of High Events (Weeks) | 0 | 6 | 6 | 5 | 5 | 5 |
| Percent Period of Record of High Events (Weeks) | 0 | 1 | 2 | 2 | 2 | 2 |
| IR 116 WCA-3A NE (2.0, -1.0) | | | | | | |
| Number of Low Events | 7 | 8 | 1 | 1 | 1 | 1 |
| Average Duration of Low Events (Weeks) | 5 | 5 | 4 | 4 | 4 | 4 |
| Percent Period of Record of Low Events | 2 | 2 | 0 | 0 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| (Weeks) | | | | | | |
| Number of High Events | 0 | 7 | 18 | 19 | 19 | 18 |
| Average Duration of High Events (Weeks) | 0 | 9 | 7 | 7 | 7 | 7 |
| Percent Period of Record of High Events (Weeks) | 0 | 3 | 7 | 7 | 7 | 7 |
| IR 117 WCA-3A NW (2.5, -1.0) | | | | | | |
| Number of Low Events | 4 | 2 | 6 | 7 | 8 | 7 |
| Average Duration of Low Events (Weeks) | 5 | 6 | 4 | 4 | 3 | 4 |
| Percent Period of Record of Low Events (Weeks) | 1 | 1 | 1 | 1 | 1 | 1 |
| Number of High Events | 0 | 3 | 5 | 5 | 5 | 5 |
| Average Duration of High Events (Weeks) | 0 | 7 | 6 | 6 | 6 | 6 |
| Percent Period of Record of High Events (Weeks) | 0 | 1 | 2 | 2 | 1 | 1 |
| IR 118 WCA-3A Alley North (2.5, -1.0) | | | | | | |
| Number of Low Events | 7 | 10 | 8 | 8 | 8 | 9 |
| Average Duration of Low Events (Weeks) | 3 | 4 | 7 | 7 | 7 | 6 |
| Percent Period of Record of Low Events (Weeks) | 1 | 2 | 3 | 3 | 3 | 3 |
| Number of High Events | 0 | 10 | 16 | 16 | 15 | 15 |
| Average Duration of High Events (Weeks) | 0 | 8 | 8 | 7 | 8 | 8 |
| Percent Period of Record of High Events (Weeks) | 0 | 4 | 7 | 6 | 6 | 6 |
| IR 119 WCA-3A East (2.5, -1.0) | | | | | | |
| Number of Low Events | 4 | 1 | 7 | 7 | 7 | 7 |
| Average Duration of Low Events (Weeks) | 3 | 3 | 3 | 3 | 3 | 3 |
| Percent Period of Record of Low Events (Weeks) | 1 | 0 | 1 | 1 | 1 | 1 |
| Number of High Events | 0 | 38 | 41 | 41 | 40 | 40 |
| Average Duration of High Events (Weeks) | 0 | 26 | 15 | 15 | 15 | 15 |
| Percent Period of Record of High Events (Weeks) | 0 | 53 | 33 | 32 | 32 | 32 |
| IR 120 WCA-3A West (2.5, -1.0) | | | | | | |
| Number of Low Events | 5 | 7 | 7 | 7 | 7 | 7 |
| Average Duration of Low Events (Weeks) | 5 | 3 | 4 | 4 | 4 | 4 |
| Percent Period of Record of Low Events (Weeks) | 1 | 1 | 2 | 2 | 2 | 2 |
| Number of High Events | 0 | 3 | 3 | 3 | 3 | 3 |
| Average Duration of High Events (Weeks) | 0 | 5 | 6 | 6 | 6 | 6 |
| Percent Period of Record of High Events (Weeks) | 0 | 1 | 1 | 1 | 1 | 1 |
| IR 121 WCA-3A North Central (2.5, -1.0) | | | | | | |
| Number of Low Events | 7 | 2 | 5 | 5 | 5 | 5 |
| Average Duration of Low Events (Weeks) | 3 | 3 | 3 | 3 | 3 | 3 |
| Percent Period of Record of Low Events (Weeks) | 1 | 0 | 1 | 1 | 1 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Number of High Events | 0 | 5 | 6 | 6 | 6 | 6 |
| Average Duration of High Events (Weeks) | 0 | 10 | 9 | 9 | 9 | 9 |
| Percent Period of Record of High Events (Weeks) | 0 | 3 | 3 | 3 | 3 | 3 |
| IR 122 WCA-3A Gap (2.5, -1.0) | | | | | | |
| Number of Low Events | 8 | 8 | 7 | 7 | 7 | 7 |
| Average Duration of Low Events (Weeks) | 4 | 5 | 5 | 5 | 5 | 5 |
