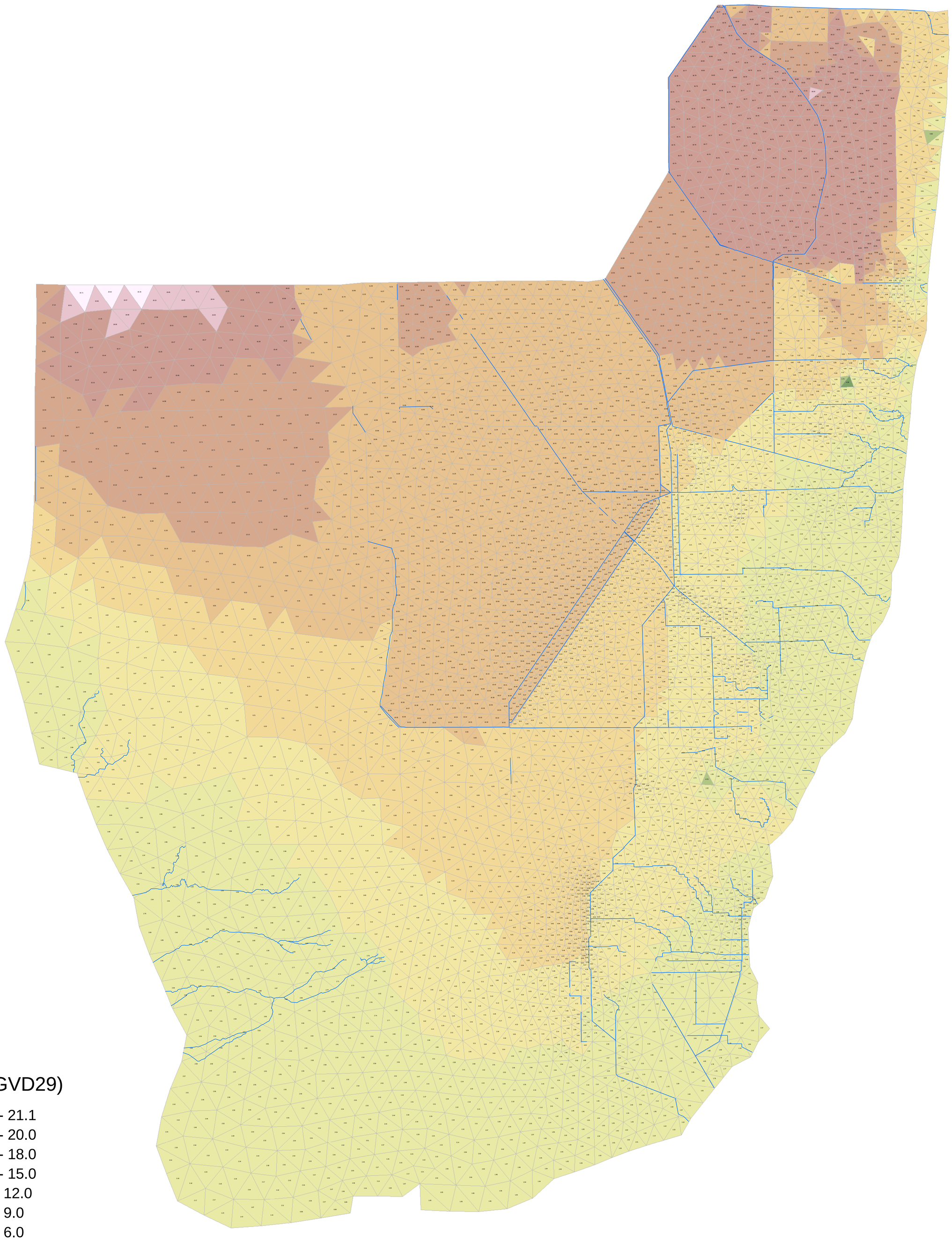
Annual Average Stage

1995



Stage (ft NGVD29)

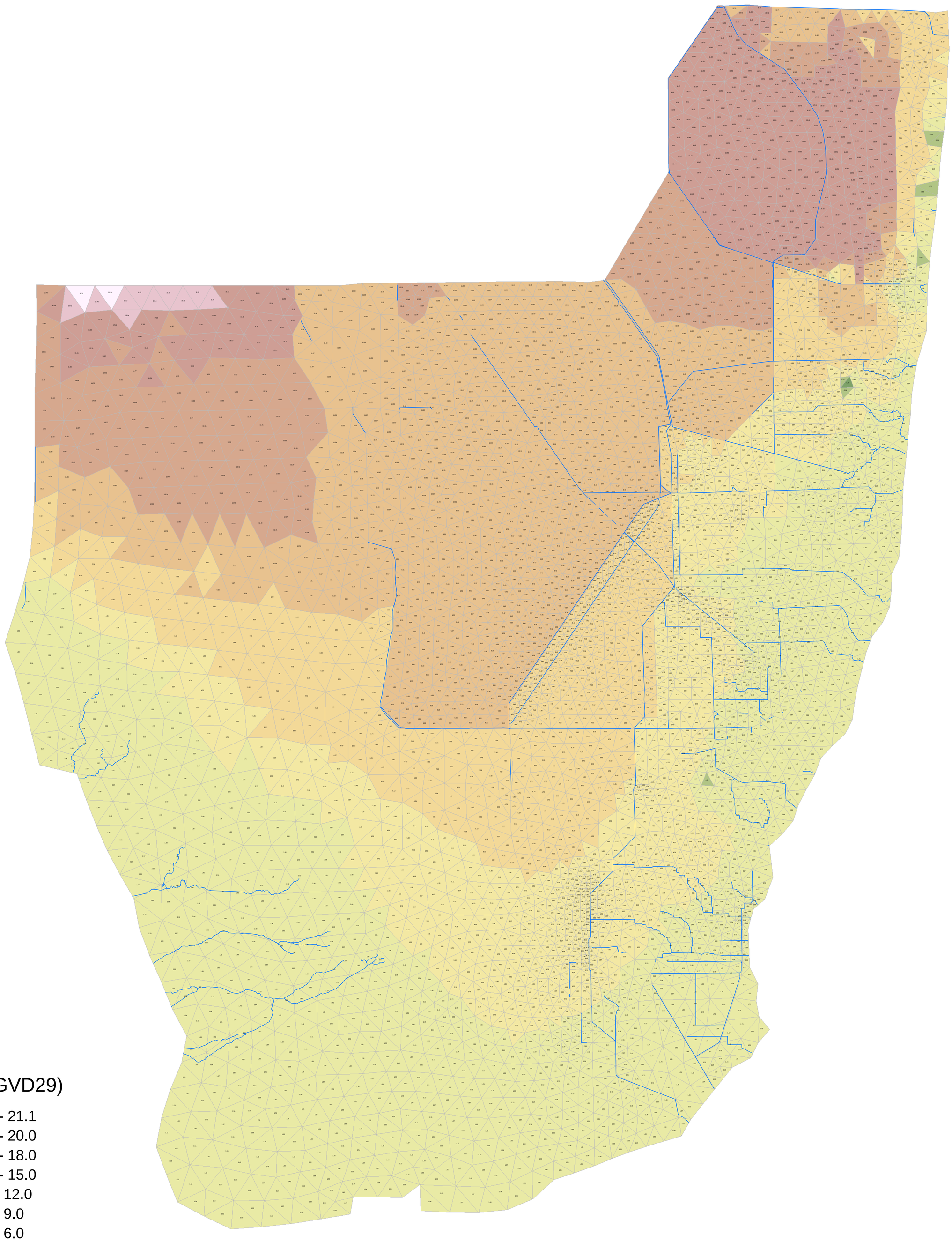
- 20.0 - 21.1
- 18.0 - 20.0
- 15.0 - 18.0
- 12.0 - 15.0
- 9.0 - 12.0
- 6.0 - 9.0
- 3.0 - 6.0
- 0.0 - 3.0
- -3.0 - 0.0
- -7.0 --3.0

0 5 10 20 30 40 Miles

Run Name: RSMGL_FWO
Run Date: December 13, 2012

Average Annual Stage

1965-2005



Stage (ft NGVD29)

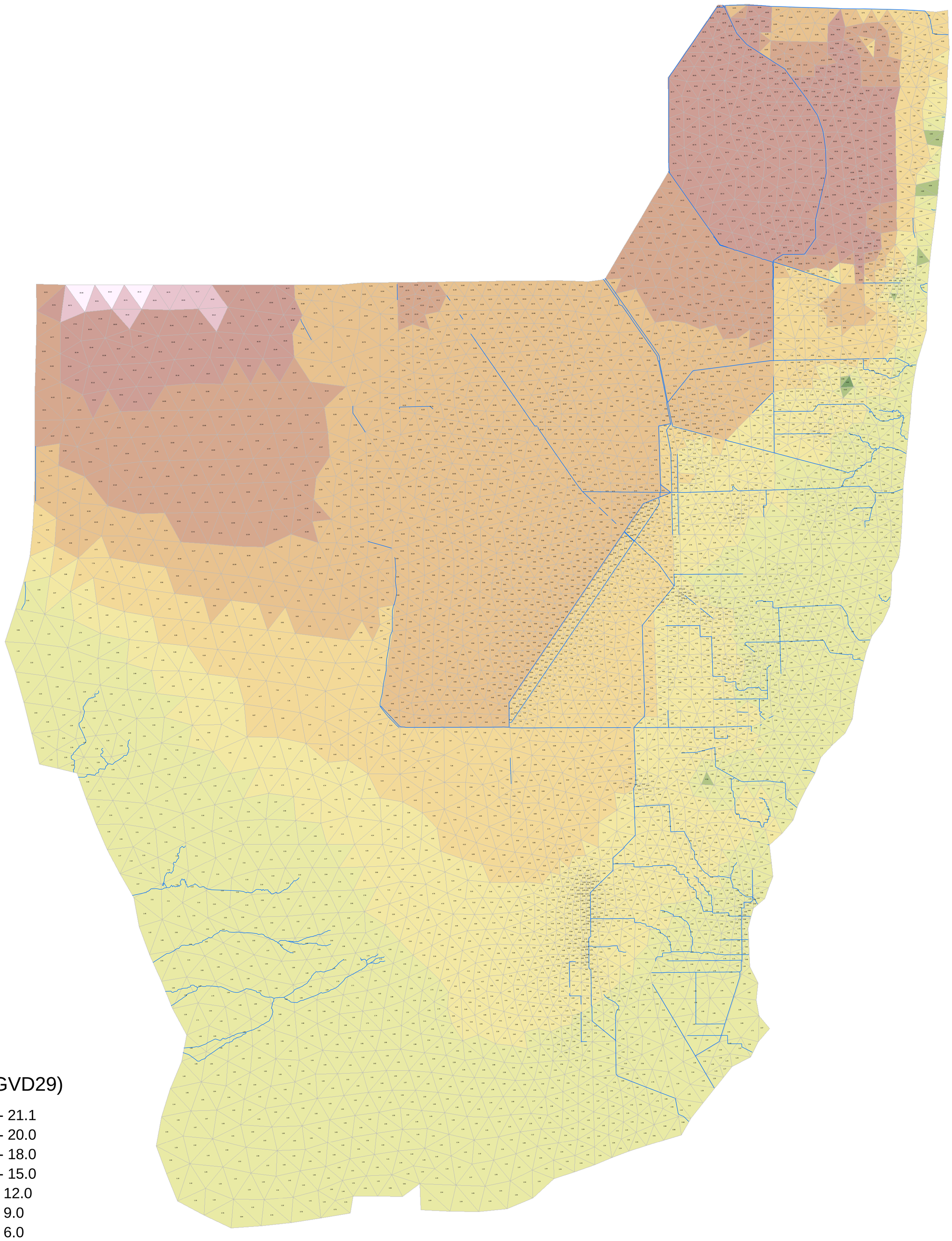
- 20.0 - 21.1
- 18.0 - 20.0
- 15.0 - 18.0
- 12.0 - 15.0
- 9.0 - 12.0
- 6.0 - 9.0
- 3.0 - 6.0
- 0.0 - 3.0
- -3.0 - 0.0
- -7.0 --3.0

0 5 10 20 30 40 Miles

Run Name: RSMGL_FWO
Run Date: December 13, 2012

Annual Average Stage

1978



Stage (ft NGVD29)

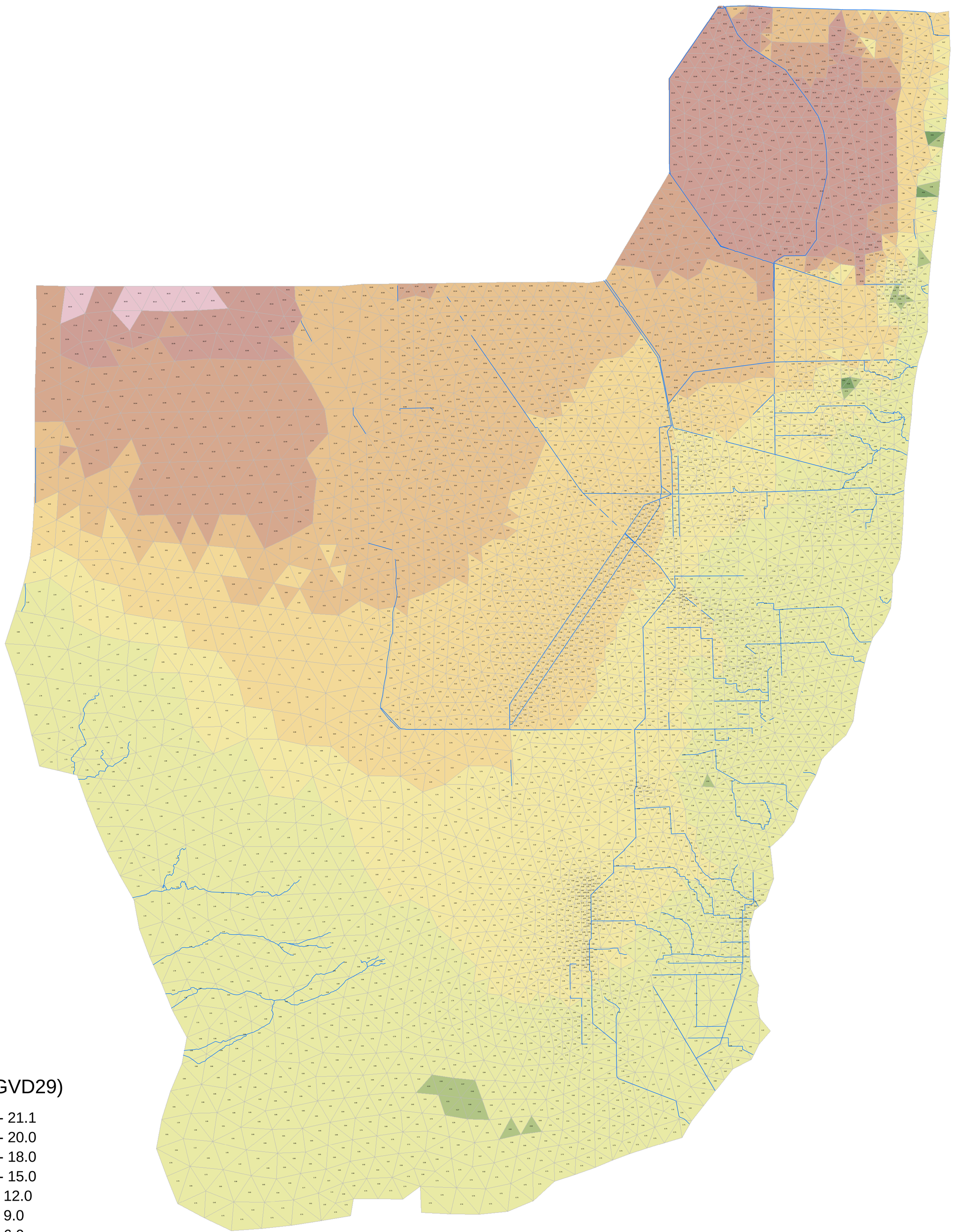
- 20.0 - 21.1
- 18.0 - 20.0
- 15.0 - 18.0
- 12.0 - 15.0
- 9.0 - 12.0
- 6.0 - 9.0
- 3.0 - 6.0
- 0.0 - 3.0
- -3.0 - 0.0
- -7.0 --3.0

0 5 10 20 30 40 Miles

Run Name: RSMGL IORBL1
Run Date: 03 June 2013

Annual Average Stage

1989



Stage (ft NGVD29)

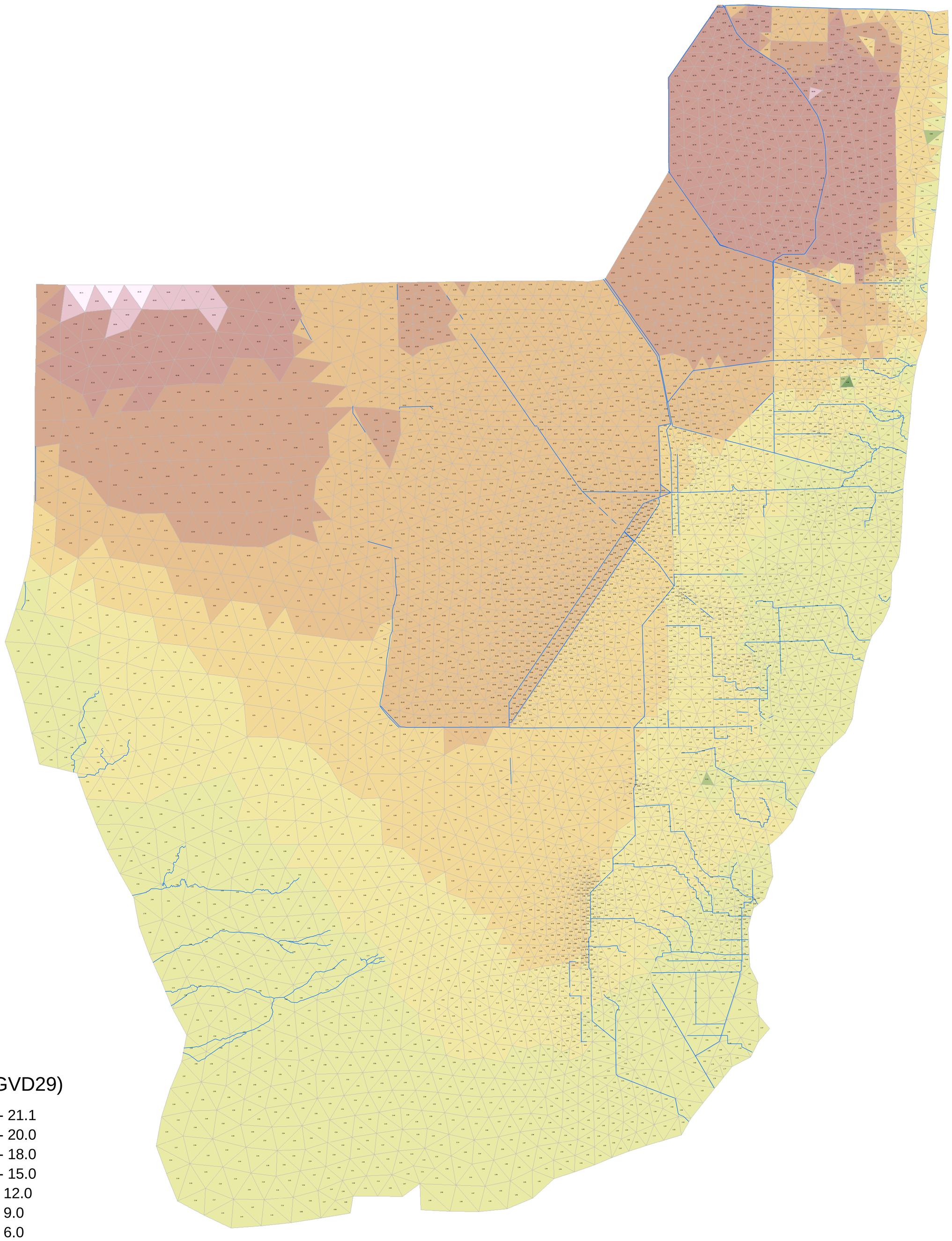
- 20.0 - 21.1
- 18.0 - 20.0
- 15.0 - 18.0
- 12.0 - 15.0
- 9.0 - 12.0
- 6.0 - 9.0
- 3.0 - 6.0
- 0.0 - 3.0
- -3.0 - 0.0
- -7.0 --3.0

0 5 10 20 30 40 Miles

Run Name: RSMGL IORBL1
Run Date: 03 June 2013

Annual Average Stage

1995



Stage (ft NGVD29)

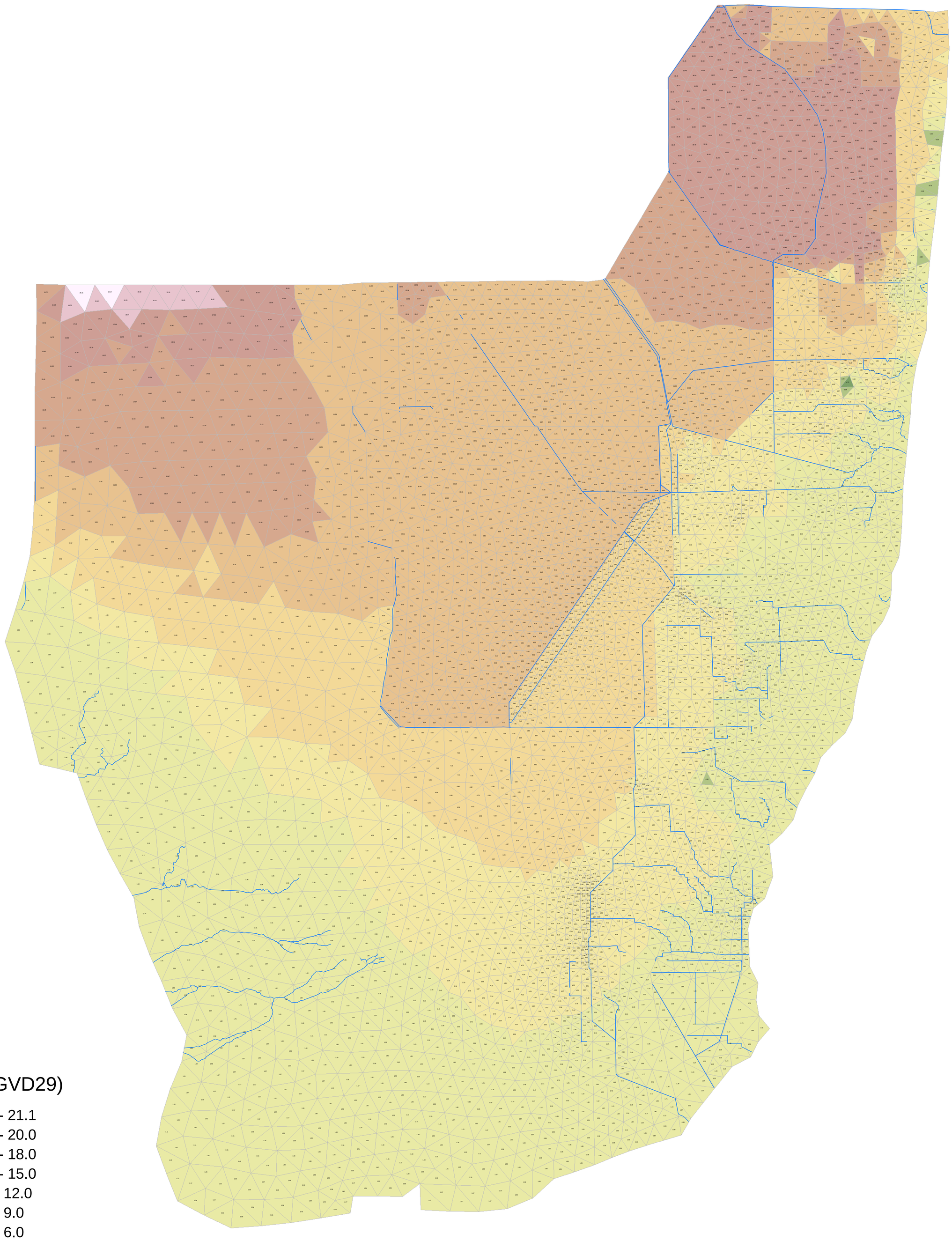
- 20.0 - 21.1
- 18.0 - 20.0
- 15.0 - 18.0
- 12.0 - 15.0
- 9.0 - 12.0
- 6.0 - 9.0
- 3.0 - 6.0
- 0.0 - 3.0
- -3.0 - 0.0
- -7.0 --3.0

0 5 10 20 30 40 Miles

Run Name: RSMGL IORBL1
Run Date: 03 June 2013

Average Annual Stage

1965-2005



Stage (ft NGVD29)