| Percent Period of Record of Low Events (Weeks) | 2 | 2 | 2 | 2 | 2 | 2 |
| Number of High Events | 0 | 5 | 3 | 3 | 3 | 3 |
| Average Duration of High Events (Weeks) | 0 | 6 | 7 | 7 | 7 | 7 |
| Percent Period of Record of High Events (Weeks) | 0 | 1 | 1 | 1 | 1 | 1 |
| IR 123 WCA-3A South Central (2.5, -1.0) | | | | | | |
| Number of Low Events | 7 | 4 | 9 | 9 | 9 | 9 |
| Average Duration of Low Events (Weeks) | 5 | 4 | 4 | 4 | 4 | 4 |
| Percent Period of Record of Low Events (Weeks) | 2 | 1 | 2 | 2 | 2 | 2 |
| Number of High Events | 0 | 12 | 6 | 5 | 5 | 5 |
| Average Duration of High Events (Weeks) | 0 | 8 | 10 | 12 | 12 | 12 |
| Percent Period of Record of High Events (Weeks) | 0 | 5 | 3 | 3 | 3 | 3 |
| IR 124 WCA-3A South (2.5, -1.0) | | | | | | |
| Number of Low Events | 7 | 2 | 7 | 7 | 7 | 7 |
| Average Duration of Low Events (Weeks) | 4 | 2 | 3 | 3 | 3 | 3 |
| Percent Period of Record of Low Events (Weeks) | 1 | 0 | 1 | 1 | 1 | 1 |
| Number of High Events | 0 | 31 | 7 | 7 | 7 | 7 |
| Average Duration of High Events (Weeks) | 0 | 10 | 10 | 10 | 10 | 10 |
| Percent Period of Record of High Events (Weeks) | 0 | 17 | 4 | 4 | 4 | 4 |
| IR 125 WCA-3B North (2.5, -1.0) | | | | | | |
| Number of Low Events | 5 | 1 | 8 | 9 | 8 | 9 |
| Average Duration of Low Events (Weeks) | 4 | 1 | 5 | 5 | 6 | 5 |
| Percent Period of Record of Low Events (Weeks) | 1 | 0 | 2 | 2 | 2 | 2 |
| Number of High Events | 0 | 1 | 26 | 27 | 27 | 27 |
| Average Duration of High Events (Weeks) | 0 | 2 | 13 | 12 | 12 | 12 |
| Percent Period of Record of High Events (Weeks) | 0 | 0 | 18 | 17 | 18 | 17 |
| IR 126 WCA-3B West (2.5, -1.0) | | | | | | |
| Number of Low Events | 4 | 3 | 7 | 7 | 6 | 6 |
| Average Duration of Low Events (Weeks) | 3 | 1 | 5 | 5 | 6 | 6 |
| Percent Period of Record of Low Events (Weeks) | 1 | 0 | 2 | 2 | 2 | 2 |
| Number of High Events | 3 | 1 | 28 | 27 | 27 | 28 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Average Duration of High Events (Weeks) | 2 | 3 | 11 | 11 | 11 | 11 |
| Percent Period of Record of High Events (Weeks) | 0 | 0 | 16 | 16 | 16 | 16 |
| IR 127 Pennsuco Wetlands (2.0, -1.0) | | | | | | |
| Number of Low Events | 2 | 25 | 33 | 32 | 31 | 32 |
| Average Duration of Low Events (Weeks) | 4 | 6 | 5 | 5 | 5 | 5 |
| Percent Period of Record of Low Events (Weeks) | 0 | 8 | 8 | 8 | 8 | 8 |
| Number of High Events | 8 | 6 | 19 | 18 | 21 | 19 |
| Average Duration of High Events (Weeks) | 6 | 3 | 11 | 12 | 10 | 11 |
| Percent Period of Record of High Events (Weeks) | 2 | 1 | 11 | 11 | 11 | 11 |
| IR 128 WCA-3B East (2.5, -1.0) | | | | | | |
| Number of Low Events | 2 | 11 | 18 | 18 | 19 | 18 |
| Average Duration of Low Events (Weeks) | 3 | 7 | 5 | 5 | 5 | 5 |
| Percent Period of Record of Low Events (Weeks) | 0 | 4 | 5 | 5 | 5 | 5 |
| Number of High Events | 4 | 5 | 33 | 33 | 33 | 31 |
| Average Duration of High Events (Weeks) | 4 | 3 | 15 | 15 | 15 | 16 |
| Percent Period of Record of High Events (Weeks) | 1 | 1 | 26 | 26 | 26 | 26 |
| IR 129 NE Shark Slough (2.5, -1.0) | | | | | | |
| Number of Low Events | 5 | 13 | 12 | 13 | 13 | 13 |
| Average Duration of Low Events (Weeks) | 3 | 6 | 6 | 5 | 5 | 5 |
| Percent Period of Record of Low Events (Weeks) | 1 | 4 | 4 | 4 | 4 | 4 |
| Number of High Events | 5 | 0 | 9 | 9 | 9 | 9 |
| Average Duration of High Events (Weeks) | 5 | 0 | 6 | 6 | 6 | 6 |
| Percent Period of Record of High Events (Weeks) | 1 | 0 | 3 | 3 | 3 | 3 |
| IR 130 Mid Shark Slough (2.5, -1.0) | | | | | | |
| Number of Low Events | 4 | 12 | 10 | 9 | 9 | 9 |
| Average Duration of Low Events (Weeks) | 8 | 7 | 5 | 6 | 6 | 6 |
| Percent Period of Record of Low Events (Weeks) | 2 | 4 | 3 | 3 | 3 | 3 |
| Number of High Events | 1 | 1 | 1 | 1 | 1 | 1 |
| Average Duration of High Events (Weeks) | 1 | 1 | 1 | 1 | 1 | 1 |
| Percent Period of Record of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| IR 131 SW Shark Slough (2.5, -1.0) | | | | | | |
| Number of Low Events | 7 | 15 | 10 | 10 | 10 | 10 |
| Average Duration of Low Events (Weeks) | 6 | 6 | 6 | 6 | 6 | 6 |
| Percent Period of Record of Low Events (Weeks) | 2 | 5 | 3 | 3 | 3 | 3 |
| Number of High Events | 0 | 0 | 0 | 0 | 0 | 0 |
| Average Duration of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Percent Period of Record of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| IR 132 South Shark Slough (2.5, -1.0) | | | | | | |
| Number of Low Events | 6 | 11 | 6 | 6 | 6 | 6 |
| Average Duration of Low Events (Weeks) | 5 | 5 | 6 | 6 | 6 | 6 |
| Percent Period of Record of Low Events (Weeks) | 2 | 3 | 2 | 2 | 2 | 2 |
| Number of High Events | 1 | 0 | 0 | 0 | 0 | 0 |
| Average Duration of High Events (Weeks) | 2 | 0 | 0 | 0 | 0 | 0 |
| Percent Period of Record of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| IR 133 Taylor Slough (2.5, -1.0) | | | | | | |
| Number of Low Events | 27 | 26 | 27 | 25 | 26 | 26 |
| Average Duration of Low Events (Weeks) | 7 | 5 | 5 | 6 | 5 | 5 |
| Percent Period of Record of Low Events (Weeks) | 9 | 7 | 7 | 7 | 7 | 7 |
| Number of High Events | 0 | 0 | 0 | 0 | 0 | 0 |
| Average Duration of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| Percent Period of Record of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| IR 140 Lostman's Slough (2.0, -1.0) | | | | | | |
| Number of Low Events | 22 | 22 | 32 | 32 | 32 | 32 |
| Average Duration of Low Events (Weeks) | 9 | 13 | 11 | 11 | 11 | 11 |
| Percent Period of Record of Low Events (Weeks) | 11 | 15 | 18 | 18 | 18 | 19 |
| Number of High Events | 1 | 0 | 0 | 0 | 0 | 0 |
| Average Duration of High Events (Weeks) | 2 | 0 | 0 | 0 | 0 | 0 |
| Percent Period of Record of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| IR 141 Ochopee Marl Marsh (2.0, -1.0) | | | | | | |
| Number of Low Events | 12 | 25 | 18 | 18 | 17 | 17 |
| Average Duration of Low Events (Weeks) | 12 | 11 | 11 | 11 | 12 | 12 |
| Percent Period of Record of Low Events (Weeks) | 8 | 15 | 11 | 11 | 11 | 11 |
| Number of High Events | 12 | 3 | 4 | 4 | 4 | 4 |
| Average Duration of High Events (Weeks) | 7 | 6 | 4 | 4 | 4 | 4 |
| Percent Period of Record of High Events (Weeks) | 5 | 1 | 1 | 1 | 1 | 1 |