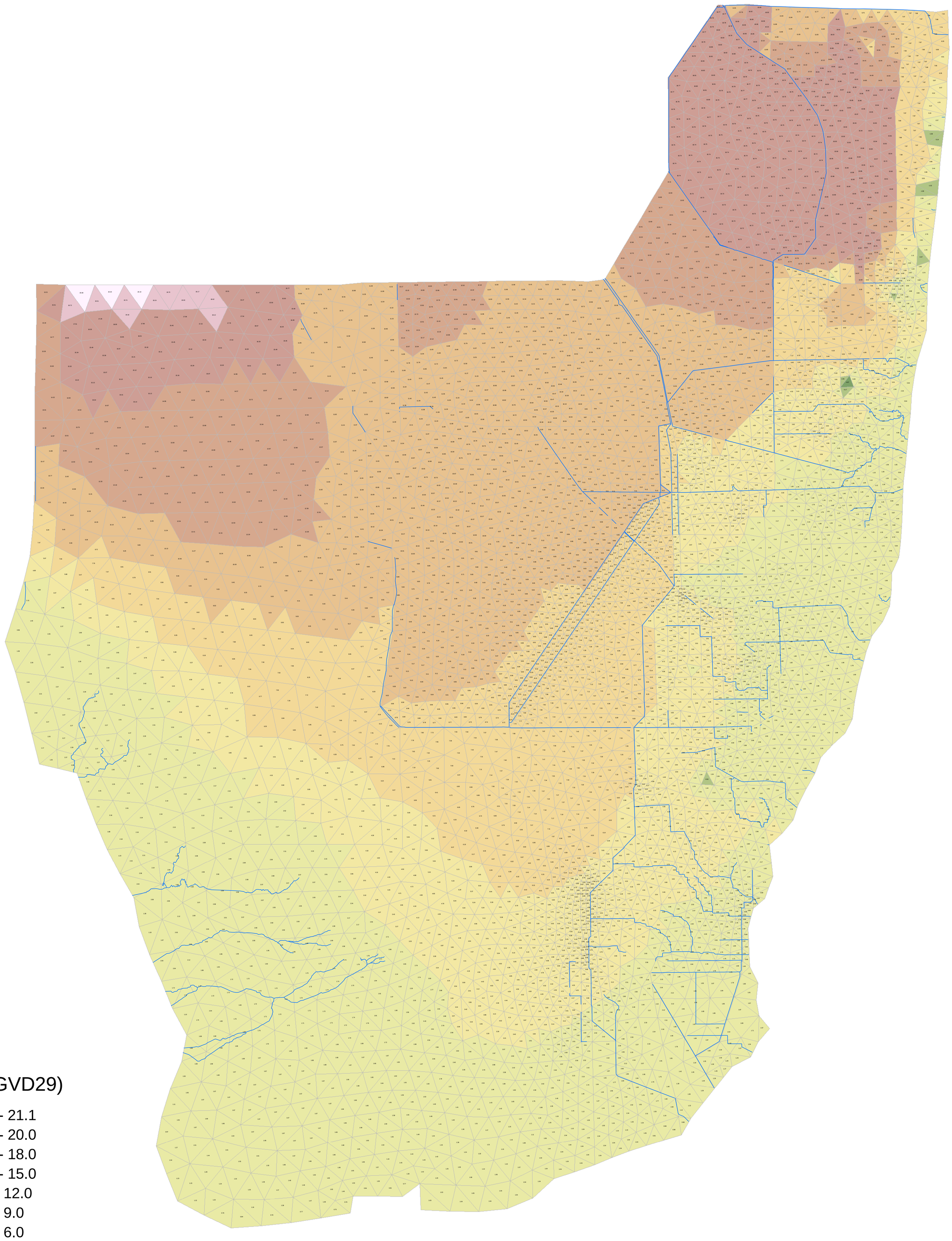
- 20.0 - 21.1
- 18.0 - 20.0
- 15.0 - 18.0
- 12.0 - 15.0
- 9.0 - 12.0
- 6.0 - 9.0
- 3.0 - 6.0
- 0.0 - 3.0
- -3.0 - 0.0
- -7.0 --3.0

0 5 10 20 30 40 Miles

Run Name: RSMGL IORBL1
Run Date: 03 June 2013

Annual Average Stage

1978



Stage (ft NGVD29)

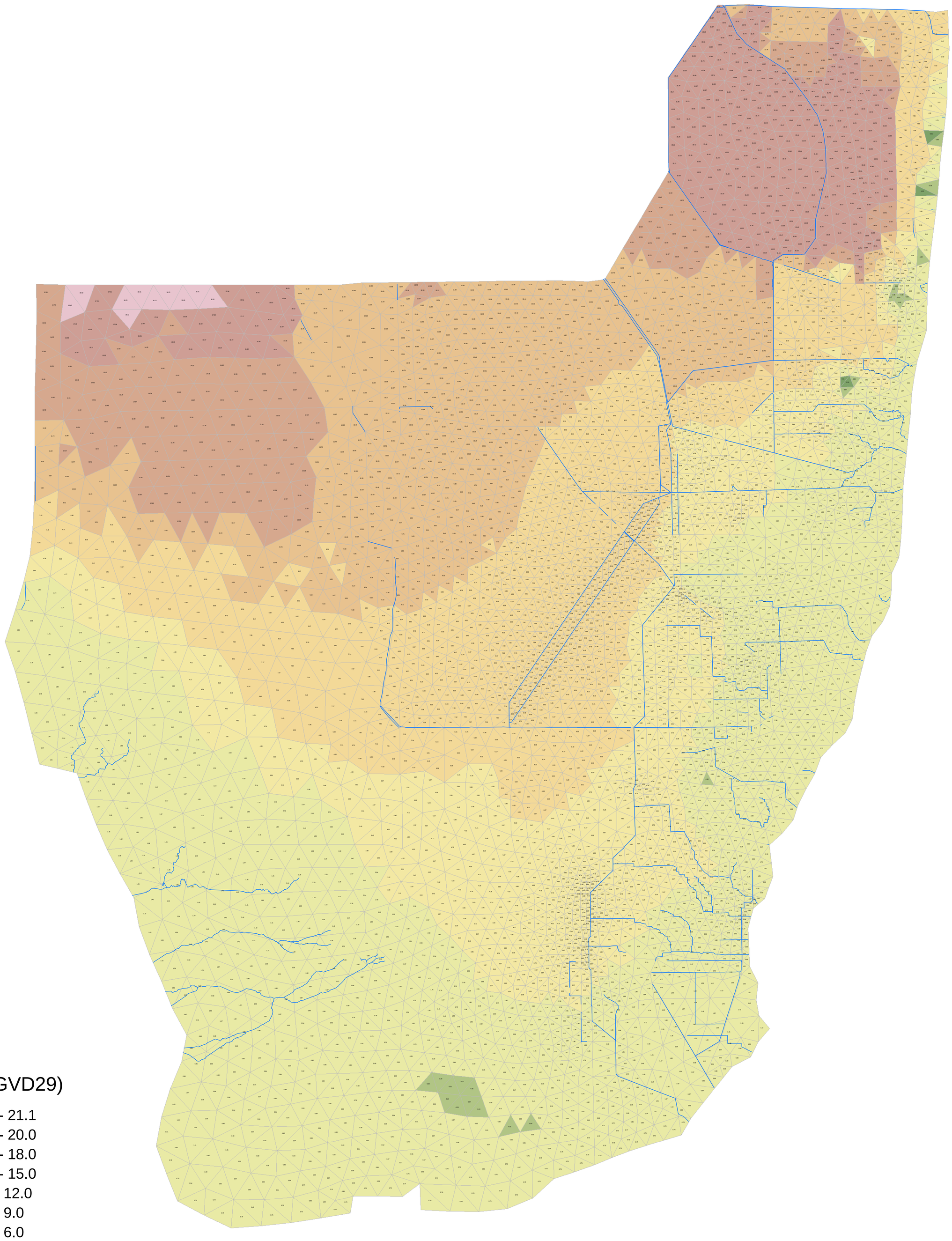
- 20.0 - 21.1
- 18.0 - 20.0
- 15.0 - 18.0
- 12.0 - 15.0
- 9.0 - 12.0
- 6.0 - 9.0
- 3.0 - 6.0
- 0.0 - 3.0
- -3.0 - 0.0
- -7.0 --3.0

0 5 10 20 30 40 Miles

Run Name: ALT4R
Run Date: February 27, 2013

Annual Average Stage

1989



Stage (ft NGVD29)

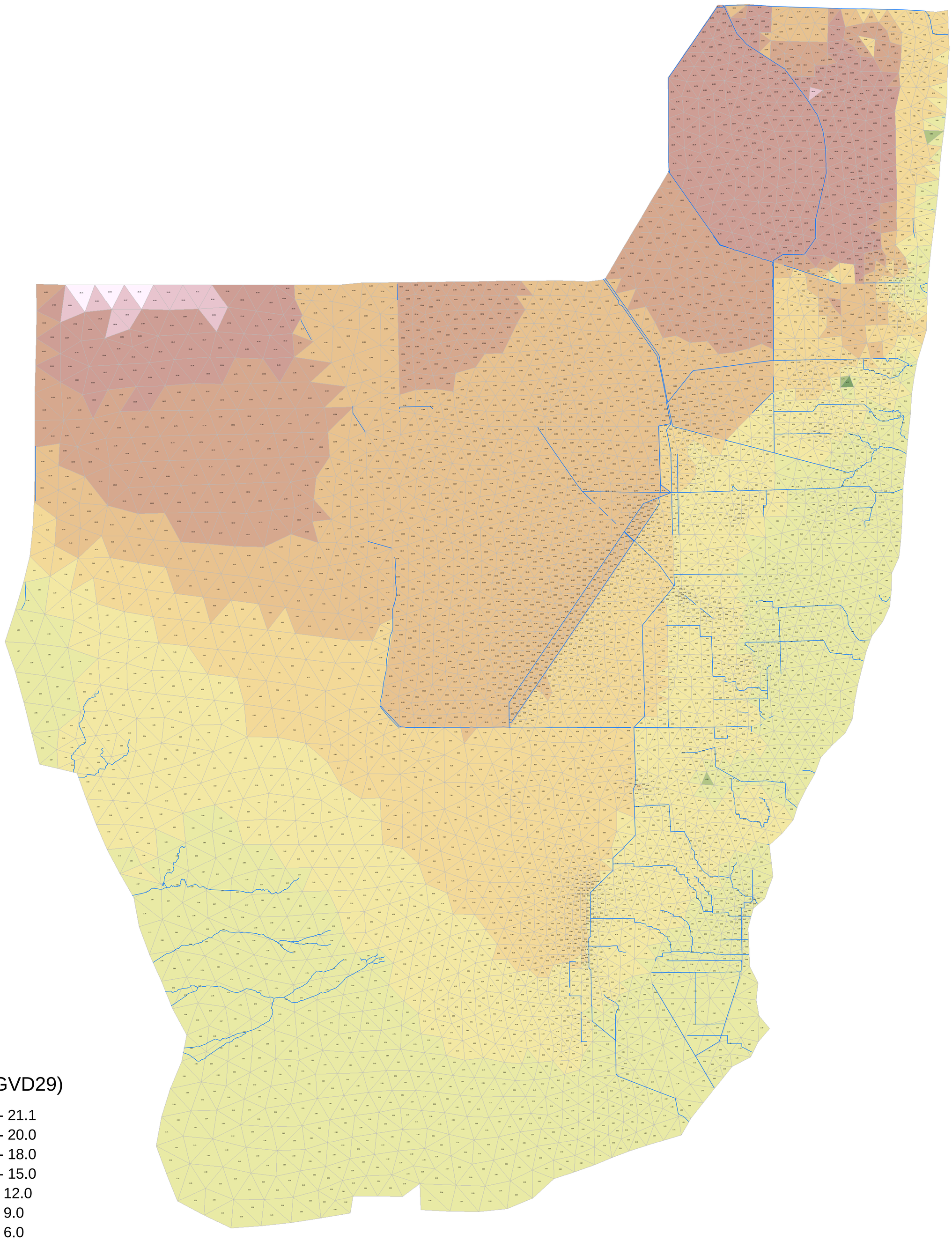
- 20.0 - 21.1
- 18.0 - 20.0
- 15.0 - 18.0
- 12.0 - 15.0
- 9.0 - 12.0
- 6.0 - 9.0
- 3.0 - 6.0
- 0.0 - 3.0
- -3.0 - 0.0
- -7.0 --3.0

0 5 10 20 30 40 Miles

Run Name: ALT4R
Run Date: February 27, 2013

Annual Average Stage

1995



Stage (ft NGVD29)

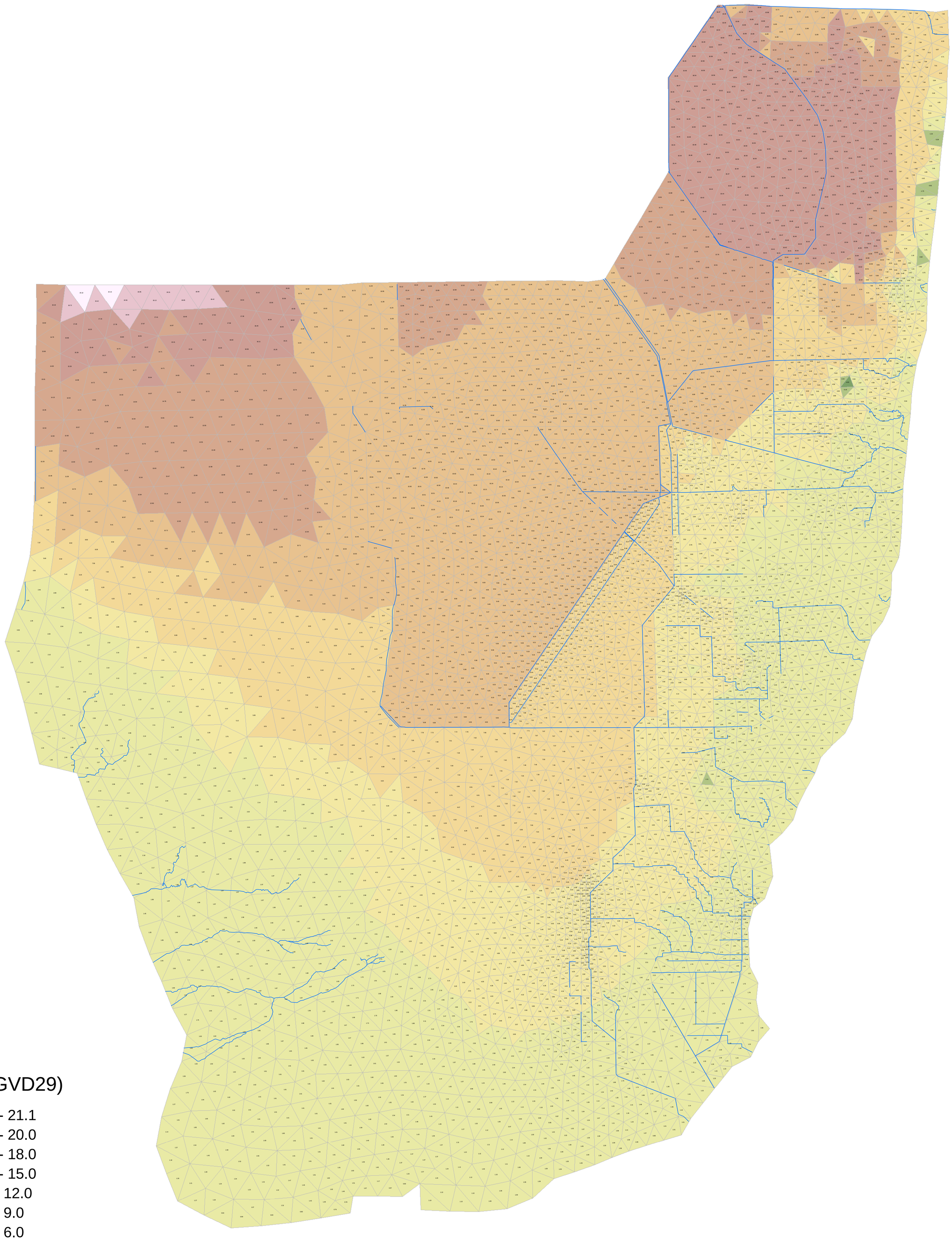
- 20.0 - 21.1
- 18.0 - 20.0
- 15.0 - 18.0
- 12.0 - 15.0
- 9.0 - 12.0
- 6.0 - 9.0
- 3.0 - 6.0
- 0.0 - 3.0
- -3.0 - 0.0
- -7.0 --3.0

0 5 10 20 30 40 Miles

Run Name: ALT4R
Run Date: February 27, 2013

Average Annual Stage

1965-2005



Stage (ft NGVD29)

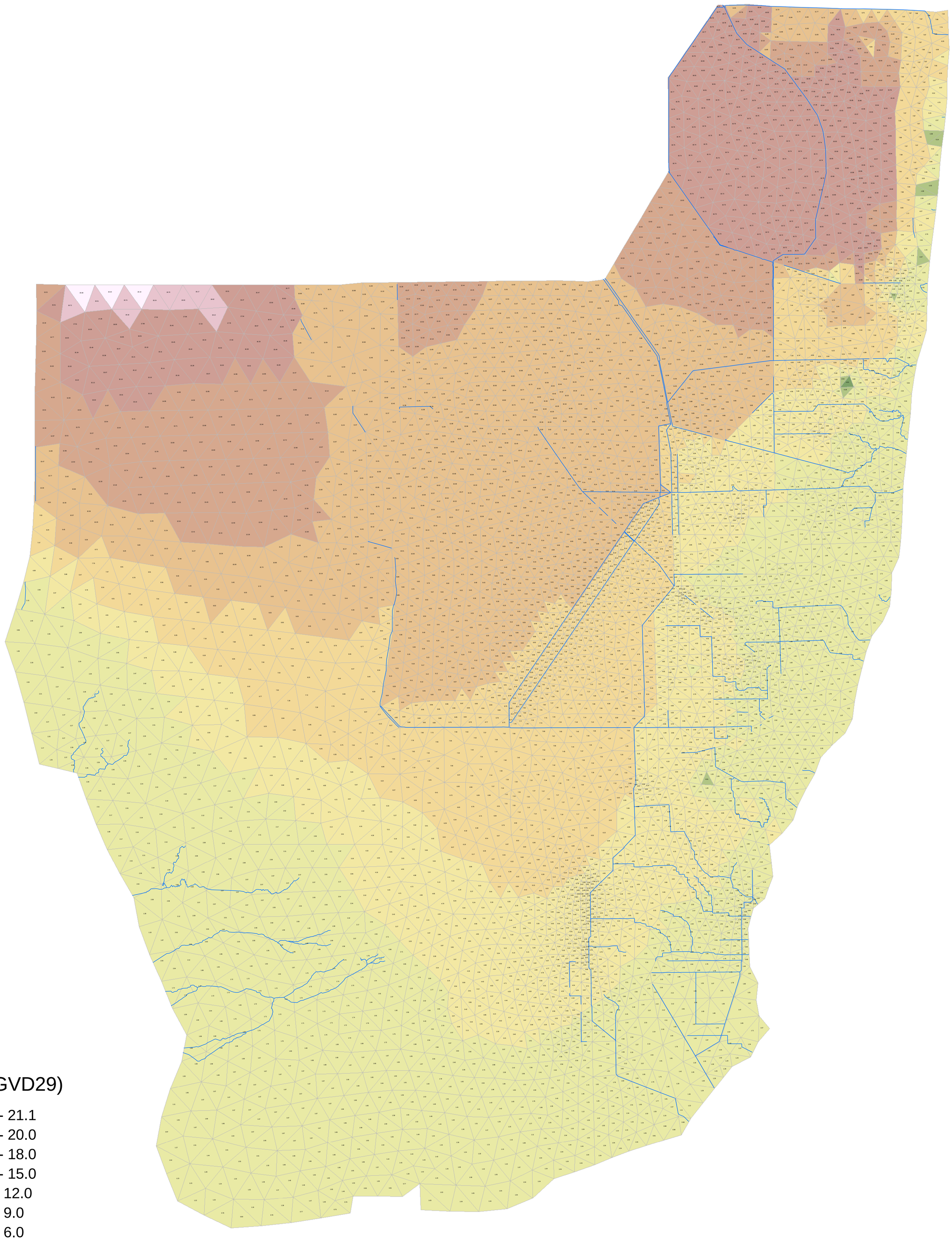
- 20.0 - 21.1
- 18.0 - 20.0
- 15.0 - 18.0
- 12.0 - 15.0
- 9.0 - 12.0
- 6.0 - 9.0
- 3.0 - 6.0
- 0.0 - 3.0
- -3.0 - 0.0
- -7.0 --3.0

0 5 10 20 30 40 Miles

Run Name: ALT4R
Run Date: February 27, 2013

Annual Average Stage

1978



Stage (ft NGVD29)

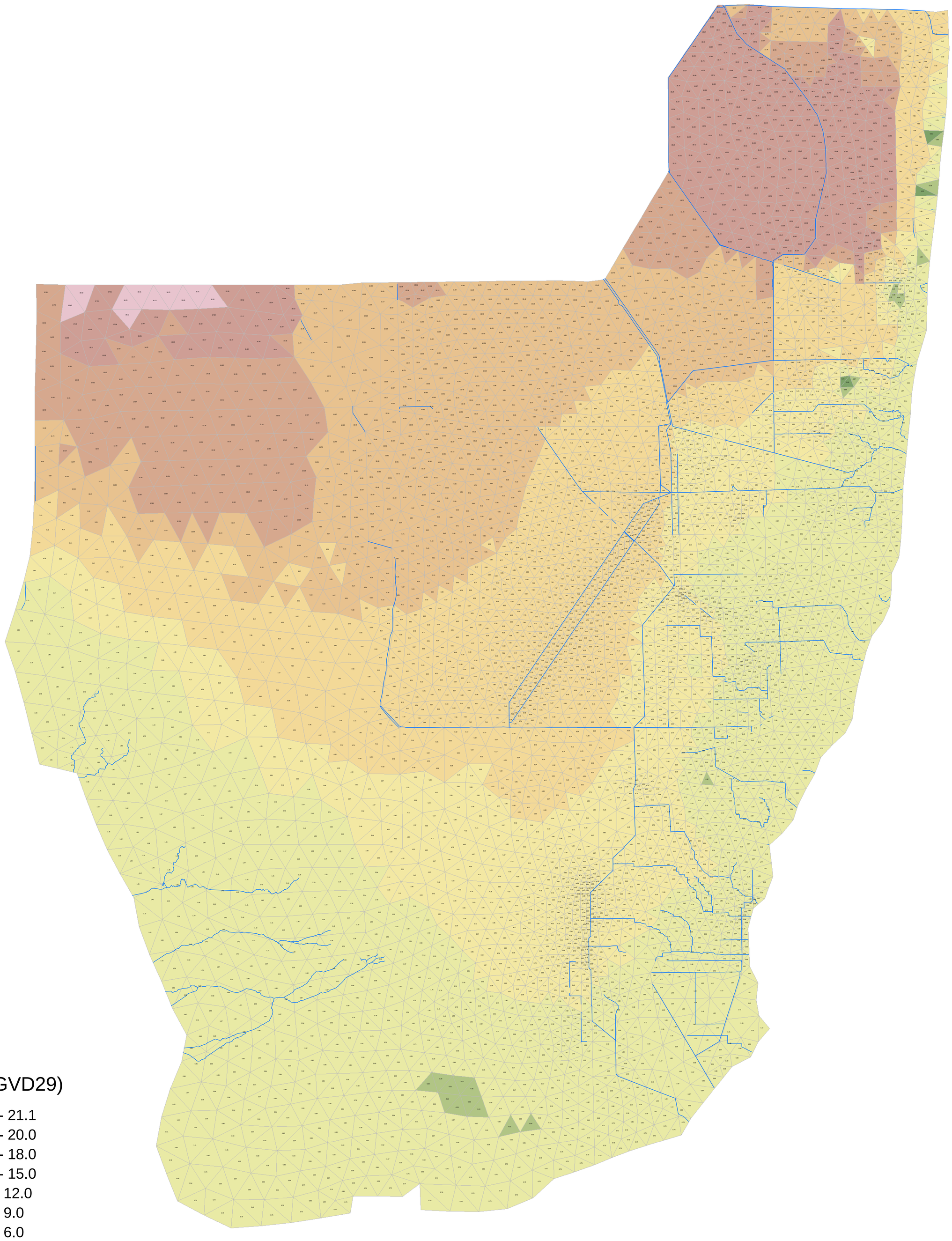
- 20.0 - 21.1
- 18.0 - 20.0
- 15.0 - 18.0
- 12.0 - 15.0
- 9.0 - 12.0
- 6.0 - 9.0
- 3.0 - 6.0
- 0.0 - 3.0
- -3.0 - 0.0
- -7.0 --3.0

0 5 10 20 30 40 Miles

Run Name: RSMGL ALT4R2
Run Date: 24 June 2013

Annual Average Stage

1989



Stage (ft NGVD29)

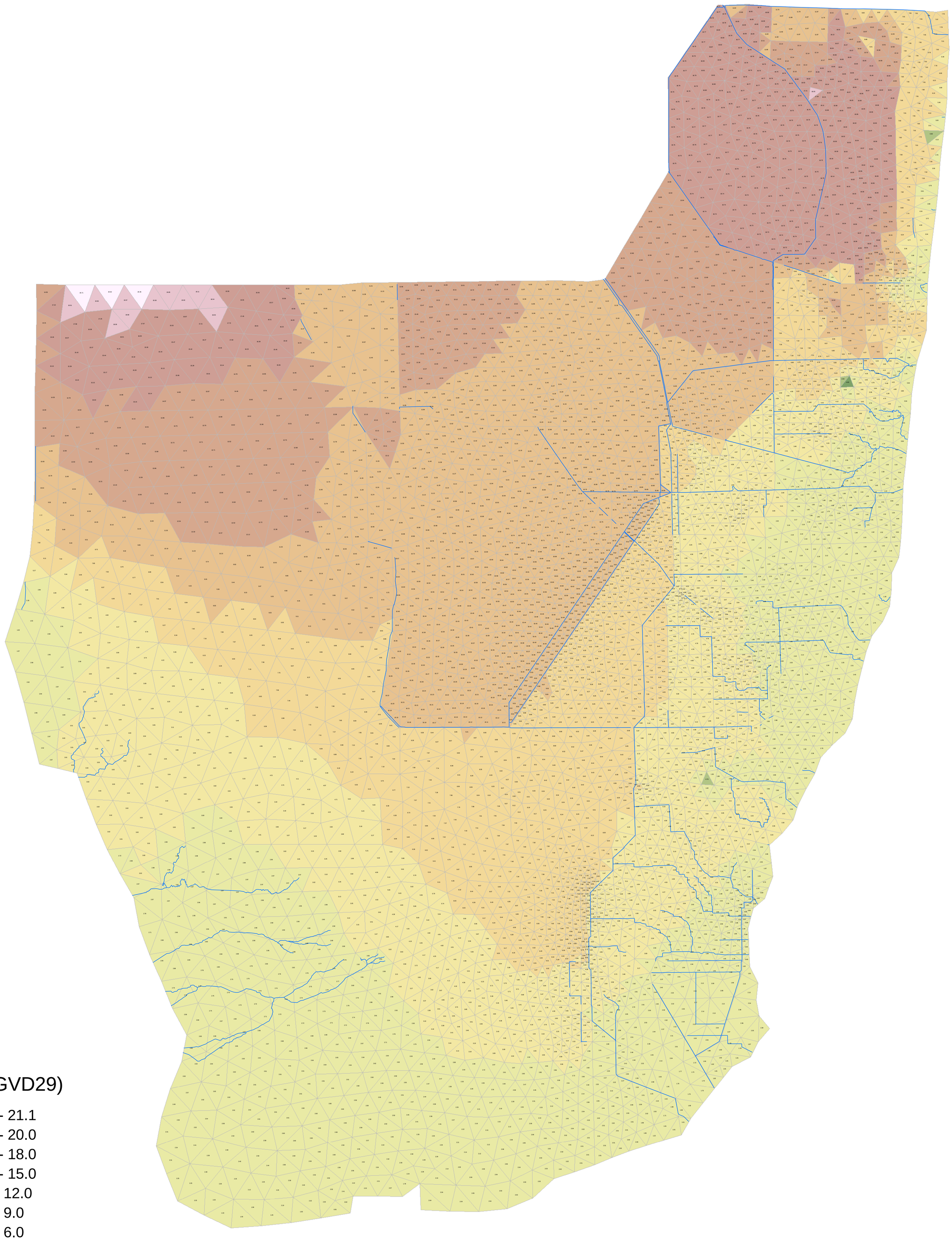
- 20.0 - 21.1
- 18.0 - 20.0
- 15.0 - 18.0
- 12.0 - 15.0
- 9.0 - 12.0
- 6.0 - 9.0
- 3.0 - 6.0
- 0.0 - 3.0
- -3.0 - 0.0
- -7.0 --3.0

0 5 10 20 30 40 Miles

Run Name: RSMGL ALT4R2
Run Date: 24 June 2013

Annual Average Stage

1995



Stage (ft NGVD29)

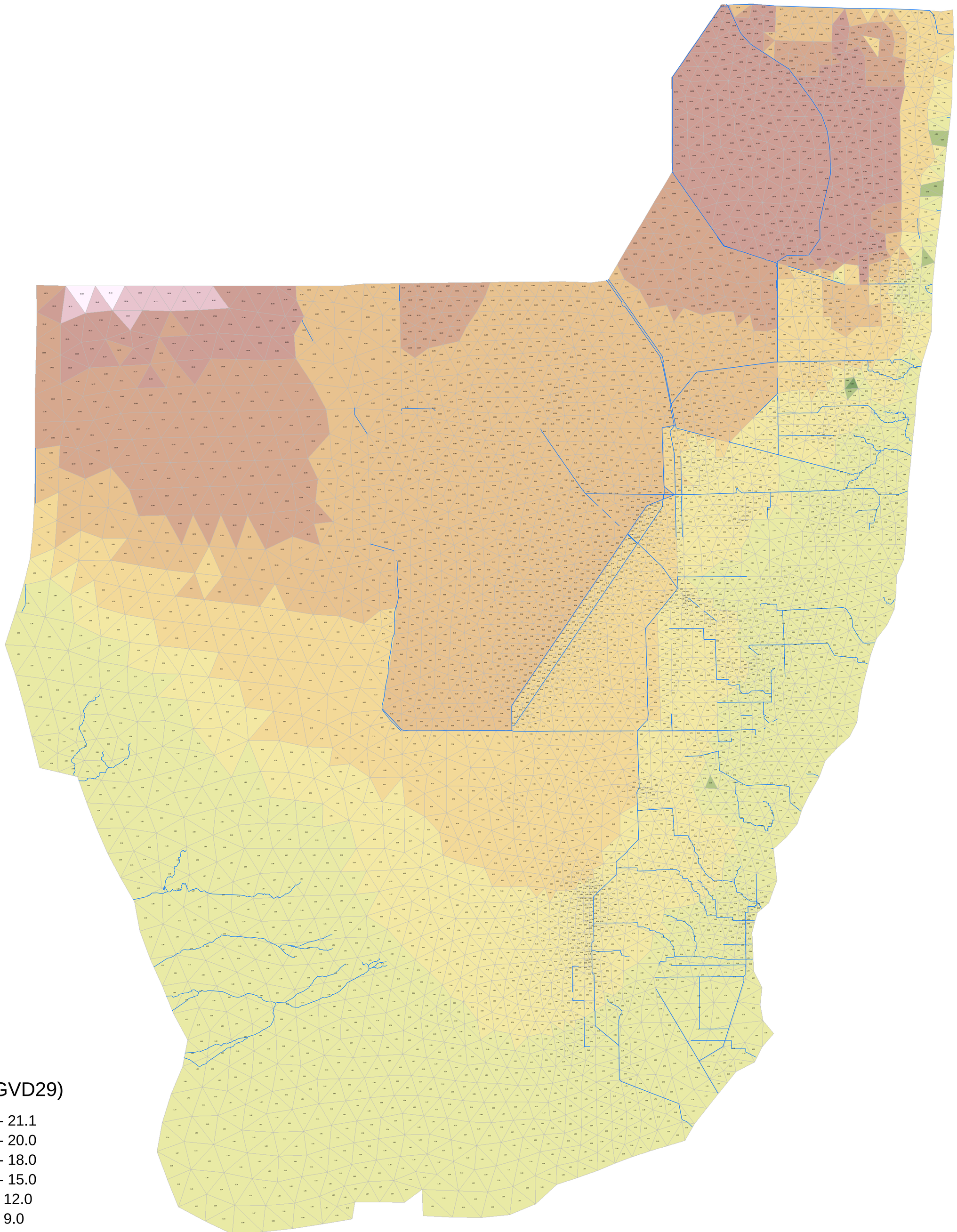
- 20.0 - 21.1
- 18.0 - 20.0
- 15.0 - 18.0
- 12.0 - 15.0
- 9.0 - 12.0
- 6.0 - 9.0
- 3.0 - 6.0
- 0.0 - 3.0
- -3.0 - 0.0
- -7.0 --3.0

0 5 10 20 30 40 Miles

Run Name: RSMGL ALT4R2
Run Date: 24 June 2013

Average Annual Stage

1965-2005



Stage (ft NGVD29)

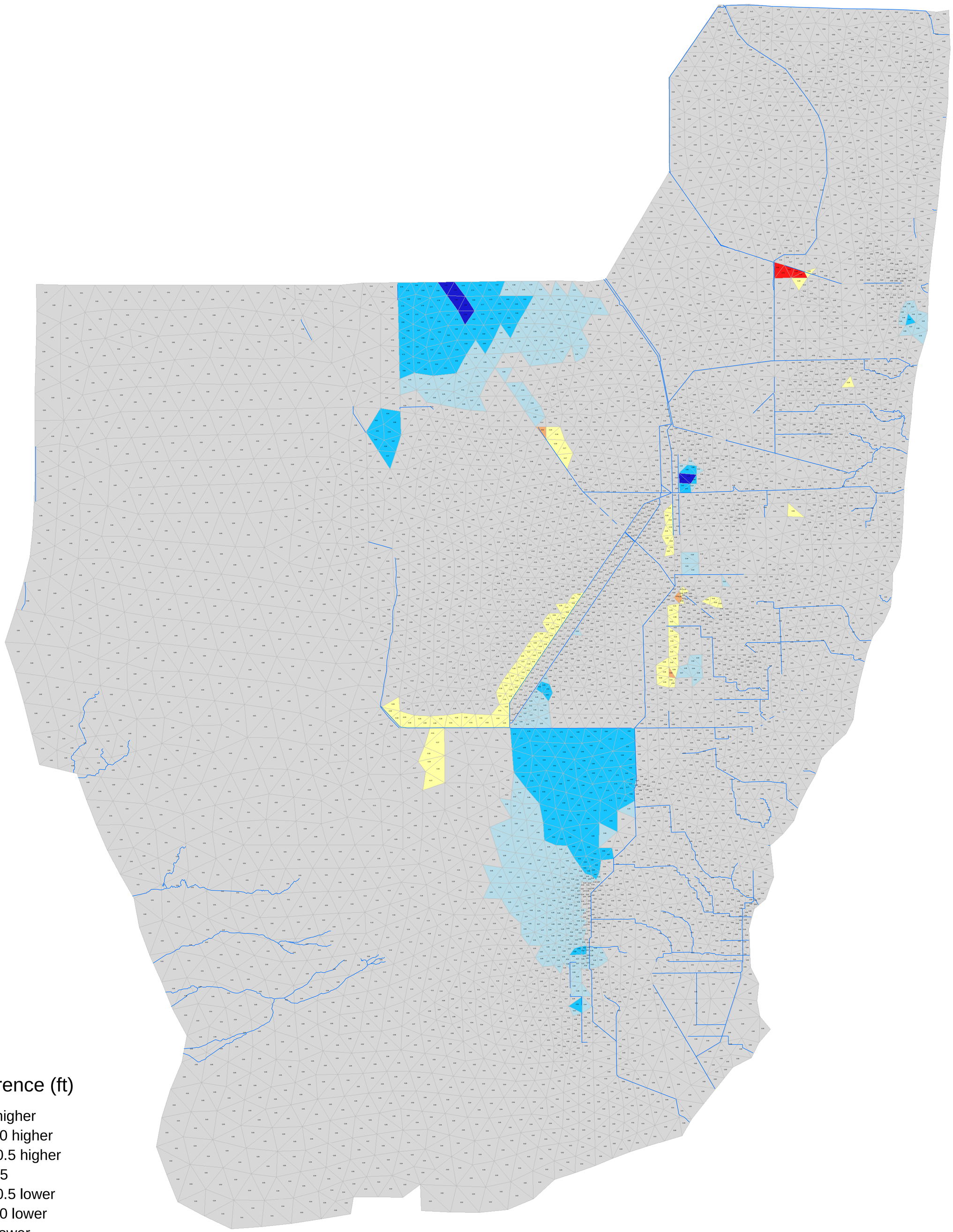
- 20.0 - 21.1
- 18.0 - 20.0
- 15.0 - 18.0
- 12.0 - 15.0
- 9.0 - 12.0
- 6.0 - 9.0
- 3.0 - 6.0
- 0.0 - 3.0
- -3.0 - 0.0
- -7.0 --3.0

0 5 10 20 30 40 Miles

Run Name: RSMGL ALT4R2
Run Date: 24 June 2013

Average Annual Stage Difference

1965-2005



Stage Difference (ft)

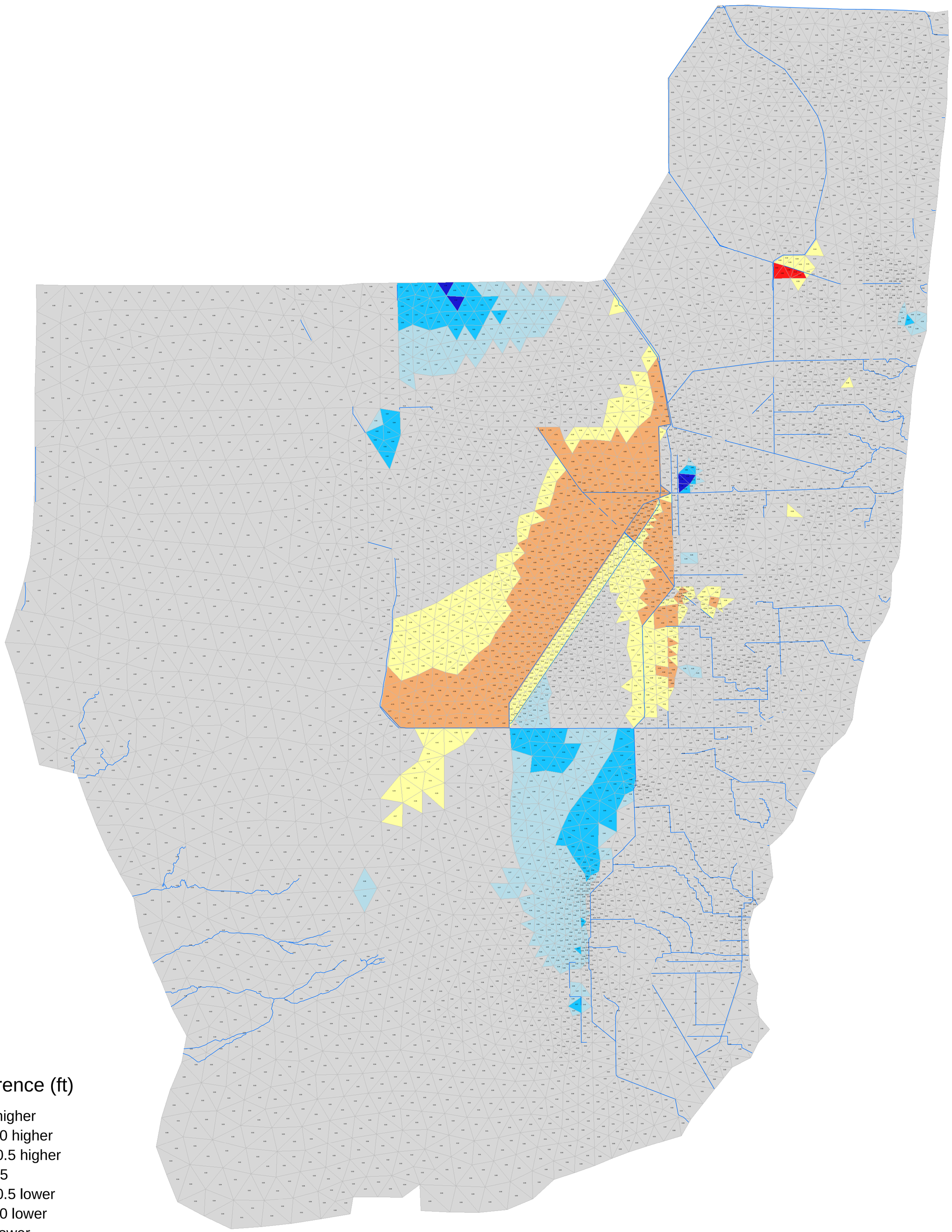
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

0 5 10 20 30 40 Miles

DRAFT
ALT4R2 - ECB
24 June 2013

Annual Average Stage Difference

1978



Stage Difference (ft)

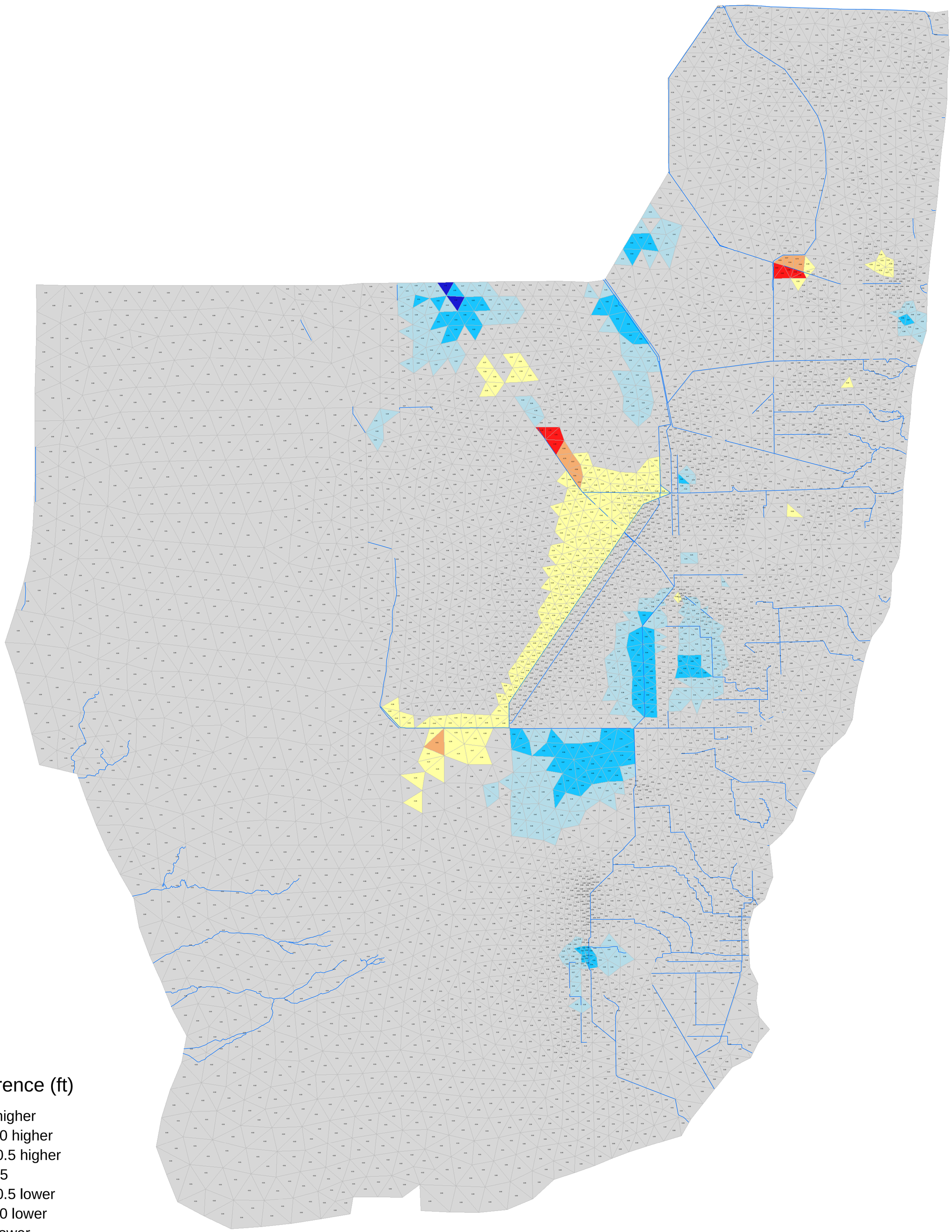
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

0 5 10 20 30 40 Miles

DRAFT
ALT4R2 - ECB
24 June, 2013

Annual Average Stage Difference

1989



Stage Difference (ft)

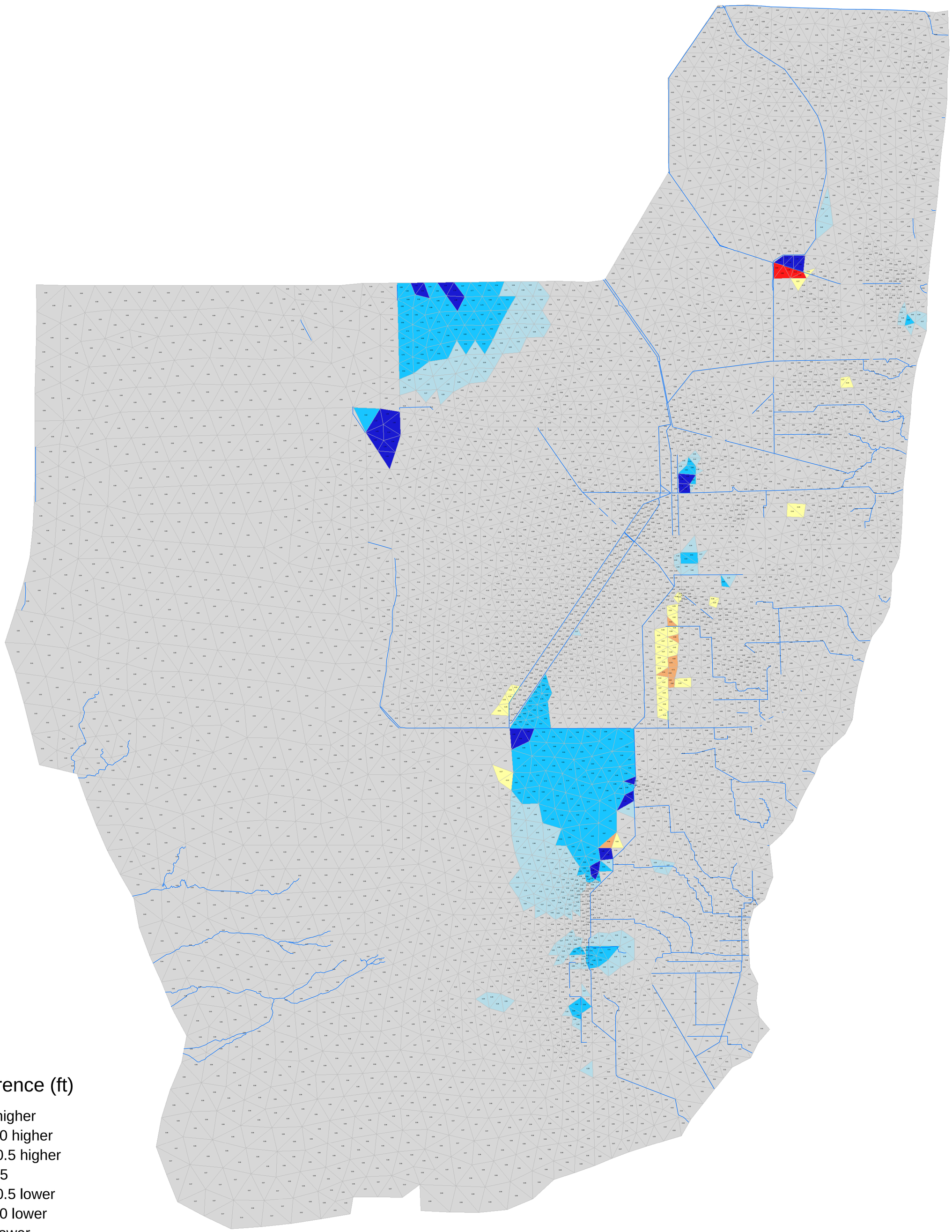
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

0 5 10 20 30 40 Miles

DRAFT
ALT4R2 - ECB
24 June, 2013

Annual Average Stage Difference

1995



Stage Difference (ft)