| IR 143 West Perrine Marl Marsh (1.5, -1.0) | | | | | | |
| Number of Low Events | 46 | 45 | 48 | 48 | 48 | 48 |
| Average Duration of Low Events (Weeks) | 16 | 18 | 16 | 16 | 16 | 16 |
| Percent Period of Record of Low Events (Weeks) | 39 | 42 | 40 | 40 | 40 | 40 |
| Number of High Events | 0 | 0 | 0 | 0 | 0 | 0 |
| Average Duration of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Percent Period of Record of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| IR 144 Craighead Basin (1.5, -1.0) | | | | | | |
| Number of Low Events | 42 | 41 | 37 | 37 | 37 | 37 |
| Average Duration of Low Events (Weeks) | 8 | 8 | 8 | 8 | 8 | 8 |
| Percent Period of Record of Low Events (Weeks) | 18 | 17 | 16 | 16 | 16 | 16 |
| Number of High Events | 0 | 0 | 0 | 0 | 0 | 0 |
| Average Duration of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| Percent Period of Record of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| IR 145 East Perrine Marl Marsh (1.5, -1.0) | | | | | | |
| Number of Low Events | 44 | 45 | 44 | 44 | 44 | 44 |
| Average Duration of Low Events (Weeks) | 9 | 7 | 8 | 8 | 8 | 8 |
| Percent Period of Record of Low Events (Weeks) | 21 | 17 | 18 | 18 | 18 | 18 |
| Number of High Events | 0 | 0 | 0 | 0 | 0 | 0 |
| Average Duration of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| Percent Period of Record of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| IR 146 Model Lands Marl Marsh (2.0, -1.0) | | | | | | |
| Number of Low Events | 33 | 47 | 51 | 50 | 50 | 50 |
| Average Duration of Low Events (Weeks) | 8 | 7 | 8 | 8 | 8 | 8 |
| Percent Period of Record of Low Events (Weeks) | 13 | 17 | 21 | 21 | 21 | 21 |
| Number of High Events | 0 | 0 | 0 | 0 | 0 | 0 |
| Average Duration of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| Percent Period of Record of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| IR 147 Rocky Glades East (1.5, -1.0) | | | | | | |
| Number of Low Events | 27 | 58 | 43 | 43 | 43 | 42 |
| Average Duration of Low Events (Weeks) | 11 | 12 | 10 | 10 | 10 | 10 |
| Percent Period of Record of Low Events (Weeks) | 16 | 36 | 23 | 23 | 23 | 23 |
| Number of High Events | 3 | 0 | 0 | 0 | 0 | 0 |
| Average Duration of High Events (Weeks) | 5 | 0 | 0 | 0 | 0 | 0 |
| Percent Period of Record of High Events (Weeks) | 1 | 0 | 0 | 0 | 0 | 0 |
| IR 148 Rocky Glades West (2.0, -1.0) | | | | | | |
| Number of Low Events | 21 | 39 | 27 | 28 | 28 | 28 |
| Average Duration of Low Events (Weeks) | 9 | 13 | 11 | 11 | 11 | 11 |
| Percent Period of Record of Low Events (Weeks) | 10 | 26 | 16 | 16 | 16 | 16 |
| Number of High Events | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Average Duration of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| Percent Period of Record of High Events (Weeks) | 0 | 0 | 0 | 0 | 0 | 0 |
| IR 160 Rotenberger WMA (1.75, -1.0) | | | | | | |
| Number of Low Events | 7 | 4 | 4 | 4 | 4 | 4 |
| Average Duration of Low Events (Weeks) | 4 | 6 | 4 | 4 | 4 | 4 |
| Percent Period of Record of Low Events (Weeks) | 1 | 1 | 1 | 1 | 1 | 1 |