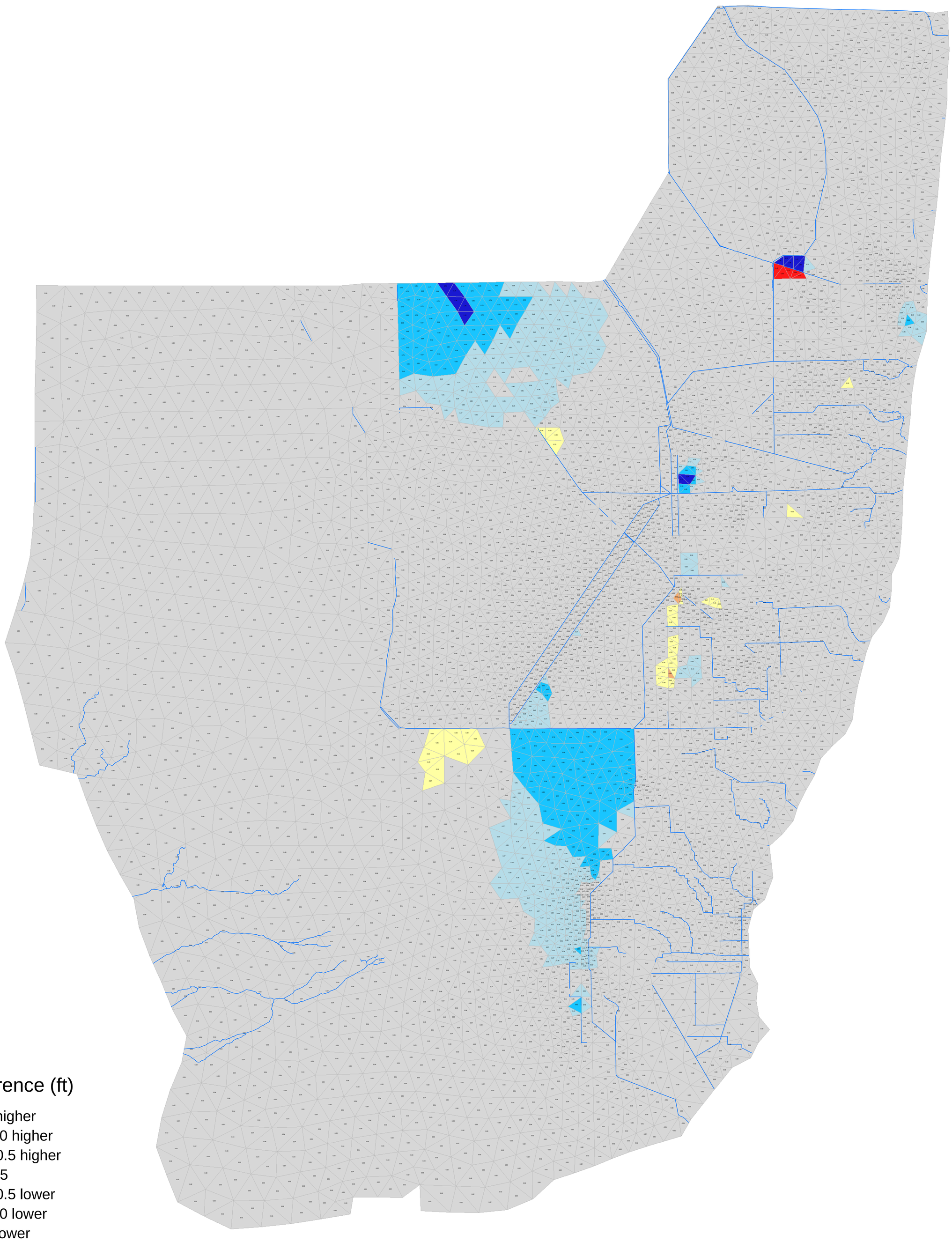
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

DRAFT
ALT4R2 - ECB
24 June, 2013

0 5 10 20 30 40 Miles

Average Annual Stage Difference

1965-2005



Stage Difference (ft)

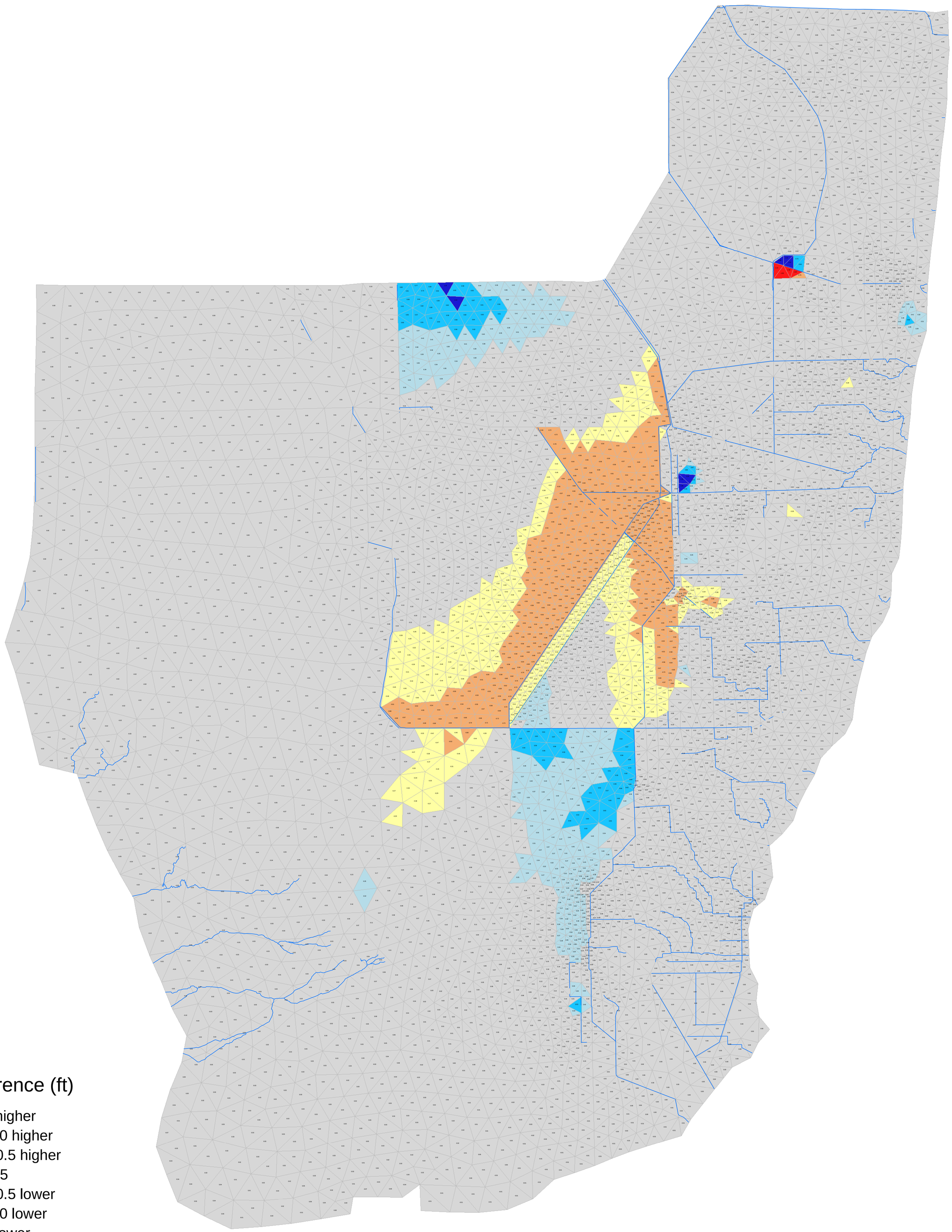
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

0 5 10 20 30 40 Miles

DRAFT
ALT4R2 - 2012EC
24 June, 2013

Annual Average Stage Difference

1978



Stage Difference (ft)

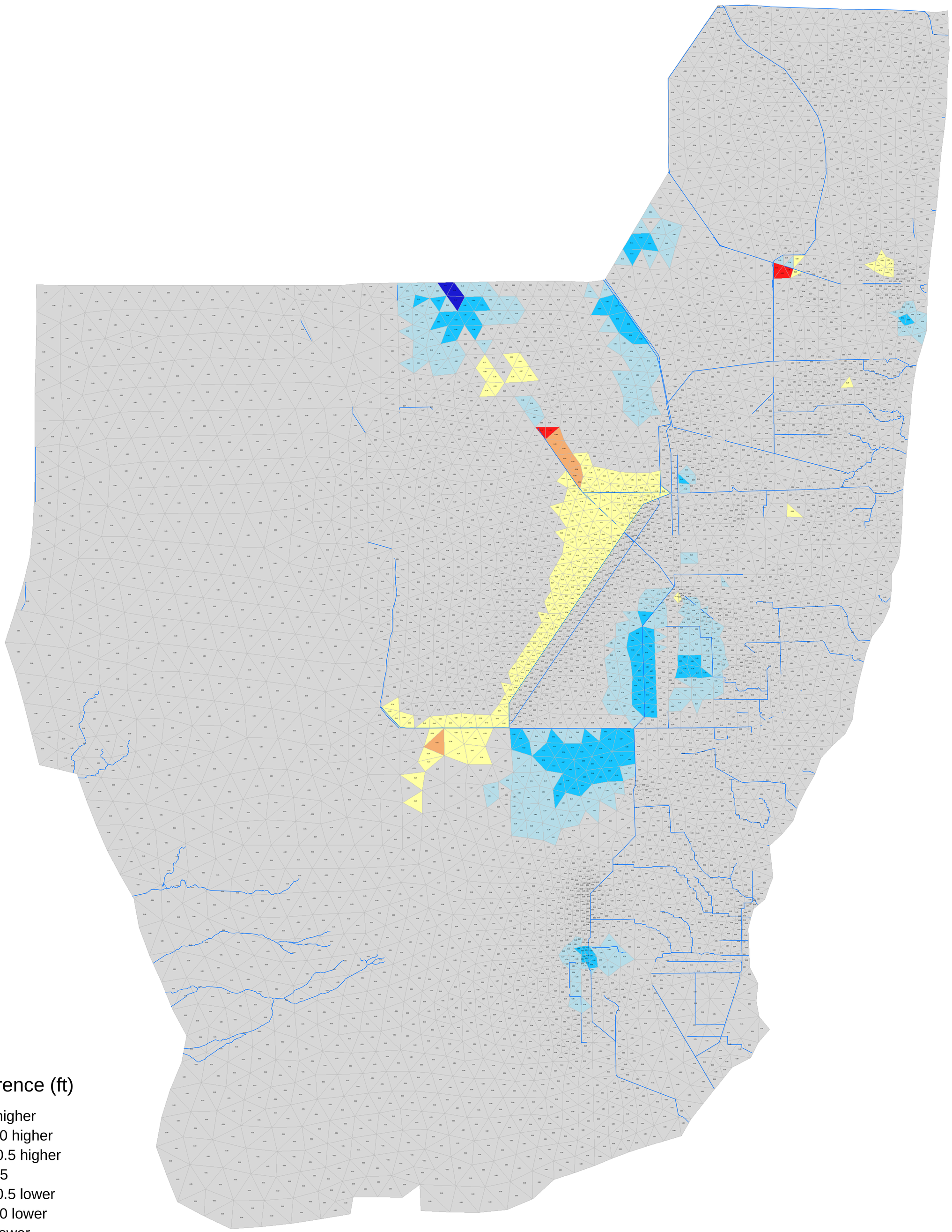
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

0 5 10 20 30 40 Miles

DRAFT
ALT4R2 - 2012EC
24 June, 2013

Annual Average Stage Difference

1989



Stage Difference (ft)

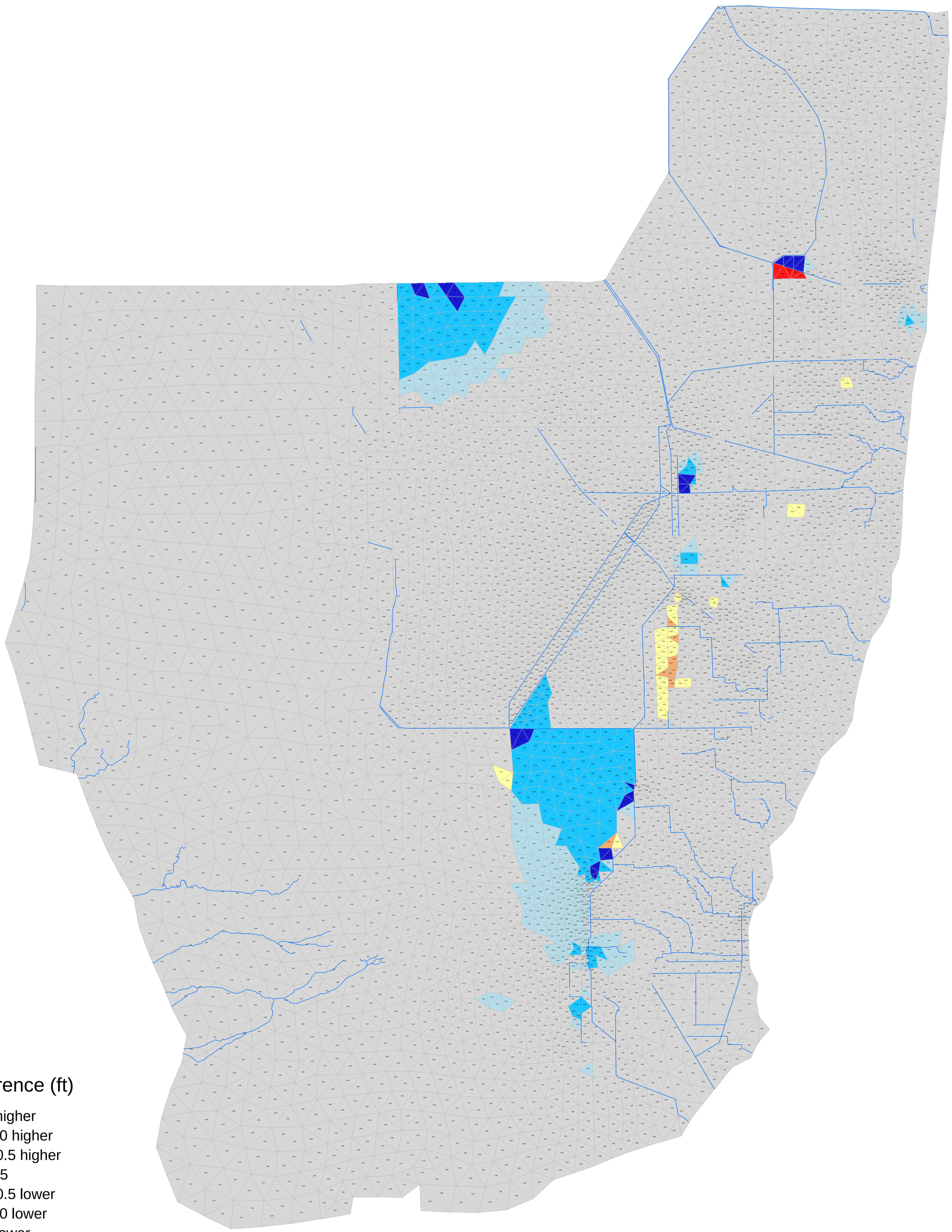
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

0 5 10 20 30 40 Miles

DRAFT
ALT4R2 - 2012EC
24 June 2013

Annual Average Stage Difference

1995



Stage Difference (ft)

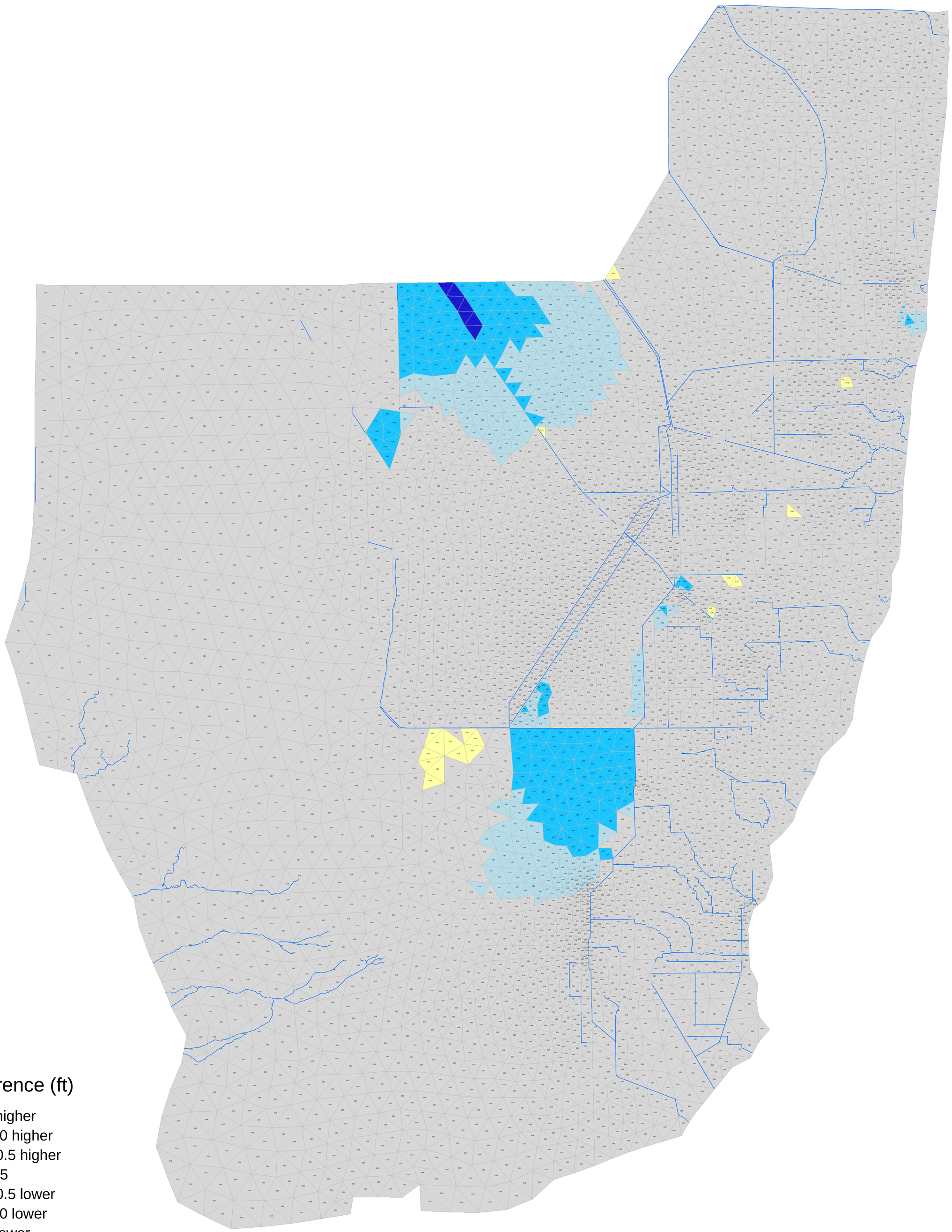
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

0 5 10 20 30 40 Miles

DRAFT
ALT4R2 - 2012EC
24 June 2013

Average Annual Stage Difference

1965-2005



Stage Difference (ft)

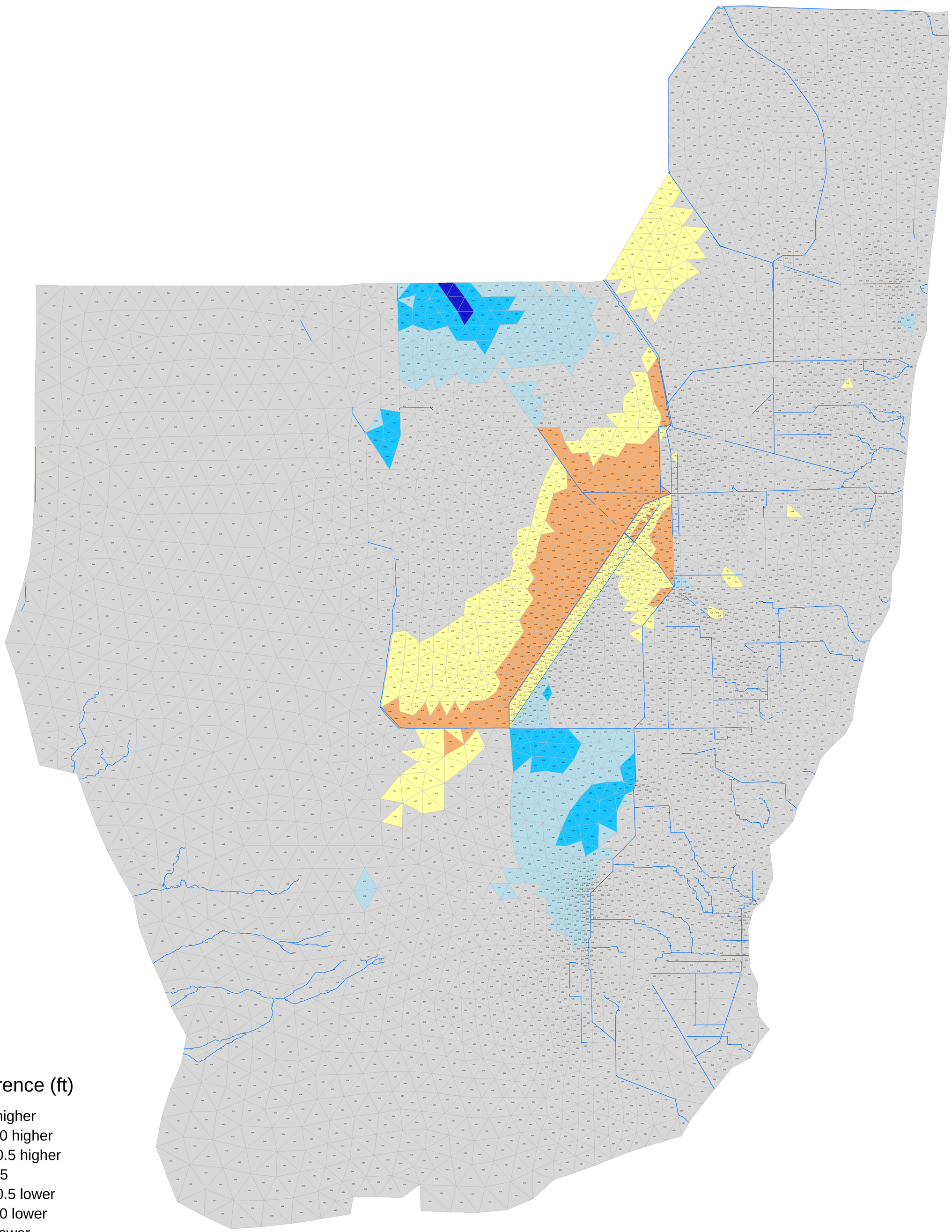
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

DRAFT
ALT4R2 - FWO
24 June, 2013

0 5 10 20 30 40 Miles

Annual Average Stage Difference

1978



Stage Difference (ft)

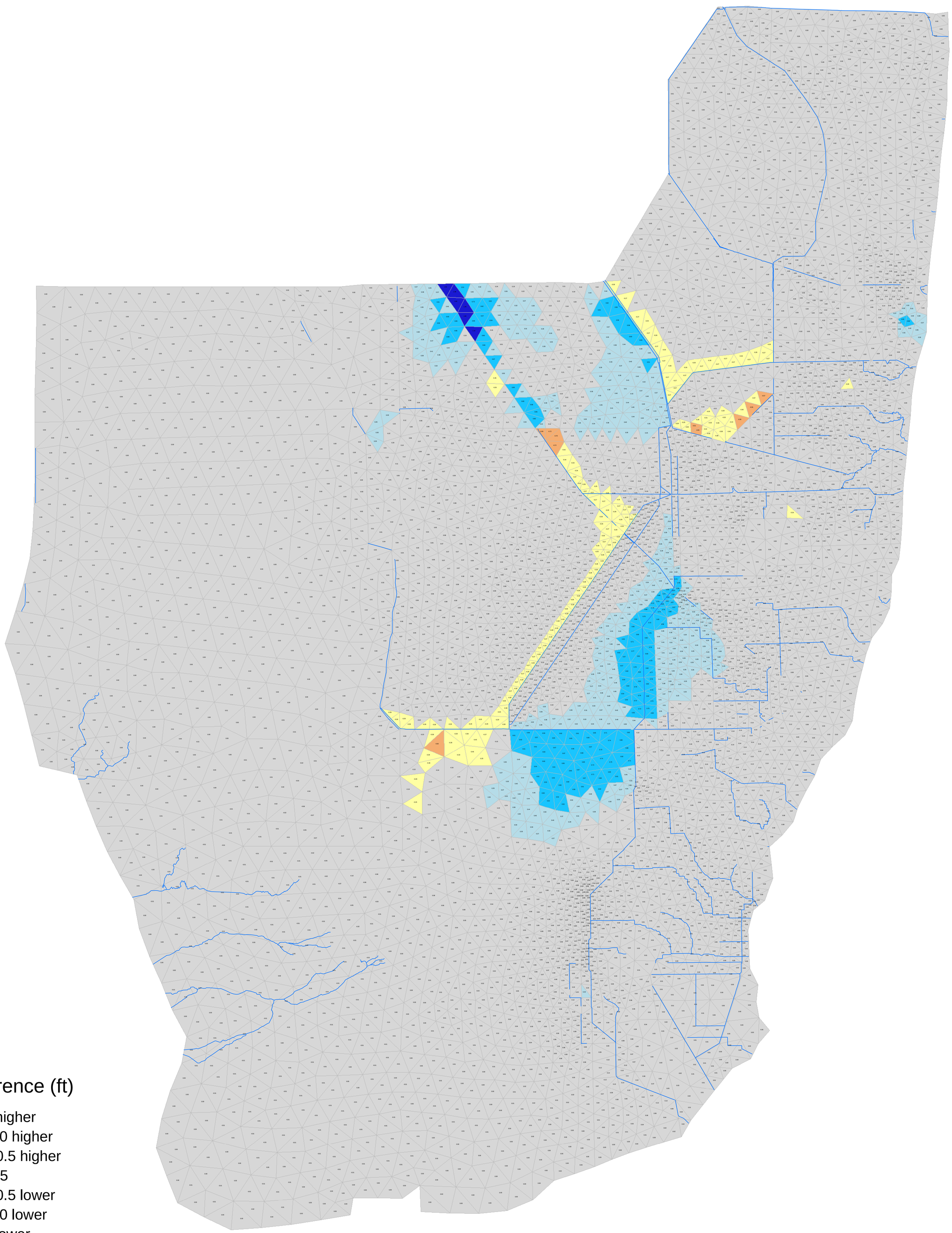
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