| Number of High Events | 11 | 9 | 9 | 9 | 9 | 9 |
| Average Duration of High Events (Weeks) | 6 | 2 | 2 | 2 | 2 | 2 |
| Percent Period of Record of High Events (Weeks) | 4 | 1 | 1 | 1 | 1 | 1 |
| IR 170 Holey Land WMA (1.75, -1.0) | | | | | | |
| Number of Low Events | 19 | 4 | 3 | 3 | 3 | 3 |
| Average Duration of Low Events (Weeks) | 7 | 3 | 2 | 2 | 2 | 2 |
| Percent Period of Record of Low Events (Weeks) | 7 | 1 | 0 | 0 | 0 | 0 |
| Number of High Events | 1 | 42 | 38 | 38 | 38 | 38 |
| Average Duration of High Events (Weeks) | 4 | 18 | 23 | 23 | 23 | 23 |
| Percent Period of Record of High Events (Weeks) | 0 | 40 | 47 | 47 | 47 | 47 |
| IR 180 NE Cypress (0.25, -1.0) | | | | | | |
| Number of Low Events | 35 | 64 | 64 | 64 | 64 | 64 |
| Average Duration of Low Events (Weeks) | 10 | 15 | 15 | 15 | 15 | 15 |
| Percent Period of Record of Low Events (Weeks) | 18 | 52 | 52 | 52 | 52 | 52 |
| Number of High Events | 58 | 19 | 19 | 19 | 19 | 19 |
| Average Duration of High Events (Weeks) | 6 | 2 | 2 | 2 | 2 | 2 |
| Percent Period of Record of High Events (Weeks) | 19 | 2 | 2 | 2 | 2 | 2 |
| IR 181 Mullet Slough (0.25, -1.0) | | | | | | |
| Number of Low Events | 20 | 36 | 36 | 36 | 36 | 36 |
| Average Duration of Low Events (Weeks) | 7 | 9 | 9 | 9 | 9 | 9 |
| Percent Period of Record of Low Events (Weeks) | 7 | 17 | 17 | 17 | 17 | 17 |
| Number of High Events | 32 | 56 | 56 | 56 | 56 | 56 |
| Average Duration of High Events (Weeks) | 42 | 15 | 15 | 15 | 15 | 15 |
| Percent Period of Record of High Events (Weeks) | 71 | 45 | 45 | 45 | 45 | 45 |
| IR 182 Dwarf Cypress (0.25, -1.0) | | | | | | |
| Number of Low Events | 24 | 35 | 36 | 36 | 36 | 36 |
| Average Duration of Low Events (Weeks) | 8 | 11 | 11 | 11 | 11 | 11 |
| Percent Period of Record of Low Events (Weeks) | 10 | 20 | 21 | 21 | 21 | 21 |
| Number of High Events | 53 | 82 | 76 | 76 | 76 | 76 |
| Average Duration of High Events (Weeks) | 22 | 6 | 6 | 6 | 6 | 6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Percent Period of Record of High Events (Weeks) | 61 | 26 | 25 | 25 | 25 | 25 |
| IR 183 Roberts Lake Cypress Strand | | | | | | |
| (0.25, -1.0 | ) | | | | | |
| Number of Low Events | 17 | 36 | 36 | 37 | 36 | 36 |
| Average Duration of Low Events (Weeks) | 12 | 9 | 9 | 9 | 9 | 9 |
| Percent Period of Record of Low Events (Weeks) | 11 | 16 | 17 | 17 | 17 | 17 |
| Number of High Events | 48 | 59 | 60 | 60 | 60 | 60 |
| Average Duration of High Events (Weeks) | 25 | 13 | 13 | 13 | 13 | 13 |
| Percent Period of Record of High Events (Weeks) | 65 | 42 | 40 | 40 | 40 | 40 |
| IR 190 WCA-3A Sawgrass (2.0, -1.0) | | | | | | |
| Number of Low Events | 16 | 13 | 1 | 1 | 1 | 1 |
| Average Duration of Low Events (Weeks) | 9 | 6 | 1 | 1 | 1 | 1 |
| Percent Period of Record of Low Events (Weeks) | 7 | 4 | 0 | 0 | 0 | 0 |
| Number of High Events | 0 | 5 | 9 | 10 | 10 | 10 |
| Average Duration of High Events (Weeks) | 0 | 9 | 9 | 8 | 8 | 8 |
| Percent Period of Record of High Events (Weeks) | 0 | 2 | 4 | 4 | 4 | 4 |