DRAFT
ALT4R2 - FWO
24 June, 2013

0 5 10 20 30 40 Miles

Annual Average Stage Difference

1989



Stage Difference (ft)

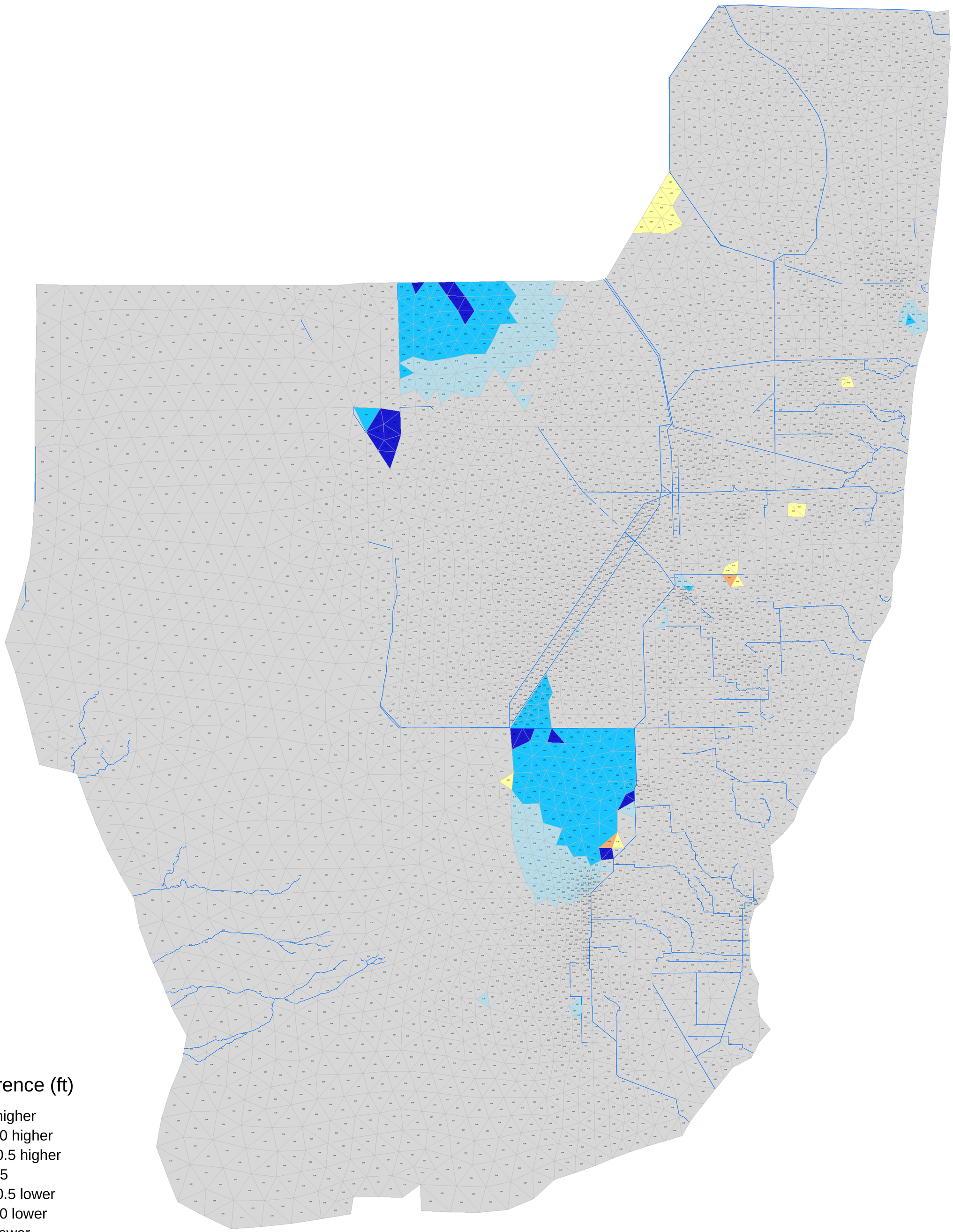
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

DRAFT
ALT4R2 - FWO
24 June, 2013

0 5 10 20 30 40 Miles

Annual Average Stage Difference

1995



Stage Difference (ft)

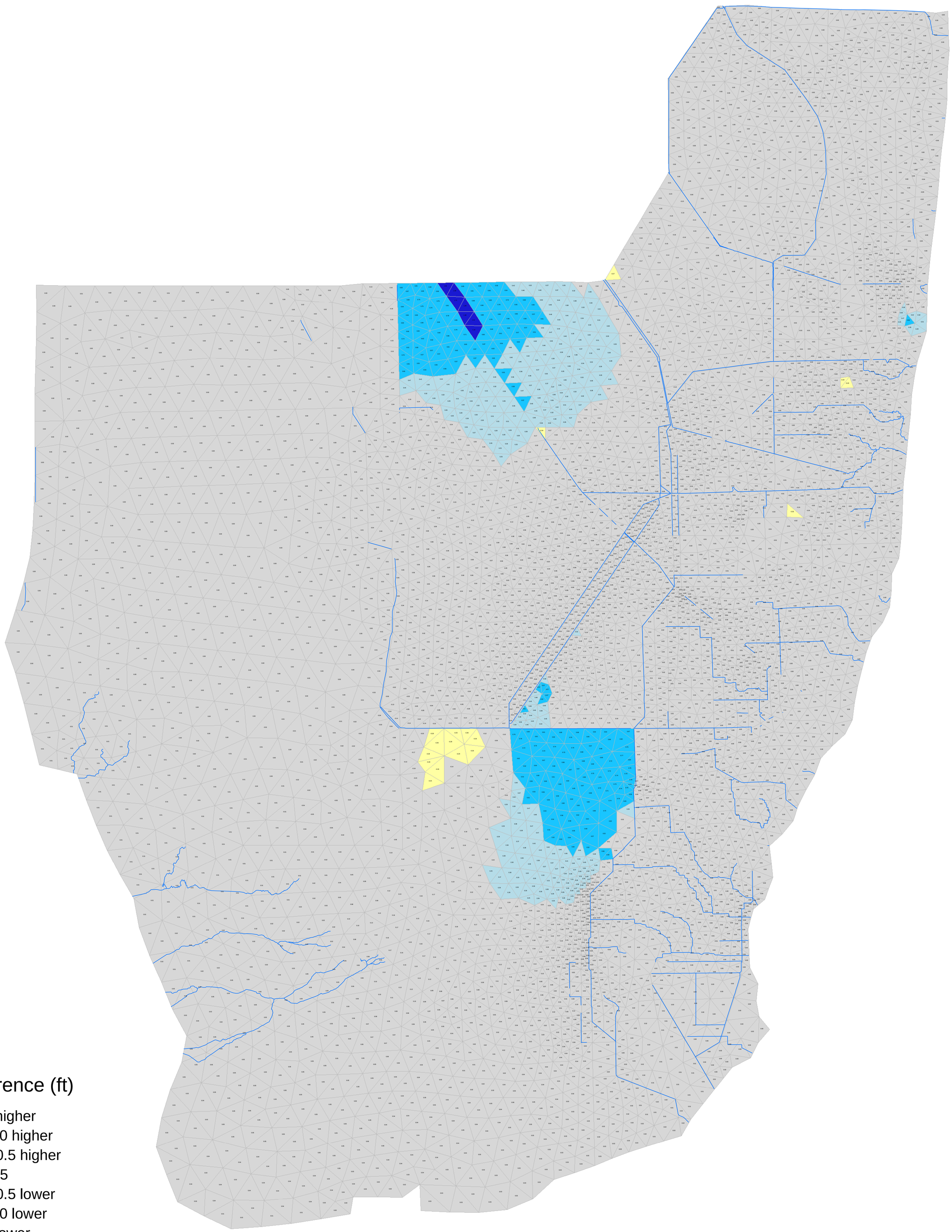
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

0 5 10 20 30 40 Miles

DRAFT
ALT4R2 - FWO
24 June, 2013

Average Annual Stage Difference

1965-2005



Stage Difference (ft)

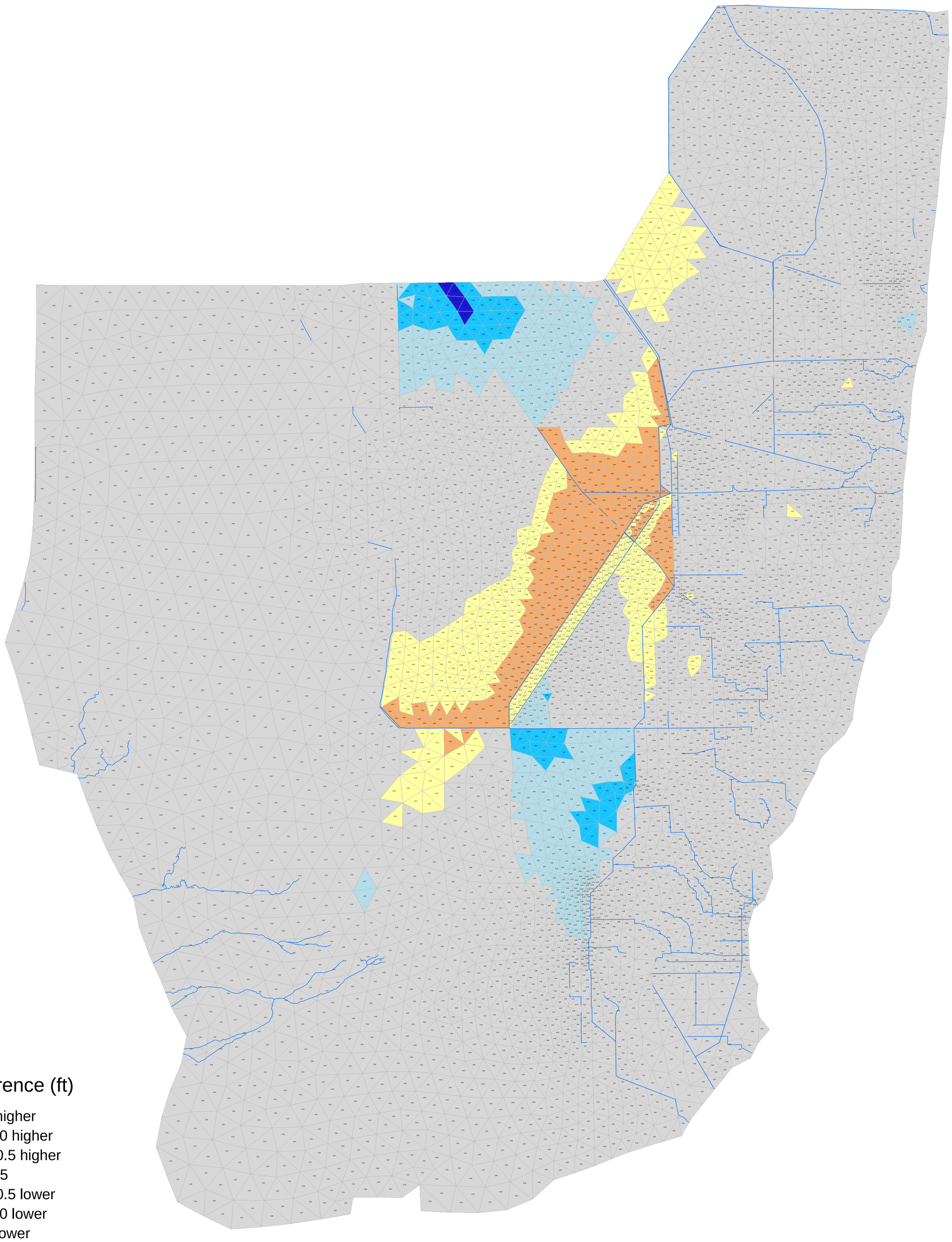
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

DRAFT
ALT4R2 - IORBL1
24 June, 2013

0 5 10 20 30 40 Miles

Annual Average Stage Difference

1978



Stage Difference (ft)

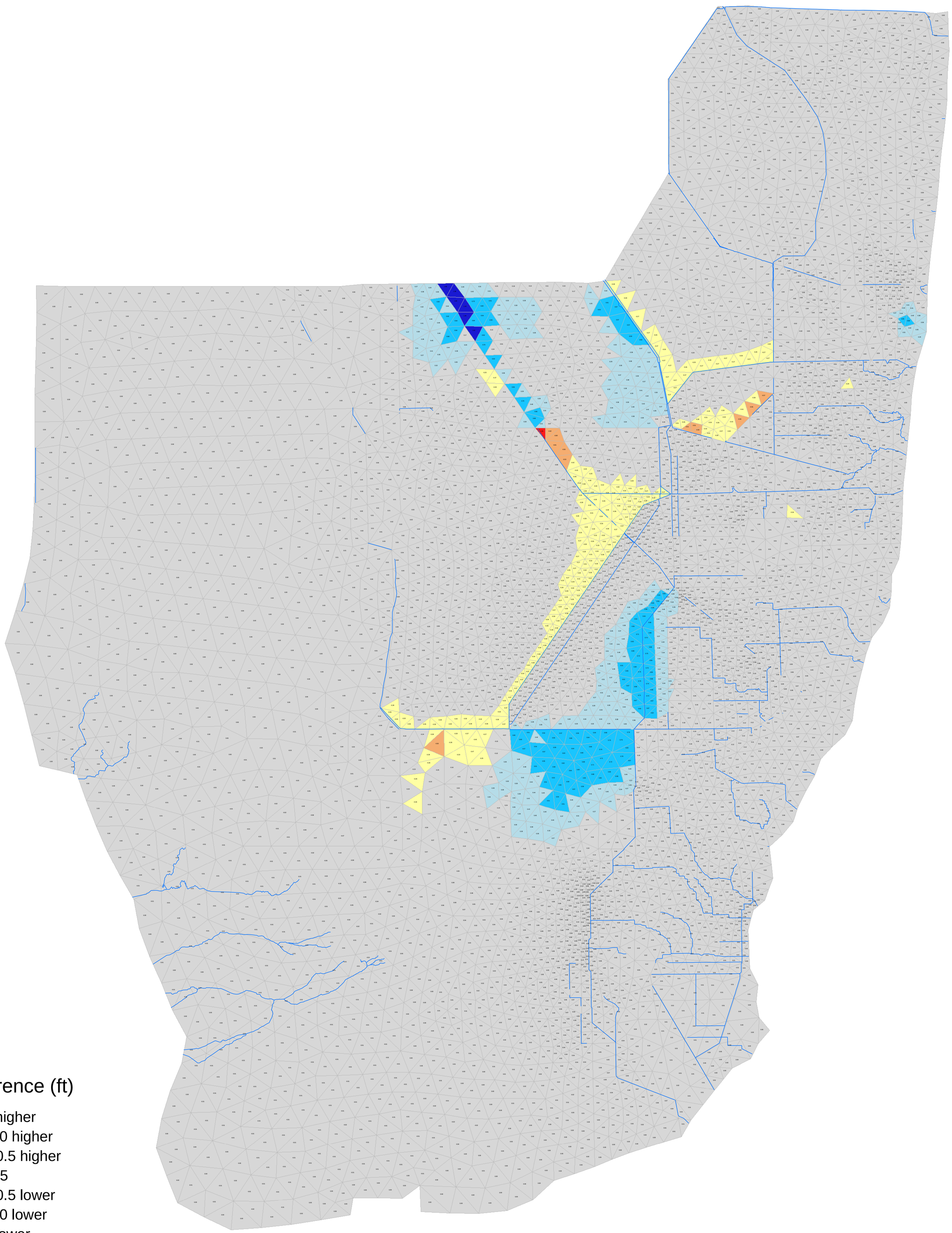
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

0 5 10 20 30 40 Miles

DRAFT
ALT4R2 - IORBL1
24 June, 2013

Annual Average Stage Difference

1989



Stage Difference (ft)

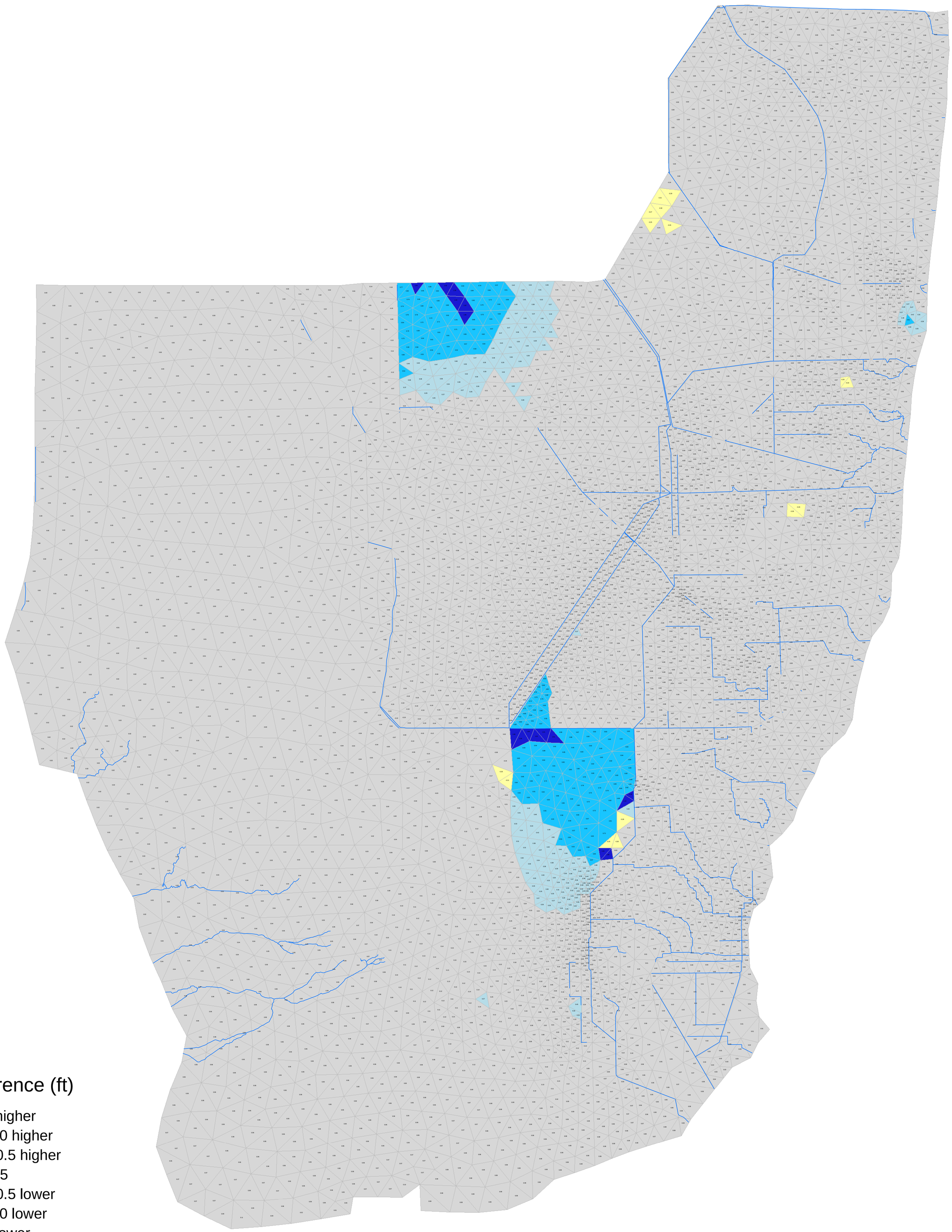
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

DRAFT
ALT4R2 - IORBL1
24 June 2013

0 5 10 20 30 40 Miles

Annual Average Stage Difference

1995



Stage Difference (ft)

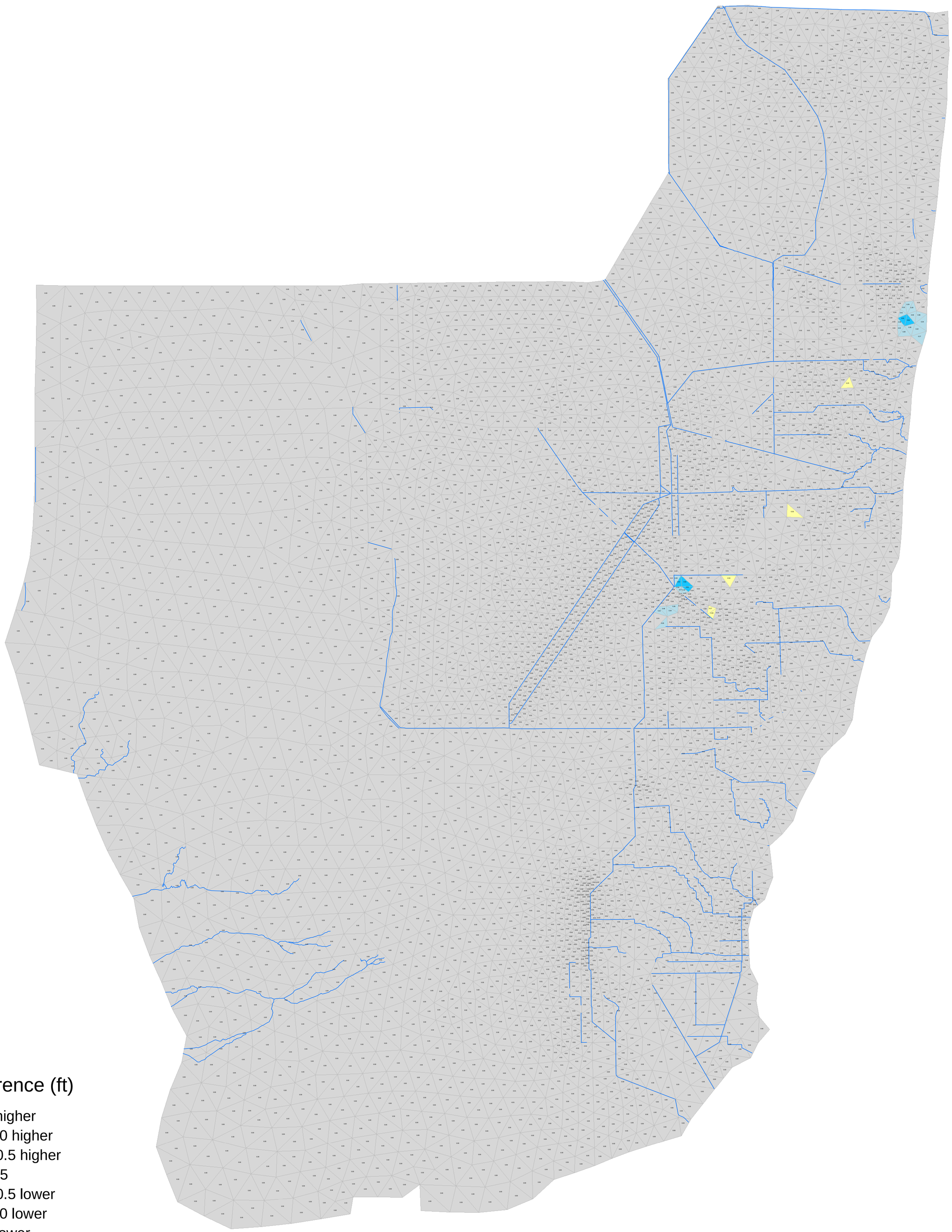
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

0 5 10 20 30 40 Miles

DRAFT
ALT4R2 - IORBL1
24 June, 2013

Average Annual Stage Difference

1965-2005



Stage Difference (ft)