**Water Supply and Flood Protection**

**Table 24. LOSA water restrictions for 2050B2 alternatives.**

| | Target | 2050B2 | 50B2W2 | 50B2W4 | 50B2W6 |
|---|---|---|---|---|---|
| # Years w/ water shortage | 3 | 12 | 12 | 13 | 13 |
| Duration (months) | 8 | 45 | 48 | 49 | 49 |
| Severity (score) | 7 | 25 | 26 | 27 | 27 |

**Table 25. LOSA water restrictions for 2050B3 alternatives.**

| | Target | 2050B3 | 50B3W2 | 50B3W4 | 50B3W6 |
|---|---|---|---|---|---|
| # Years w/ water shortage | 3 | 12 | 12 | 12 | 12 |
| Duration (months) | 8 | 35 | 38 | 39 | 40 |
| Severity (score) | 7 | 21 | 21 | 21 | 22 |

**Table 26. LECSA water supply performance for 2050B2 alternatives**

| | Target | Future Without Condition (2050B2) | Alt 2 50B2W2 | Alt 4 50B2W4 | Alt 6 50B2W6 |
|---|---|---|---|---|---|
| Service Area 1 | | | | | |
| # of Years w/ water shortages | 3 | 7 | 8 | 9 | 9 |
| Duration (months) | 5 | 53 | 57 | 64 | 64 |
| Severity | All Phase 1 | Yes | Yes | Yes | Yes |
| Service Area 2 | | | | | |
| # of Years w/ water shortages | 3 | 23 | 24 | 24 | 24 |
| Duration (months) | 18 | 132 | 134 | 137 | 137 |
| Severity | All Phase 1 | No | No | No | No |
| Service Area 3 | | | | | |
| # of Years w/ water shortages | 3 | 7 | 8 | 9 | 9 |
| Duration (months) | 18 | 55 | 59 | 65 | 65 |
| Severity | All Phase 1 | No | No | No | No |
| Northern Palm Beach County Service Area | | | | | |
| # of Years w/ water shortages | 3 | 8 | 9 | 10 | 10 |
| Duration (months) | 18 | 50 | 54 | 61 | 61 |
| Severity | All Phase 1 | Yes | Yes | Yes | Yes |

**Table 27. LECSA water supply performance for 2050B3 alternatives**

| | Target | Future Without Condition (2050B3) | Alt 2 50B3W2 | Alt 4 50B3W4 | Alt 6 50B3W6 |
|---|---|---|---|---|---|
| Service Area 1 | | | | | |
| # of Years w/ water shortages | 3 | 7 | 7 | 7 | 7 |
| Duration (months) | 5 | 56 | 55 | 56 | 56 |
| Severity | All Phase 1 | Yes | Yes | Yes | Yes |
| Service Area 2 | | | | | |
| # of Years w/ water shortages | 3 | 27 | 27 | 27 | 28 |
| Duration (months) | 18 | 152 | 151 | 152 | 155 |
| Severity | All Phase 1 | Yes | Yes | Yes | Yes |
| Service Area 3 | | | | | |
| # of Years w/ water shortages | 3 | 6 | 6 | 6 | 6 |

| | | | | | |
|---|---|---|---|---|---|
| Duration (months) | 18 | 47 | 46 | 47 | 47 |
| Severity | All Phase 1 | Yes | Yes | Yes | Yes |
| Northern Palm Beach County Service Area | | | | | |
| # of Years w/ water shortages | 3 | 6 | 6 | 6 | 6 |
| Duration (months) | 18 | 43 | 42 | 43 | 43 |
| Severity | All Phase 1 | Yes | Yes | Yes | Yes |

**Table 28. Number of times MFL criteria for the Biscayne Aquifer were not met for 2050B2 alternatives**

| Location | MFL Stage | 2050B2 | Alt 2 | Alt 4 | Alt 6 |
|---|---|---|---|---|---|
| C-51 | 7.80 | 0 | 0 | 0 | 0 |
| C-16 | 7.80 | 0 | 0 | 0 | 0 |
| C-15 | 7.80 | 0 | 0 | 0 | 0 |
| Hillsboro | 6.75 | 0 | 0 | 0 | 0 |
| C-13 | 4.00 | 0 | 0 | 0 | 0 |
| C-14 | 6.50 | 0 | 0 | 0 | 0 |
| N New River | 3.50 | 0 | 0 | 0 | 0 |
| C-9 | 2.00 | 0 | 0 | 0 | 0 |
| C-6 | 2.50 | 0 | 0 | 0 | 0 |
| C-4 | 2.50 | 6 | 6 | 6 | 5 |
| C-2 | 2.50 | 3 | 3 | 3 | 3 |

**Table 29. Number of times MFL criteria for the Biscayne Aquifer were not met for 2050B3 alternatives**

| Location | MFL Stage | 2050B3 | Alt 2 | Alt 4 | Alt 6 |
|---|---|---|---|---|---|
| C-51 | 7.80 | 0 | 0 | 0 | 0 |
| C-16 | 7.80 | 0 | 0 | 0 | 0 |
| C-15 | 7.80 | 0 | 0 | 0 | 0 |
| Hillsboro | 6.75 | 0 | 0 | 0 | 0 |
| C-13 | 4.00 | 0 | 0 | 0 | 0 |
| C-14 | 6.50 | 0 | 0 | 0 | 0 |
| N New River | 3.50 | 0 | 0 | 0 | 0 |
| C-9 | 2.00 | 0 | 0 | 0 | 0 |
| C-6 | 2.50 | 0 | 0 | 0 | 0 |
| C-4 | 2.50 | 2 | 2 | 2 | 2 |
| C-2 | 2.50 | 2 | 2 | 1 | 2 |

**Table 30. LEC saltwater intrusion in the Biscayne Aquifer in South Miami-Dade County for 2050B2 Alternatives**

| Canal/Structure | | Target | 2050B2 | Alt 2 | Alt 4 | Alt 6 |
|---|---|---|---|---|---|---|
| C-100A at S-123 | Metric based on 90th percentile | 1 | 0.94 | 0.94 | 0.94 | 0.94 |
| | Metric based on 50th percentile | 1 | 0.48 | 0.48 | 0.48 | 0.48 |
| | Combined score | 1 | 0.71 | 0.71 | 0.71 | 0.71 |
| | | | | | | |
| C-1 at S-21 | Metric based on 90th percentile | 1 | 0.83 | 0.83 | 0.83 | 0.83 |
| | Metric based on 50th percentile | 1 | 0.53 | 0.52 | 0.52 | 0.52 |
| | Combined score | 1 | 0.68 | 0.68 | 0.68 | 0.68 |
| | | | | | | |
| C-102 at S-21A | Metric based on 90th percentile | 1 | 0.74 | 0.74 | 0.74 | 0.74 |
| | Metric based on 50th percentile | 1 | 0.50 | 0.50 | 0.50 | 0.50 |
| | Combined score | 1 | 0.62 | 0.62 | 0.62 | 0.62 |
| | | | | | | |
| C-103 at S-20F | Metric based on 90th percentile | 1 | 0.28 | 0.28 | 0.28 | 0.28 |
| | Metric based on 50th percentile | 1 | 0.42 | 0.42 | 0.42 | 0.42 |
| | Combined score | 1 | 0.35 | 0.35 | 0.35 | 0.35 |
| | | | | | | |
| | Combined score for All structures | 1 | 0.59 | 0.59 | 0.59 | 0.59 |