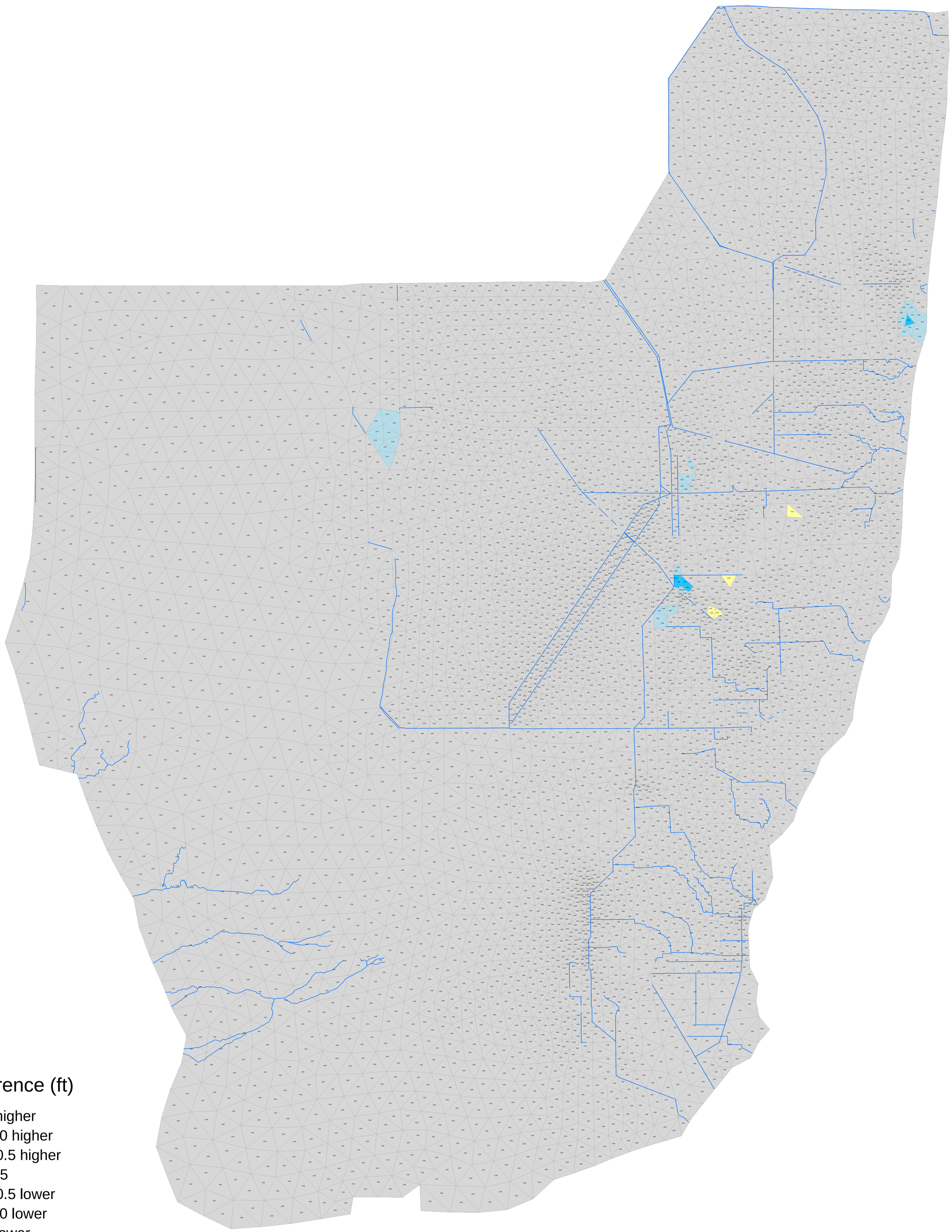
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

0 5 10 20 30 40 Miles

DRAFT
ALT4R2 - ALT4R
24 June 2013

Annual Average Stage Difference

1978



Stage Difference (ft)

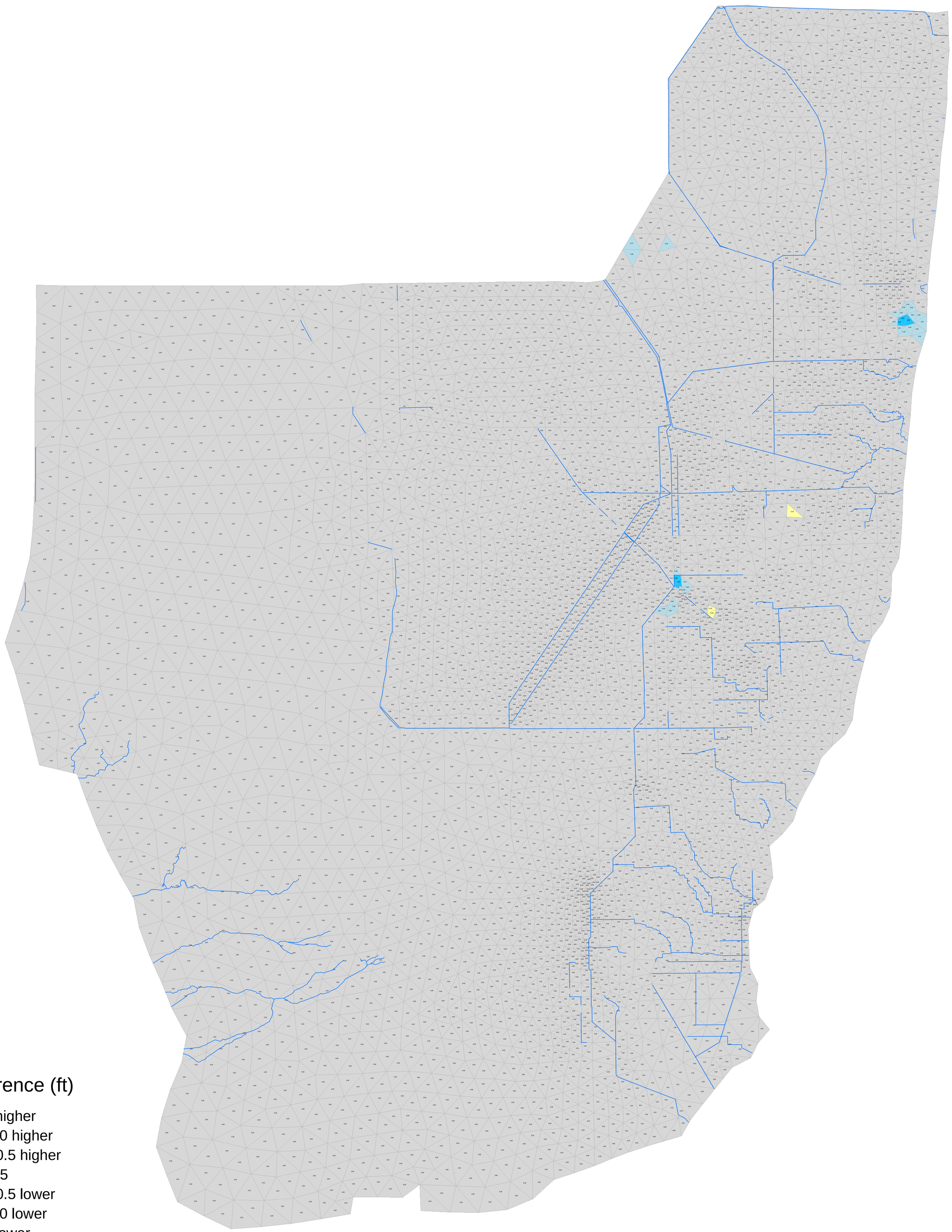
- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

DRAFT
ALT4R2 - ALT4R
24 June 2013

0 5 10 20 30 40 Miles

Annual Average Stage Difference

1989



Stage Difference (ft)

- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

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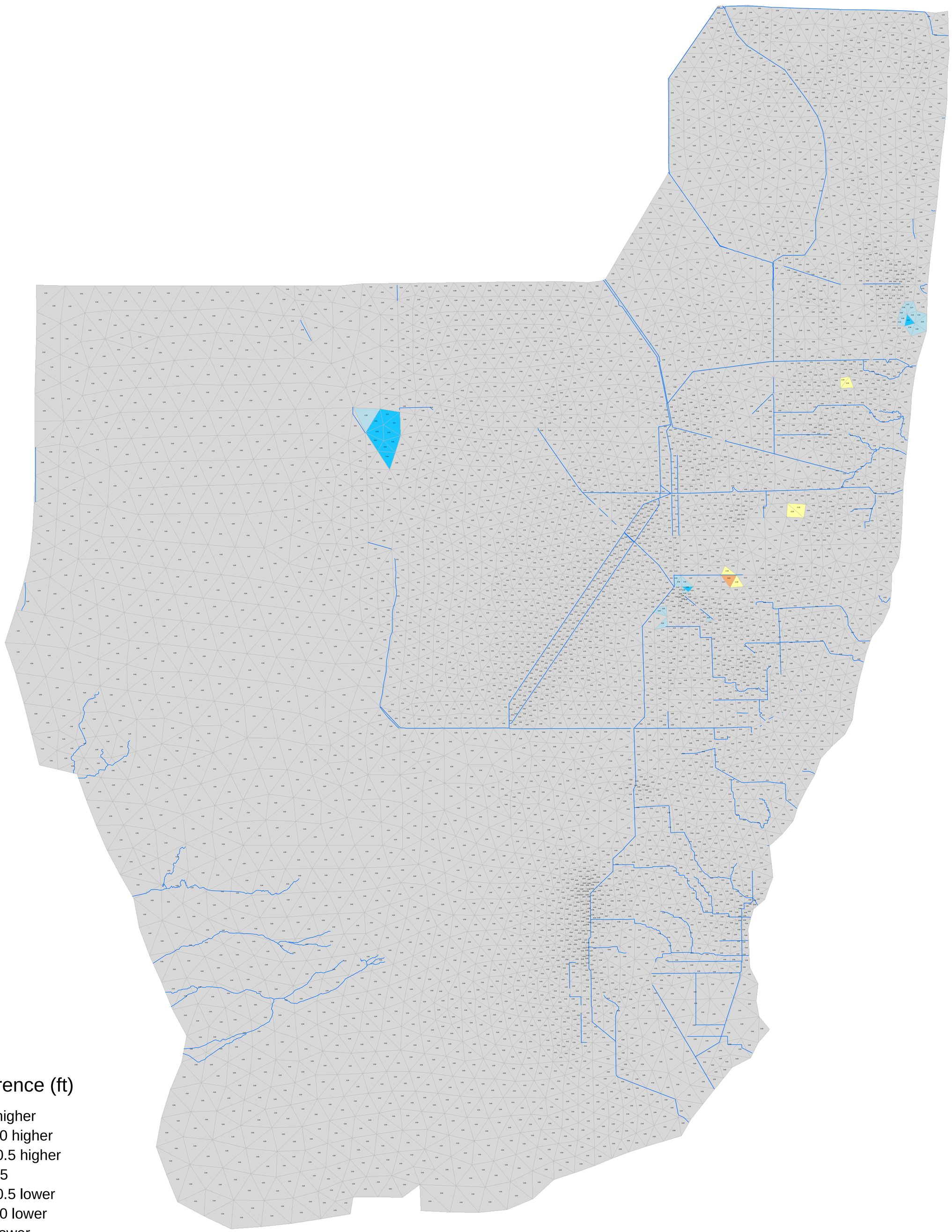
ALT4R2 - ALT4R
24 June 2013

0 5 10 20 30 40 Miles

Annual Average Stage Difference

1995



Stage Difference (ft)

- >1.0 higher
- 0.5-1.0 higher
- 0.25-0.5 higher
- +- 0.25
- 0.25-0.5 lower
- 0.5-1.0 lower
- >1.0 lower

DRAFT
ALT4R2 - ALT4R
24 June 2013

0 5 10 20 30 40 Miles

ANNEX A-3: MODEL DOCUMENTATION REPORTS

SFWMD Hydrologic and Environmental Systems Modeling
USACE Jacksonville District, Interagency Modeling Center
February 2014

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Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Central Everglades Planning Project (CEPP) Screening Models Documentation Report

IMC MSR 368 **February 14, 2014**

1.0 Overview

Identification

The Central Everglades Planning Project (CEPP) is an expedited planning effort undertaken as part of the overall Comprehensive Everglades Restoration Plan (CERP), a program led by the United States Army Corps of Engineers (USACE) with the South Florida Water Management District (SFWMD) as local sponsor. The project worked throughout 2012 and 2013 to develop a Project Implementation Report (PIR) that combines planning and design activities for three primary areas of interest in the south Florida system as follows: 1) Storage & water treatment facilities in the Everglades Agricultural Area, 2) Decompartmentalization of levees within the Everglades Protection Area (EPA) and 3) Levee seepage management features along the Everglades / urban boundary in southeastern Florida. Modeling support to the CEPP effort was provided by a team comprised of modelers from the Hydrologic & Environmental Systems Modeling Section of the SFWMD and the Interagency Modeling Center (IMC), with direct support also provided by the USACE and Everglades National Park of the Department of the Interior (DOI). Modeling workflow and coordination were performed in a manner consistent with the procedures outlined in IMC Modeling Services Request (MSR) 368 and the CEPP Modeling Strategy (**SFWMD, 2012a**).

Scope and Objectives

Modeling support for CEPP focused on working with the larger project planning team and other interested parties to formulate and test project features leading to the ultimate identification and refinement of a tentatively selected plan (TSP). Modeling products were developed at the appropriate level of detail to support feature screening and detailed representation of project features and to provide information to all necessary evaluations required for plan development and documentation in the PIR. The project plan formulation framework is shown in **Figure 1.1** and illustrates a spatially determined workflow (moving north to south through the south Florida system) utilizing initial screening followed by detailed evaluation to identify final project planning alternatives and ultimately a TSP for the effort.

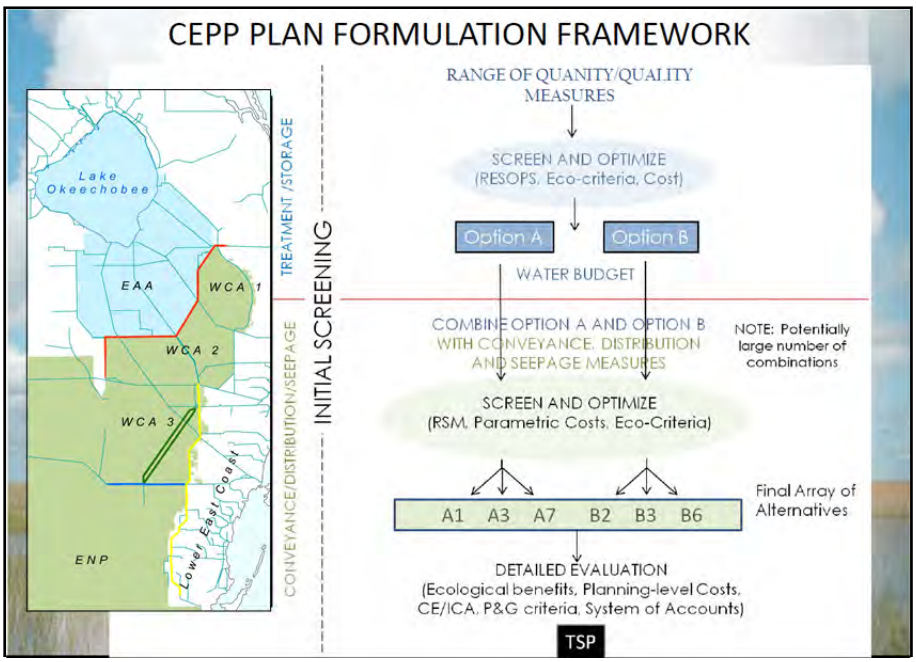

Figure 1.1. Central Everglades Planning Project Plan Formulation Framework

The CEPP Modeling Strategy document (**SFWMD, 2012a**) describes the modeling process and tools utilized, the associated rationale of the selection process and the means by which the tools could expediently support the project workflow. The primary model support tools utilized in CEPP are as follows:

Screening Tools:

- REservoir Sizing and OPerations Screening (RESOPS)
- Lake Okeechobee OPerations Screening (LOOPS)
- C-43 Spreadsheet Model
- iModel©

Detailed Planning Models:

- Regional Simulation Model Basins (RSMBN)
- Regional Simulation Model Glades-LECSA (RSMGL)
- Dynamic Model for Stormwater Treatment Areas (DMSTA)

From a modeling deliverable perspective, the entirety of the CEPP modeling support can be summarized by reviewing the following four Model Documentation Reports (MDRs):

1. CEPP Baseline Runs – Reviews the various non-CEPP model representations (e.g. current and future without project conditions) used in various aspects of the project planning (**SFWMD & IMC, 2014a**).
2. CEPP Final Array of Alternatives – Reviews four proposed with-CEPP project model representations examined during plan formation (**SFWMD & IMC, 2014b**).
3. CEPP Tentatively Selected Plan – Reviews the model representation of the CEPP TSP and subsequent refinements during final plan formulation and project assurance planning (**SFWMD & IMC, 2014c**).
4. CEPP Model Supported Screening Efforts – Reviews the various model-supported feature screening efforts undertaken at various points in the planning process (this document).

This screening models MDR describes the assumptions, model implementation steps and observed outcomes associated with modeling representations of screening and sensitivity analysis performed in support of developing the CEPP final array of alternatives and TSP. Due to the broad nature of this MDR, the outline of this MDR differs from the standard used in the CEPP baselines, final array and TSP MDRs. This document will provide an overview of the CEPP screening modeling in Section 2 followed by individual model applications and outcomes organized by geographic area in Section 3. Section 4 will then summarize the final identification of all screening modeling products. These model runs were in support of plan formulation efforts; information on the use and rationale for the definition of these specific screening products is contained in the CEPP PIR Appendix E (**USACE, 2014**).

2.0 Screening Overview

Screening Methodology

As outlined in the CEPP Modeling Strategy document (**SFWMD, 2012a**), the CEPP modeling process utilized a modified approach to the traditional modeling workflow of narrowing and refining alternatives incrementally over longer periods of time. In CEPP, where possible, screening, rapid sensitivity assessment, batch processing of model information and/or inverse modeling techniques were performed up front in the planning process to identify to decision-makers key performance or tradeoff issues.

The benefit of performing screening is to quickly test the performance of management measures, components and potential alternative configurations; this

- Allows comparisons of the viability of management measures
- Identifies the feasible sizing ranges for further in-depth analysis
- Is not a replacement for the detailed regional models, but can reduce the burden on the more detailed regional models which helps to expedite the project schedule
- Optimization and inverse modeling techniques can be used to automatically evaluate thousands of operating rules and select the best performers
- Informs the discussion on what objectives are most critical to design

The project and modeling teams in CEPP proceeded within the plan formulation framework identified in Section 1 using a spatial approach as shown in **Figure 2.1.**

The screening products summarized in Section 3 will be organized in relation to this spatial perspective and each subsection will describe the assumptions and outcomes of the screening model applications in a given area. This document will focus on the modeling details and quality assurance steps taken in developing CEPP screening products, but it is important to note that these products were used by the project team in conjunction with other tools and multi-criteria decision analysis (MCDA) in determining project outcomes.

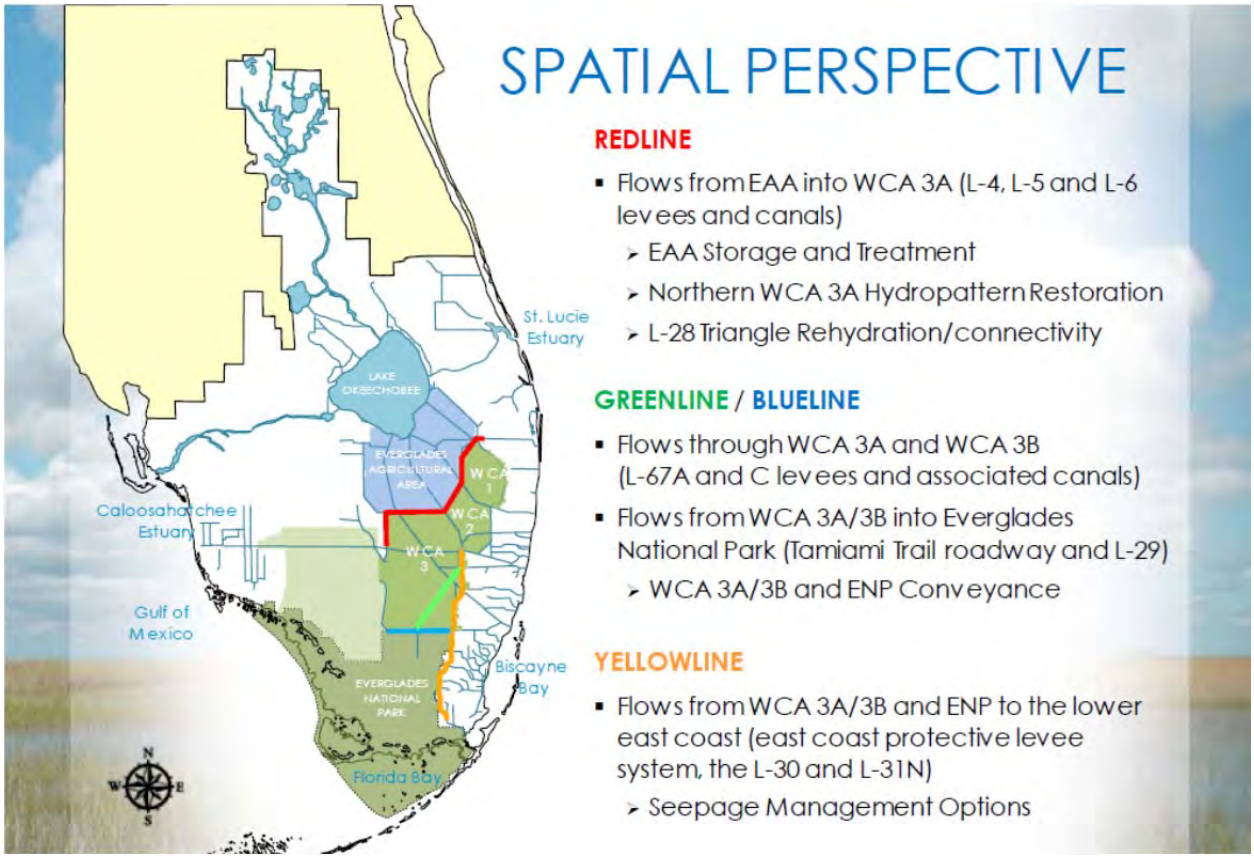

Figure 2.1. Spatial Perspective for CEPP Screening Efforts

Model Limitations and Intended Use of Results

The primary modeling products of CEPP were evaluated based on outputs from the Regional Simulation Model (RSM; **SFWMD, 2005a** and **2005b**). The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g., use available input-driven options to represent more complex project operations).

The RSMBN, RSMGL (**SFWMD, 2010** and **2011**), and DMSTA (**Walker & Kadlec, 2005**; **Wang, 2012**) models were reviewed through the USACE validation process for engineering software, as part of the CEPP project. The RSM and DMSTA models were classified as "allowed for use" for South Florida applications in August 2012 and January 2013, respectively. Additionally, the RESOPS (**SFWMD, 2009**), LOOPS (**Neidrauer et al, 2006**), and C-43 spreadsheet model (**Starnes & Marlowe, 2007**) tools and the iModel optimization tool (**Ali, 2009**) used in CEPP underwent USACE Agency Technical Review (ATR). Approval of these modeling tools for CEPP application was completed in November, 2012.

3.0 Screening Modeling

North of Redline RESOPS Screening

The CEPP project team identified a series of project features (management measures) on available land north of the redline and used the RESOPS model (as described in the CEPP modeling strategy) to test the potential of these various features to achieve desired system performance objectives. The model was set up to run a discrete set of combinations of various management measures (e.g., 12 ft deep storage, 6 ft deep storage, shallow storage, stormwater treatment area, flow equalization basin) that could be located within the ~27,600 acre effective area of the Talisman property in the Everglades Agricultural Area. For each combination of assumed features, the RESOPS model was run numerous times using an optimization algorithm included in the model toolset that seeks to vary operational protocols within the assumed system with the following goals:

- Increase total flow to the downstream Everglades system
- Increase dry season flow to the downstream Everglades system
- Reduce high discharge months to the Northern Estuary systems
- Maintain performance for Lake Okeechobee and Lake Okeechobee Service Area (LOSA) users relative to the LORS08 baseline
- Attempt to meet water quality (phosphorous) objectives for discharge south using a simplified algorithm that mimics the behavior of the DMSTA model.

Once a database of optimally performing storage combinations was developed, various post processing graphics were produced and provided to the project team. Examples of these types of products are shown in **Figures 3.1** and **3.2**. A full list of screening products produced by RESOPS is provided in **Appendix A**. All RESOPS modeling utilized a period of simulation based on climate data from 1965-2005.

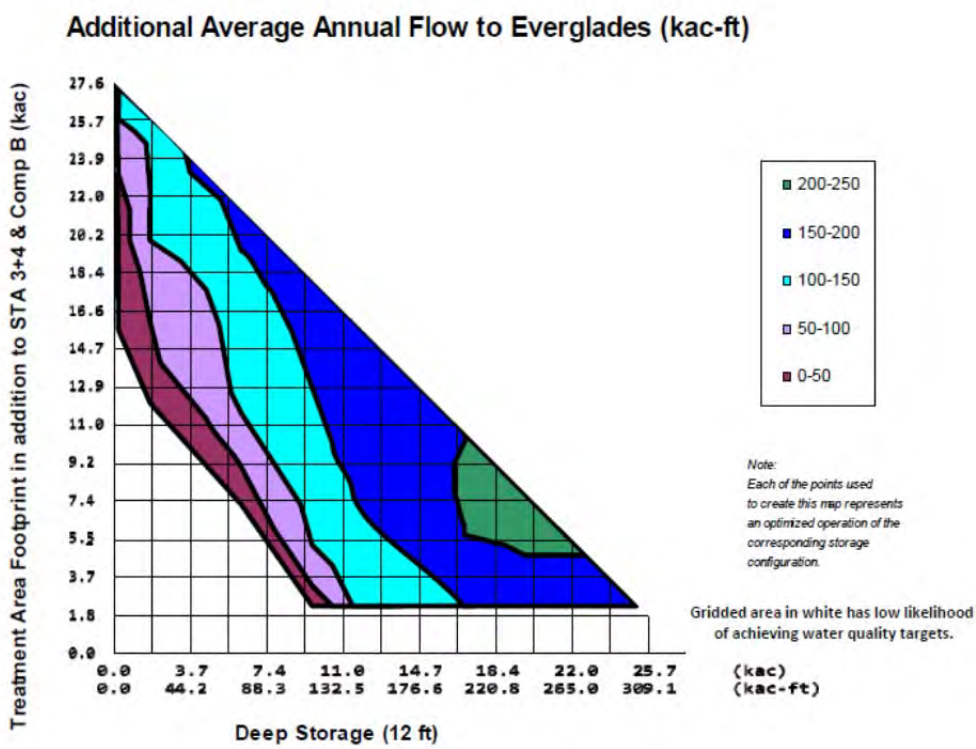

Figure 3.1. Example RESOPS output showing potential for increasing flow to the Everglades given multiple configurations of storage and treatment area expansion on the Talisman site in the EAA.