**Table 31. LEC saltwater intrusion in the Biscayne Aquifer in South Miami-Dade County for 2050B3 Alternatives**

| Canal/Structure | | Target | 2050B3 | Alt 2 | Alt 4 | Alt 6 |
|---|---|---|---|---|---|---|
| C-100A at S-123 | Metric based on 90th percentile | 1 | 0.96 | 0.96 | 0.96 | 0.96 |
| | Metric based on 50th percentile | 1 | 0.49 | 0.49 | 0.49 | 0.49 |
| | Combined score | 1 | 0.72 | 0.72 | 0.72 | 0.72 |
| | | | | | | |
| C-1 at S-21 | Metric based on 90th percentile | 1 | 0.84 | 0.84 | 0.84 | 0.84 |
| | Metric based on 50th percentile | 1 | 0.44 | 0.44 | 0.44 | 0.44 |
| | Combined score | 1 | 0.64 | 0.64 | 0.64 | 0.64 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| C-102 at S-21A | Metric based on 90th percentile | 1 | 0.76 | 0.75 | 0.76 | 0.76 |
| | Metric based on 50th percentile | 1 | 0.50 | 0.50 | 0.50 | 0.50 |
| | Combined score | 1 | 0.63 | 0.62 | 0.63 | 0.63 |
| | | | | | | |
| C-103 at S-20F | Metric based on 90th percentile | 1 | 0.40 | 0.40 | 0.40 | 0.40 |
| | Metric based on 50th percentile | 1 | 0.48 | 0.48 | 0.48 | 0.47 |
| | Combined score | 1 | 0.44 | 0.44 | 0.44 | 0.43 |
| | | | | | | |
| | Combined score for All structures | 1 | 0.61 | 0.60 | 0.61 | 0.60 |

**Table 32. Percent of time tree roots are inundated for 2050B2 alternatives**

| CELLS (% time above root zone) | Target should not exceed | 2050B2 | Alt 2 50B2W2 | Alt 4 50B2W4 | Alt 6 50B2W6 |
|---|---|---|---|---|---|
| R10C25 | 49.3 | 52.9 | 52.7 | 52.5 | 52.4 |
| R13C25 | 17.0 | 55.4 | 55.4 | 55.3 | 55.1 |
| R15C26 | 2.3 | 4.3 | 4.3 | 4.4 | 4.3 |
| R17C27 | 1.1 | 0.7 | 0.7 | 0.7 | 0.7 |
| R19C27 | 58.6 | 74.9 | 74.8 | 74.9 | 74.9 |
| R20C27 | 87.4 | 100 | 100 | 100 | 100 |

**Table 33. Percent of time tree roots are inundated for 2050B2 alternatives**

| CELLS (% time above root zone) | Target should not exceed | 2050B3 | Alt 2 50B3W2 | Alt 4 50B3W4 | Alt 6 50B3W6 |
|---|---|---|---|---|---|
| R10C25 | 49.3 | 56.9 | 56.9 | 56.9 | 56.8 |
| R13C25 | 17.0 | 48.4 | 48.5 | 48.4 | 48.4 |
| R15C26 | 2.3 | 3.3 | 3.2 | 3.2 | 3.2 |
| R17C27 | 1.1 | 0.3 | 0.3 | 0.3 | 0.3 |
| R19C27 | 58.6 | 77.4 | 77.1 | 77.1 | 77.1 |
| R20C27 | 87.4 | 100 | 100 | 100 | 100 |