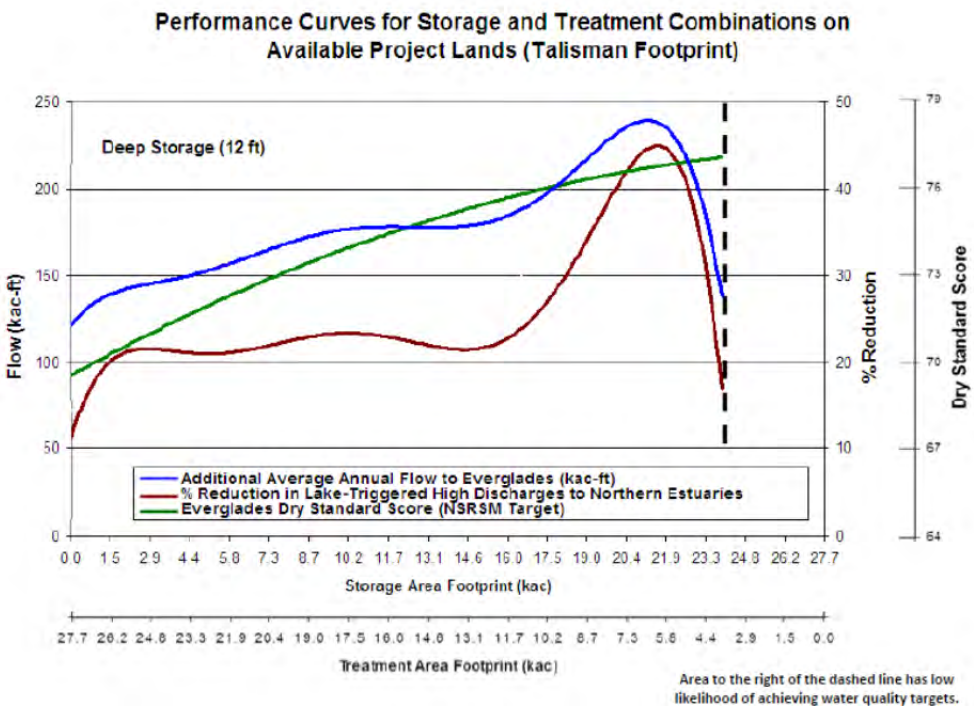

Figure 3.2. Example RESOPS output showing potential for increasing flow to the Everglades given multiple configurations of storage and treatment area expansion utilizing the full footprint of the Talisman site in the EAA

Following review of the initial RESOPS modeling results in combination with other factors, the project team identified a series of viable plan components for continued consideration. It was observed that these options could be generally categorized into three groupings based on their ability to achieve flow south to the Everglades system. These groupings were labeled “High”, Medium” and “Low” and an additional three RESOPS scenarios were produced to represent these generalized conditions. Data from these RESOPS scenarios were then utilized as boundary conditions in subsequent LOOPS screening as described in the next section.

In all steps of the RESOPS screening process, results were reviewed by the modeling team to ensure correct execution of the model and reasonable and explainable predicted outcomes. Additionally, due to the highly interactive nature of the CEPP planning process, results were being reviewed and evaluated by regional experts immediately after release, providing an additional means for product QAQC.

North of Redline LOOPS / C43 Screening

Continued analysis of potential project features north of the redline utilized the LOOPS and C43 screening models (as described in the CEPP modeling strategy) to further refine the outcomes of the RESOPS screening and to explore a broader range of operational options for Lake Okeechobee. The objectives of this screening work built upon the outcomes of those gains identified in the RESOPS screening and additionally looked in more detail at Lake Okeechobee, LOSA and Northern Estuary performance trends. Several applications of the LOOPS model were set up to run with assumed downstream flow boundary conditions derived for the High, Medium and Low RESOPS scenarios. All LOOPS and C43 modeling utilized a period of simulation based on climate data from 1965-2005.

For a given assumed flow scenario, the LOOPS model was run numerous times using a batch-processing algorithm included in the model toolset that can apply changes to Lake Okeechobee operations based on parameters identified in a discrete user-specified matrix. Performance measure outcomes for each of these individual runs were saved and then, through coordination with the project team, minimum acceptable levels were identified. The resulting outcomes were summarized in figures such as **Figure 3.3**, in which all possible scenarios run are illustrated as black circles, but only those scenarios that meet minimum criteria are highlighted in red. Using these type of modeling products, the project team identified three unique operational scenarios for each of the High, Medium and Low RESOPS scenarios as follows:

- LOKOPT – maximum performance observed utilizing the Lake Okeechobee Standard Score performance measure
- WSOPT – maximum performance observed utilizing the average water supply cutback % for the eight worst cutback years in the simulation
- ESTOPT – maximum performance observed in minimizing the frequency of high discharge months to the Northern Estuaries

As a post processing step to the LOOPS outcomes, flows leaving Lake Okeechobee were imposed as a boundary condition to the C43 Spreadsheet model as a means of simulating the assumed project baseline feature of the C43 reservoir. Performance summaries provided to the project for S79 discharges into the Caloosahatchee Estuary came from the C43 model while all other summaries were derived directly from LOOPS. Examples of the performance measure

matrices for each geographic region are provided in **Tables 3.1 to 3.4.** Each table is organized in a hierarchical way such that the three LOOPS "OPT" scenarios are grouped with the assumed RESOPS High, Medium or Low boundary condition.

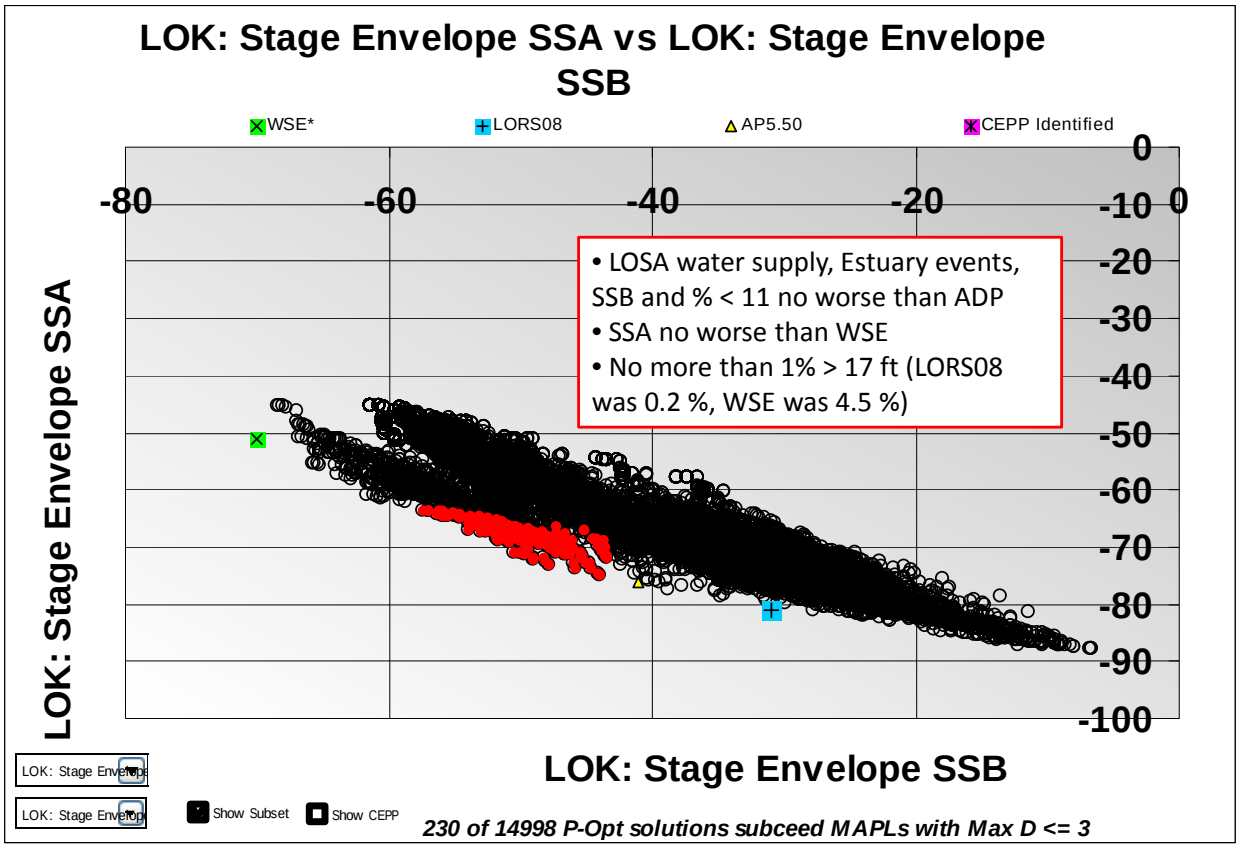

Figure 3.3. Example LOOPS output for multiple Lake Okeechobee (LOK) operating strategies

Table 3.1. Example LOOPS Output for Lake Okeechobee Performance

	Baselines		
Run	WSE	LORS08	AP5.50
Standard Score Above Envelope	51.3	81.0	76.3
Standard Score Below Envelope	70.0	30.7	41.4
Standard Score Above 17 feet	78.6	99.1	98.7
Standard Score Below 10 feet	95.7	86.1	90.3
	Low Everglades Flow		
Run	LOKOPT	WSOPT	ESTOPT
Standard Score Above Envelope	67.8	61.2	67.2
Standard Score Below Envelope	48.9	56.3	47.0
Standard Score Above 17 feet	97.5	95.7	96.1
Standard Score Below 10 feet	90.4	92.3	90.0
	Medium Everglades Flow		
Run	LOKOPT	WSOPT	ESTOPT
Standard Score Above Envelope	71.1	63.5	66.9
Standard Score Below Envelope	50.5	57.4	45.2
Standard Score Above 17 feet	97.6	95.9	95.6
Standard Score Below 10 feet	91.0	92.1	89.2
	High Everglades Flow		
Run	LOKOPT	WSOPT	ESTOPT
Standard Score Above Envelope	69.3	66.7	69.9
Standard Score Below Envelope	47.9	50.8	45.5
Standard Score Above 17 feet	97.3	96.6	96.2
Standard Score Below 10 feet	89.7	89.8	89.3

Table 3.2. Example LOOPS Output for Lake Okeechobee Service Area Performance

	Baselines		
Run	WSE	LORS08	AP5.50
Cutback %	15.50%	27.70%	24.90%
	Low Everglades Flow		
Run	LOKOPT	WSOPT	ESTOPT
Cutback %	23.30%	20.90%	24.20%
	Medium Everglades Flow		
Run	LOKOPT	WSOPT	ESTOPT
Cutback %	21.90%	20.50%	24.90%
	High Everglades Flow		
Run	LOKOPT	WSOPT	ESTOPT
Cutback %	24.10%	23.10%	24.90%

Table 3.3. Example LOOPS & C43 Model Output for Caloosahatchee Estuary Performance

Caloosahatchee (S79)						
MEAN MONTHLY FLOWS		**<450**	**450-2800**	**2801-4500**	**>2800**	**>4500**
WSE + C43 RES		68	340	39	84	45
LORS08 + C43 RES		38	375	38	79	41
ADP + C43 RES		24	382	39	86	47
LOW + LOKOPT + C43RES		75	344	30	73	43
LOW + WSOPT + C43RES		81	342	28	69	41
LOW + ESTOPT + C43 RES		66	352	37	74	37
MED + LOKOPT + C43RES		78	340	31	74	43
MED + WSOPT + C43RES		82	343	27	67	40
MED + ESTOPT + C43 RES		82	342	36	68	32
HIGH + LOKOPT + C43RES		86	335	32	71	39
HIGH+ WSOPT + C43RES		82	343	27	65	38
HIGH+ ESTOPT + C43 RES		74	348	36	70	34

Table 3.4. Example LOOPS Output for St Lucie Estuary Performance

St. Lucie (S80+SLETRIB)						
MEAN MONTHLY FLOWS		**<350**	**350-2000**	**2001 - 3000**	**>2000**	**>3000**
WSE + C43 RES		140	279	38	73	35
LORS08 + C43 RES		120	300	39	72	33
ADP + C43 RES		136	283	38	73	35
LOW + LOKOPT + C43RES		148	274	36	70	34
LOW + WSOPT + C43RES		148	276	32	68	36
LOW + ESTOPT + C43 RES		138	289	35	65	30
MED + LOKOPT + C43RES		150	272	37	70	33
MED + WSOPT + C43RES		149	277	31	66	35
MED + ESTOPT + C43 RES		149	280	39	63	24
HIGH + LOKOPT + C43RES		151	276	34	65	31
HIGH+ WSOPT + C43RES		150	277	34	65	31
HIGH+ ESTOPT + C43 RES		144	286	34	62	28

In all steps of the LOOPS and C43 screening process, results were reviewed by the modeling team to ensure correct execution of the model and reasonable and explainable predicted outcomes. Additionally, due to the highly interactive nature of the CEPP planning process, results were being reviewed and evaluated by regional experts immediately after release, providing an additional means for product QAQC.

Redline RSMGL Screening

Building upon the work performed by the WCA3A Decompartmentalization & Sheetflow Enhancement Project (**SFWMD, 2011**), additional scenarios were performed to analyze the potential effects of proposed CEPP project features in the vicinity of the Redline in northern WCA3A, as conceptually shown in **Figure 3.4**. This work was performed using the RSMGL model (as described in the CEPP modeling strategy), and specifically by modifying the RSMGL Alt A and Alt E scenarios developed during the WCA3A Decomp effort. This modeling utilized a period of simulation based on climate data from 1965-2000.

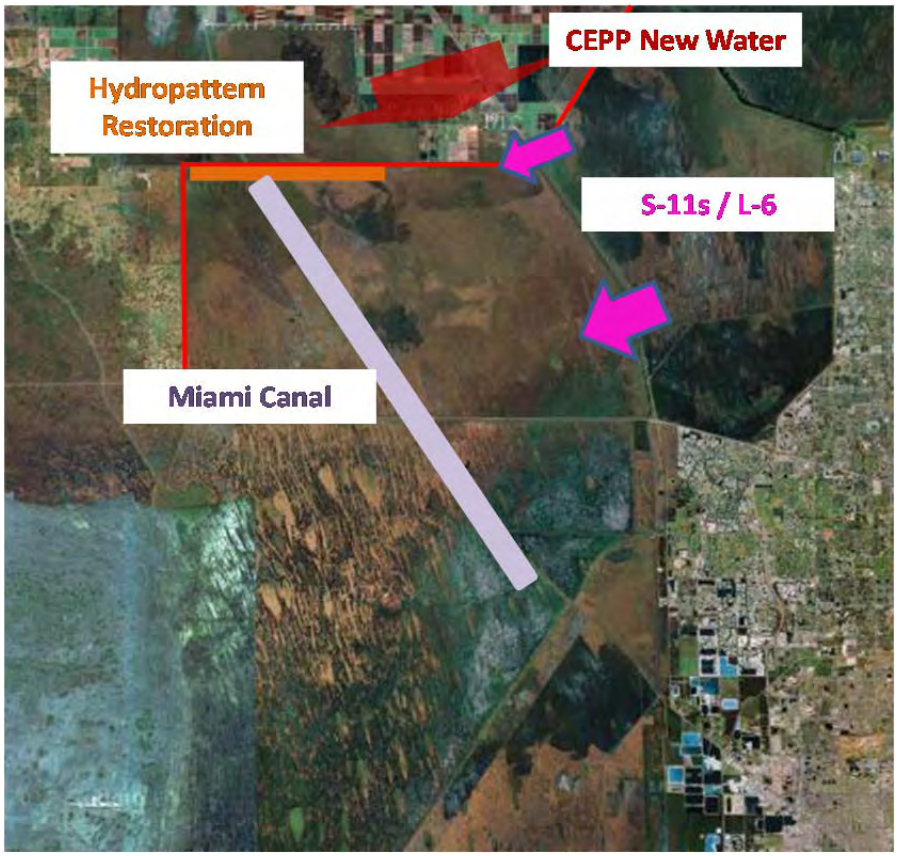

Figure 3.4. Conceptual Areas of Interest for Redline RSMGL Screening

Given consideration of additional "new water" being provided by the CEPP project as identified in the north of redline screening work, the project team identified four areas of primary interest for this screening work as follows:

- Configurations of a hydropattern restoration feature (HRF) in northern WCA3A
- Extent of Miami Canal backfill
- Potential gapping of the C-11 Extension spoil mounds
- Potential to divert STA2 outflows from the L6 to the L5 canal, thereby redirecting WCA2A inflow into WCA3A and reducing discharges at the S11 structures.

No screening hydrologic modeling work was performed on the C-11 Extension item since the scale of the RSMGL model was too large to meaningfully capture the localized effects of these modifications. Combinations of the other features were combined into four RSMGL scenarios as shown in **Table 3.5**.

Table 3.5. Assumptions for Redline RSMGL Scenarios

Model Run	HRF	Miami Canal	C-11 Ext	L-6 Deliveries
Redline Run1	West G-206	North I-75	Gapping (100')	Without
Redline Run2	West G-206	North I-75, Plug around S-340, Plug south of C-11	Removal of spoil north of C-11ext, Gapping South of C-11ext	Without
Redline Run3	Full	North I-75	Gapping (100')	Without
Redline Run4	Full	North I-75	Gapping (100')	With

For the four Redline scenarios modeled using RSMGL, northern boundary inflows were imposed as shown in **Table 3.6**. These flows were calculated using the Decomp model assumed boundary conditions plus additional "medium" flow from the RESOPS screening. Specific HRF canal (Central HRF) and Miami Canal configurations as modeled are shown in **Figures 3.5** to **3.7**. East HRF and West HRF features are not modeled as a canal within the model domain but with boundary inflows into the cells on the northern boundary in the vicinity of the proposed HRF features.

Table 3.6. Average Annual Inflows (ac-ft) assumed for Decomp (Alt A & Alt E)

Inflows	WCA2A	East HRF	West HRF	Central HRF	Sum
Alt A	336,925	64,755	223,044	233,193	857,916
Alt E	337,757	0	259,775	263,702	861,234
Run12	416,536	0	326,471	329,523	1,072,546
Run3	415,704	64,445	290,024	299,039	1,069,212
Run4	273,060	100,836	342,690	352,626	1,069,212

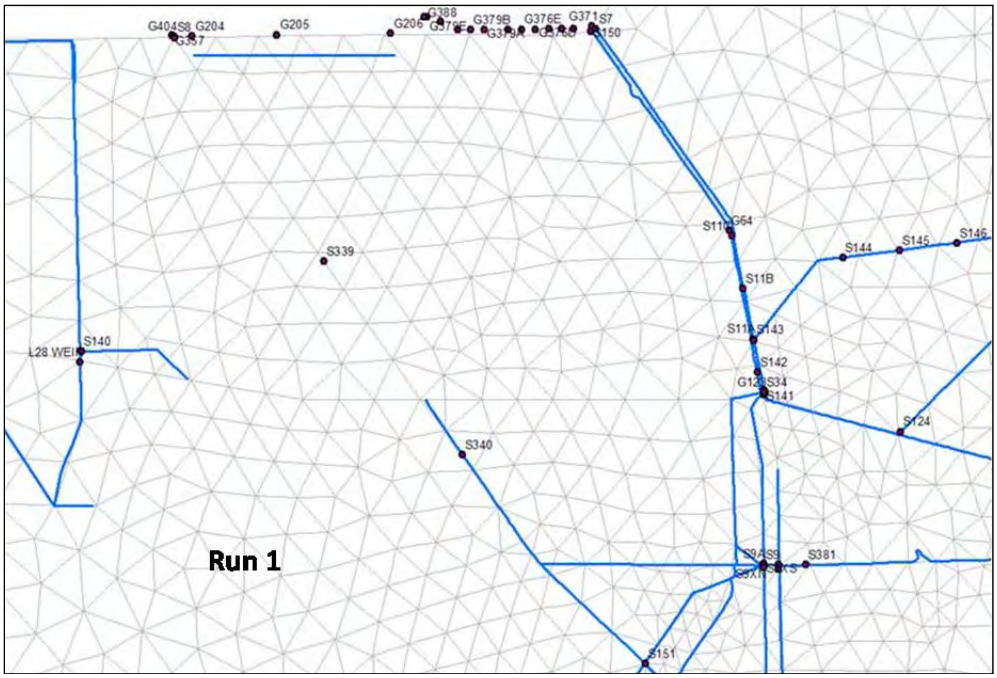

Figure 3.5. RSMGL Canal Configuration for Redline Run 1

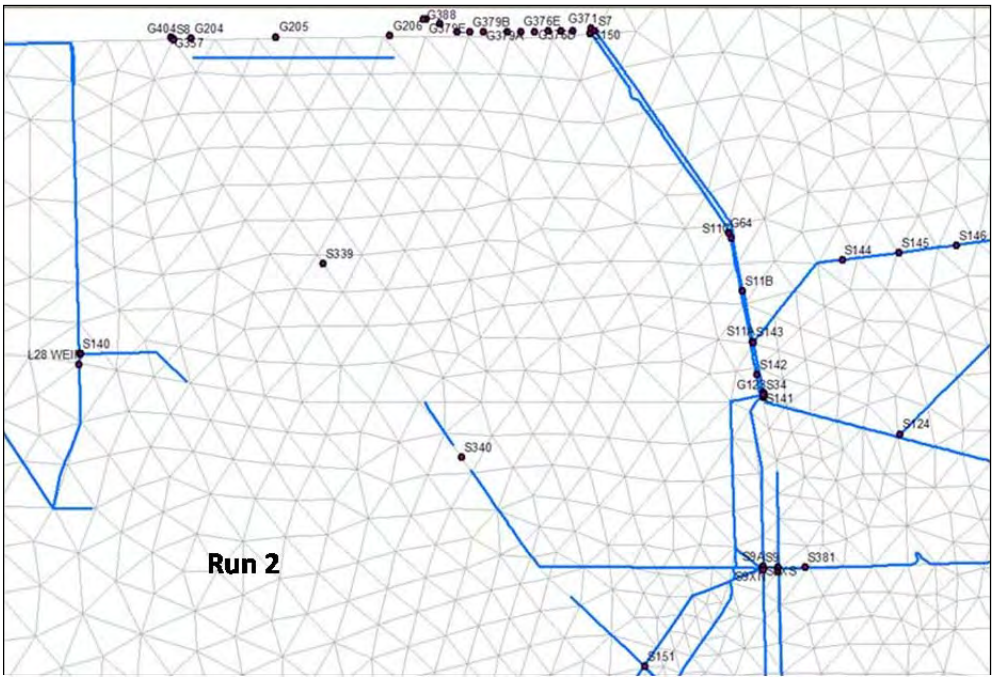

Figure 3.6. RSMGL Canal Configuration for Redline Run 2

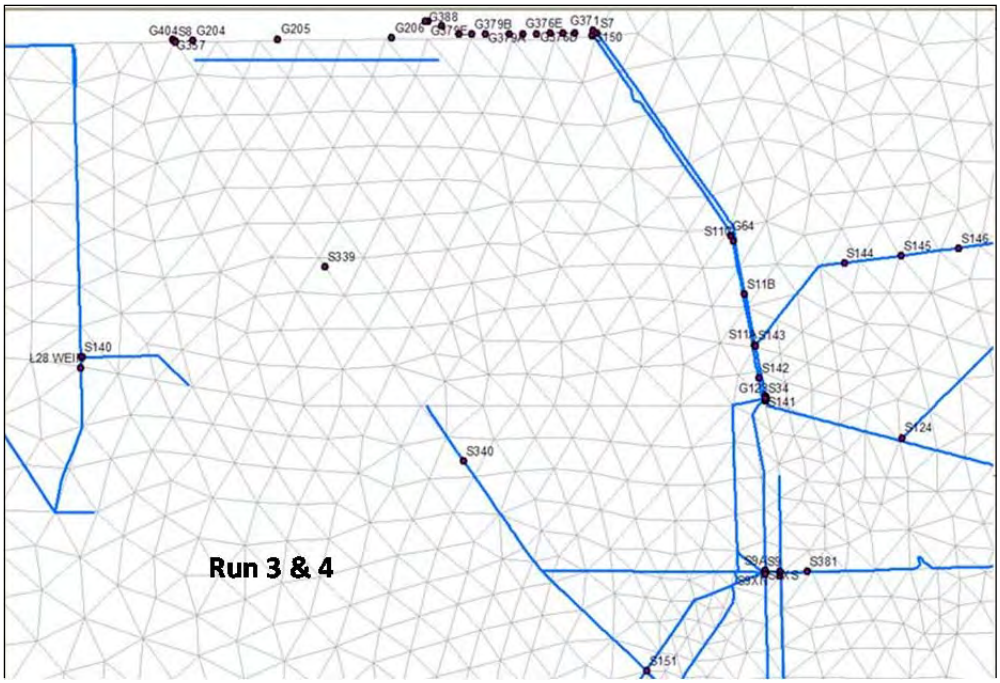

Figure 3.7. RSMGL Canal Configuration for Redline Run 3 & Run 4

The Redline Run 1, Run 2, Run 3 and Run 4 modeling scenarios were reviewed from the perspective of ensuring that localized effects of project implementations were observed as expected and that regional performance was considered reasonable. While many performance indicators were provided to the project team (in particular maps showing hydroperiod and ponding conditions), only a subset of the results are shown in this document to illustrate that the various scenarios did indeed meet the modeling intent. Trends in WCA2A were as expected with Run 1, Run 2 and Run 3 experiencing higher flows / depths and Run 4 resulting in lower depths and average flows (**Figure 3.8** illustrates depth performance at gauge 2A-17 in WCA2A). In WCA3A, a range of outcomes were observed, with many differences being in the immediate vicinity of the differences in assumed canal configurations. **Figure 3.9** shows as an example that flows in eastern WCA3A have variability across the alternatives.

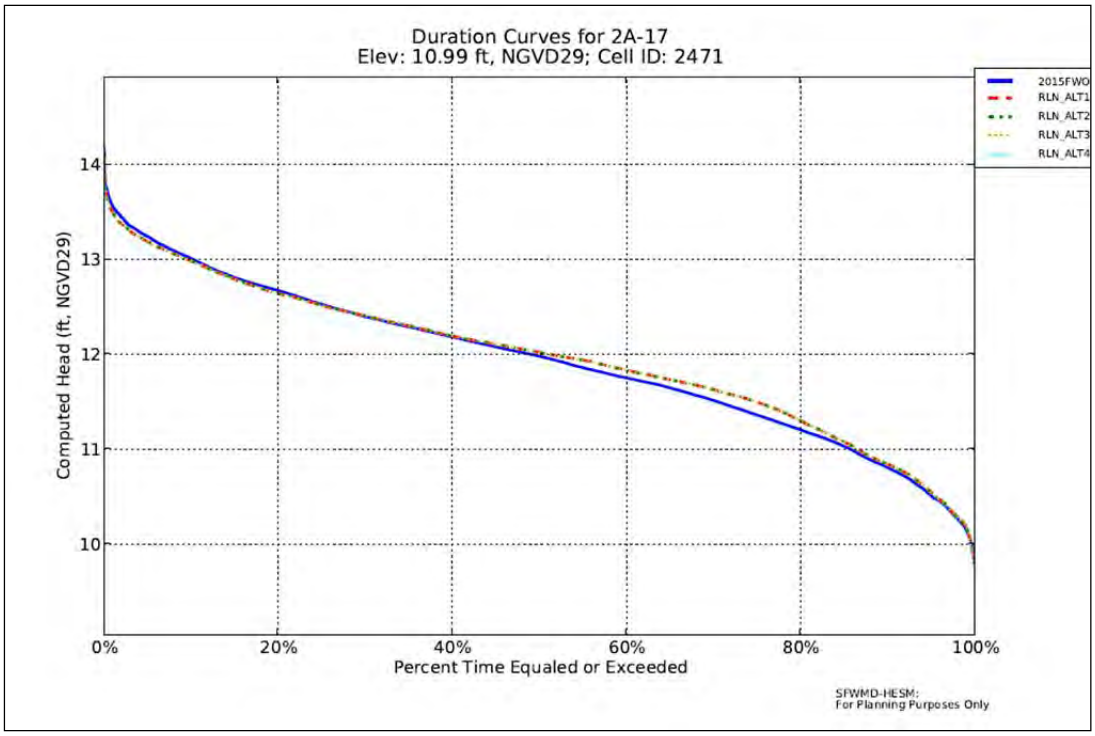

Figure 3.8. A representative gauge in WCA2A showing changes in stage duration for the Redline RSMGL scenarios

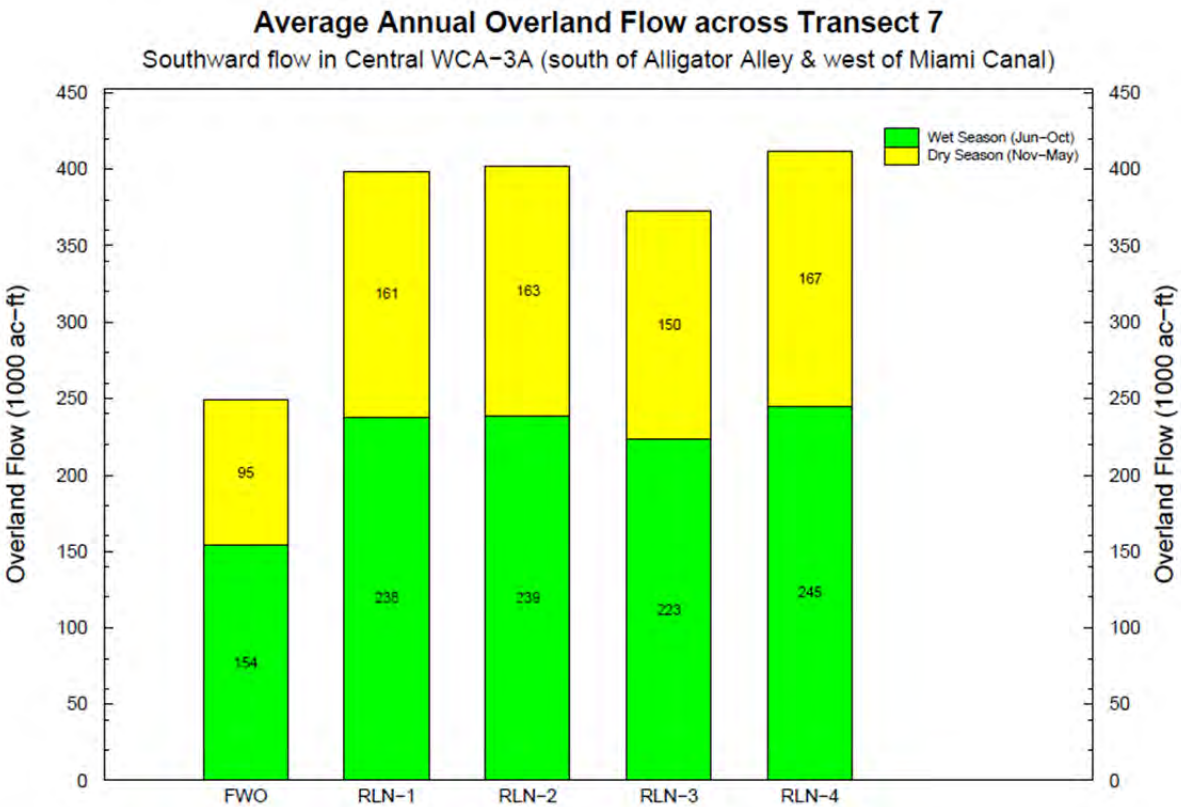

Figure 3.9. Flow differences between Redline RSMGL scenarios in central WCA3A

Greenline iModel Screening

As a result of Redline screening, it was determined that approximately 200 kac-ft of additional flow would be provided to the Everglades in CEPP. The CEPP project team held a series of public workshops to identify potential system infrastructure and operational changes that could be considered to help distribute the existing and new water in order to meet identified system objectives. The iModel (as described in the CEPP modeling strategy) was utilized to inform project screening during a series of planning steps as follows:

- Step 1: Identify conceptual configurations based on public input; perform initial analysis
- Step 2: Identify holistic system targets that were informed by ecological targets and system limitations (target contradictions, infrastructure limitations, water availability); identify causal relationships.
- Step 3: Test highly performing infrastructure options (observed in Steps 1 and 2) using operational targets defined in Step 2

Based on public input, two conceptual configurations were identified by the project team and run by the iModel as shown in **Figure 3.10**. The Green1 scenario focused on expanding a variety of infrastructure (spillways and pumps) in the L67 and L29 levees while Green2 included the "Blue Shanty" feature, a new levee aligned parallel with flow, in WCA3B. These two configurations were intentionally established with several infrastructure options, thereby allowing the iModel optimization to identify which potential features were most effective. For each configuration, a RSMGL model run was made with highly varied imposed flow boundaries (intended to encompass the range of potential physical outcomes associated with the structure operations), and then the iModel was trained on the RSMGL outputs. The features shown in **Figure 3.10** for southern WCA3A, WC3B and ENP were combined with other known south Florida infrastructure (e.g., structures in the WCA1 & WCA2 areas, inflows to northern WCA3A, seepage estimates & Lower East Coast Service Area (LEC) return seepage pumping) to create two system-wide implementations of iModel.

Green1 details near WCA 3B and ENP Green2 details near WCA 3B and ENP

Figure 3.10. Conceptual configurations for Step 1 Greenline iModel analysis

Following implementation of the iModel to the Green1 and Green2 scenarios, an iModel run was performed for both scenarios utilizing the available ecological targets for each area. These outcomes were analyzed as the results of the Step 1 planning process described above. The results of this analysis indicated that certain parts of the system were not performing as desired and that additional refinement to the operational targets was needed. Step 2 iModel work provided a series of investigations predicated from either the Green1 or Green2 scenario that examined the following areas:

- Reduced stage targets in northern WCA3A and using Gauge 3A-4 as a "pivot" point for refined operational targets.
- Ability to maintain stages within constraints of Zone A of the WCA3A regulation schedule
- Sensitivity to the L29 stage constraint (unconstrained, 8.5 ft, 8.0 ft)
- Optimization without L6 diversion operations
- Assumed impact of seepage management effects on Site 71 in WCA3B

From a modeling perspective, setup of these iModel scenarios focused on revisions to input target time series data and/or weights and on assuming limitations to structure capacity, if warranted (e.g., L6 diversion capacity set to 0 cfs). The findings from the above investigations were analyzed by the CEPP team (as described in Appendix E of the CEPP PIR) and decisions by the project team were consolidated into a consensus set of operational targets (modifications to the original ecological targets, such as scaling NSM targets to a revised percentage of the NSM depth), as shown in **Table 3.7**. Details of the data sources and rational for the consensus operational target selection can be found in the CEPP PIR. Based on review of Step 1 and Step 2 outcomes, the project team also identified a set of ten potentially highly performing alternatives. Step 3 iModel applications ran the ten options shown in **Table 3.8** using the modified operational targets identified in Step 2. Results of this screening were incorporated into a MCDA for ultimate identification of the features that would carry forward into the final array scenario modeling.

The Greenline iModel scenarios were reviewed from the perspective of ensuring that effects of project implementations were observed as expected and that optimized regional performance was considered reasonable. While many rounds of outputs were provided to the project team, only a subset of the results are shown in this document as examples of the ability to meet the modeling intent. Typical outputs from the iModel for the purposes of system performance evaluation are shown in **Figure 3.11** and **Table 3.9** which illustrate the ability of an iModel scenario to trend toward target from the assumed starting baselines. Another example of utilized iModel outputs is shown in **Figure 3.12** and **3.13**, which illustrates the difference in optimized utilization of two structures that are geographically nearby. These types of outcomes were used by the project team to identify highly efficient infrastructure to carry forward into subsequent analysis.

Table 3.7. Outcomes of Greenline Step2 Refined Operational Targets for iModel use in Step 3

Area	Gauge	Target
WCA1	1-7	Based on RSMGL Existing Condition Baseline (ECB)
WCA2A	2A-159	Based on RL4 Redline Screening Run
	2A-17	Based on RL4 Redline Screening Run
WCA2B	Eden-13	Based on RSMGL Existing Condition Baseline
WCA3A	3ANW	60% of NSM v4.6.2-based RECOVER Ridge & Slough Target
	3A11	30% of NSM v4.6.2-based RECOVER Ridge & Slough Target
	3ASW	50% of NSM v4.6.2-based RECOVER Ridge & Slough Target
	W2	100% of NSM v4.6.2-based RECOVER Ridge & Slough Target
	3A3	65% of NSM v4.6.2-based RECOVER Ridge & Slough Target
	3A4	75% of NSM v4.6.2-based RECOVER Ridge & Slough Target
	3AS	70% of NSM v4.6.2-based RECOVER Ridge & Slough Target
	3ANE	50% of NSM v4.6.2-based RECOVER Ridge & Slough Target
	3A28	100% of NSM v4.6.2-based RECOVER Ridge & Slough Target
	E4	85% of NSM v4.6.2-based RECOVER Ridge & Slough Target
WCA3B	Site71	88% of NSM v4.6.2-based RECOVER Ridge & Slough Target
	Shanty_loc	100% of NSM v4.6.2-based RECOVER Ridge & Slough Target
ENP	NP205	Based on RSMGL ECB Depth at NP46 (both NP205 and NP46 are marl areas)
	NP46	Based on RSMGL ECB Depth at NP46
	P33	Based on Florida Bay RECOVER Paleological targets
	NE2	Based on Florida Bay RECOVER Paleological targets

Table 3.8. Ten scenarios identified for Step 3 Greenline iModel screening

Option	Title	S-333	3B/L-67A levee	L67C levee	L-29 levee	Blue Shanty levee, 3B	3B Seepage Management
1A	No - WCA 3B	2000					Constrained
3A1	Southerly Orientation 3B	2000	S4, S5, S6 @500cfs	Gaps at structures	355A,B,C		Unconstrained
3A2	Southerly Orientation 3B	2000	S4, S5, S6 @750cfs	Gaps at structures	355A,B,C		Unconstrained
3B2	Southerly Orientation 3B	2000	S 4, S5, S6 @750 cfs	Gaps at structures	355A,B,C Pump 1		Unconstrained
3B3	Southerly Orientation 3B	2000	S 4, S5, S6 @750 cfs	Gaps at structures	355A,B,C Pump 1		Constrained
4A	Southwest 3B - Blue Shanty	Existing	S5, S6 and S1-4	Degrade west of Blue Shanty levee	Degrade west of blue shanty levee	From L67A to L-29	Constrained
4B	Southwest 3B - Blue Shanty	Existing	S5, S6 and S4	Degrade west of Blue Shanty levee	Degrade west of blue shanty levee	From L67A to L-29	Constrained
4C	Southwest 3B - Blue Shanty	Existing	S5, S6	Degrade west of Blue Shanty levee	Degrade west of blue shanty levee	From L67A to L-29	Constrained
9A	Entire L-67A extent	2000	6 structures S(1-6)	Gaps at structures	more 355s; gravity		Unconstrained
10A	North/South	2000	S2,S3 S5,S6 @500cfs	Gaps at structures	355A,B,C 2 pumps @500cfs		Unconstrained

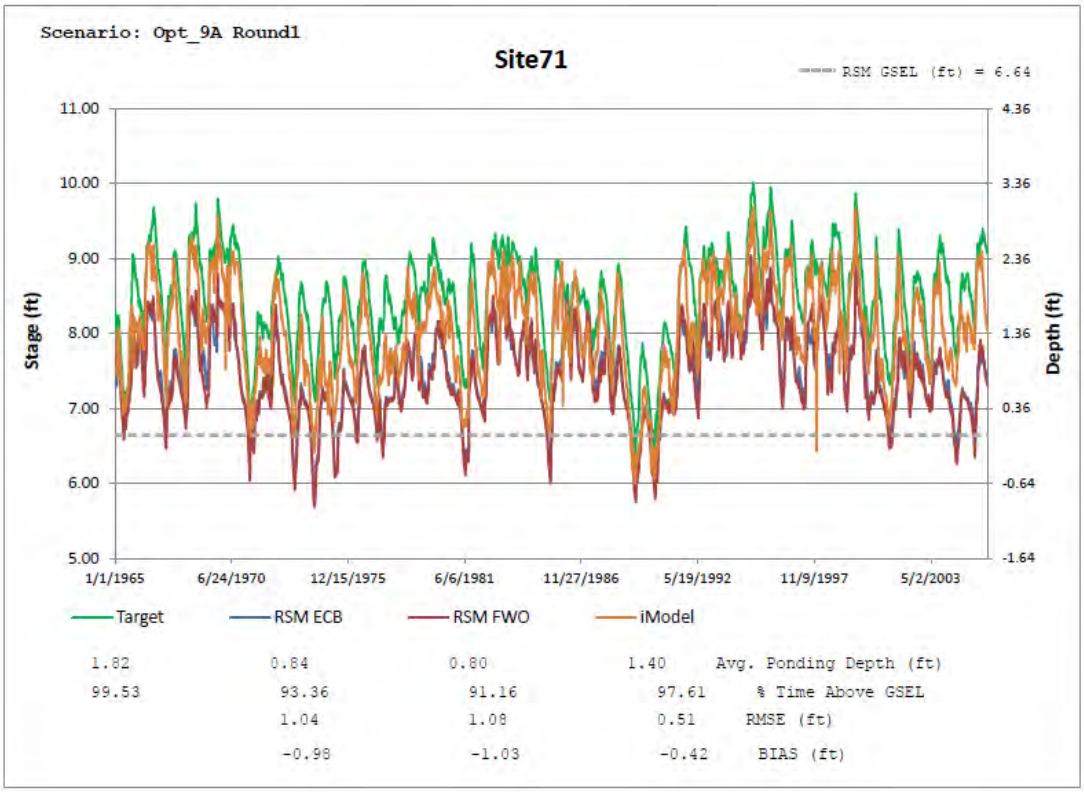

Figure 3.11. Example iModel graphic output comparing optimized outcomes to project baseline conditions and desired ecological targets at a specific location

Table 3.9. Example iModel tabular output comparing the statistics of optimized outcomes to project baseline conditions and desired ecological targets at multiple locations

Central Everglades Planning - Greenline Screening
Optimized iModel results, Stage Table 1 of 5
Scenario: Green2
Average % time above ground surface elevation (GSEL)

Location	Target	RSM ECB	RSM FWO	iModel
1-7	99.11	99.53	99.11	99.49
2A-159	90.74	91.96	93.97	92.38
2A-17	84.75	87.32	87.65	87.37
EDEN-13	97.29	95.00	97.29	99.02
3ANW	99.53	68.15	81.62	97.85
3A11	99.53	47.43	47.90	86.25
3ASW	99.53	83.82	81.95	91.39
W2	99.53	98.46	97.94	99.72
3A4	99.53	92.38	91.35	95.88
3AS	99.53	86.34	87.18	97.71
3ANE	99.53	69.27	66.18	93.12
3A28	99.53	99.25	98.97	99.77
EDEN-4	99.53	95.09	94.34	98.46
3A3	99.53	79.42	77.03	94.11
Site71	99.53	93.36	91.16	99.44
Shanty_loc	99.53	96.82	95.74	99.95
NP205	66.18	73.53	74.04	78.81
P33	98.78	89.34	89.10	99.39
NE2	99.53	87.75	87.28	97.75
NP46	66.18	63.05	64.27	73.48

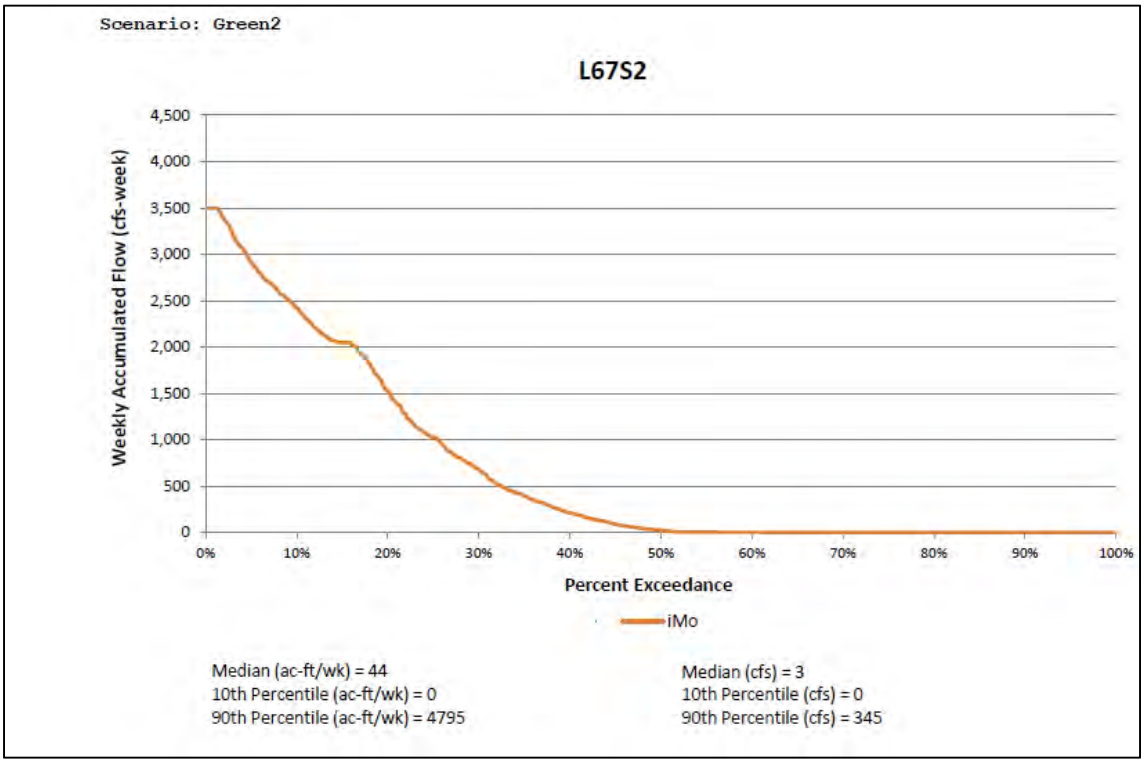

Figure 3.12. Example iModel output showing relative low utilization of structure L67 S2

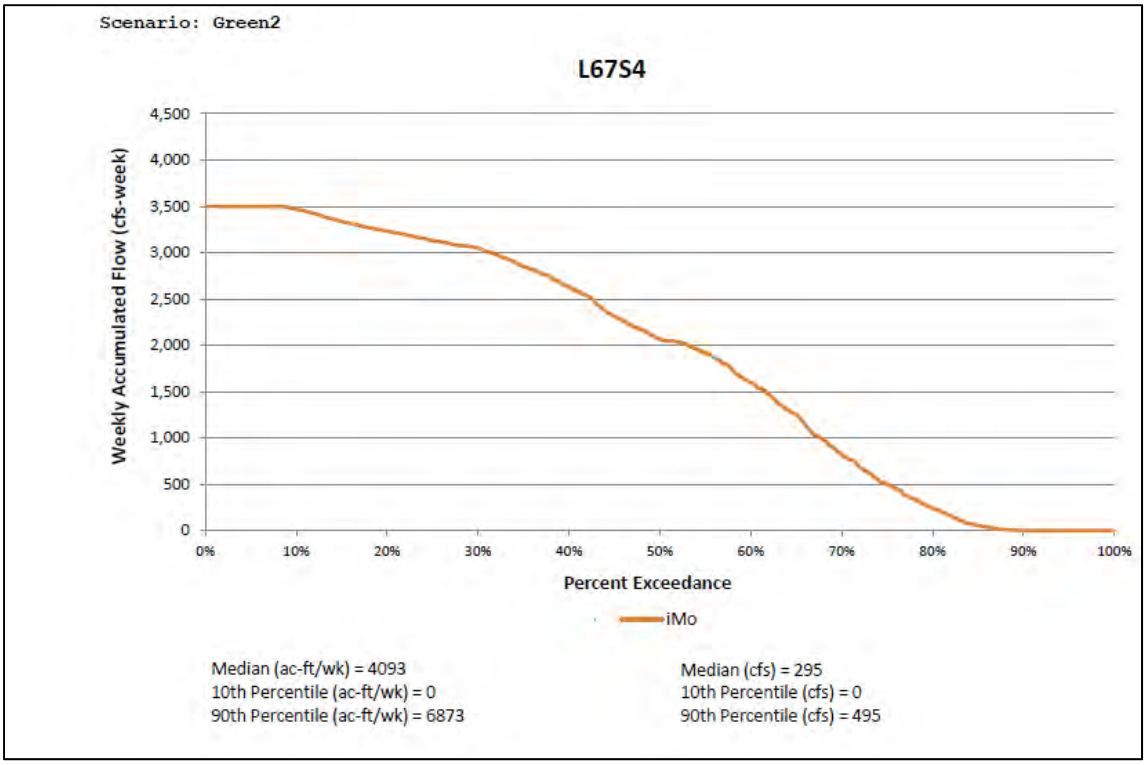

Figure 3.13. Example iModel output showing relative low utilization of structure L67 S4

Blueline and Yellowline Screening

Screening scenarios were performed to analyze the potential effects of proposed CEPP project features in the vicinity of the Blueline and Yellowline in WCA3B, ENP and the LEC, as conceptually shown in **Figure 3.14**. This work was performed using the RSMGL model (as described in the CEPP modeling strategy), and specifically by modifying the intermediate versions of RSMGL FWO baseline. This modeling utilized a period of simulation based on climate data from 1965-2000.

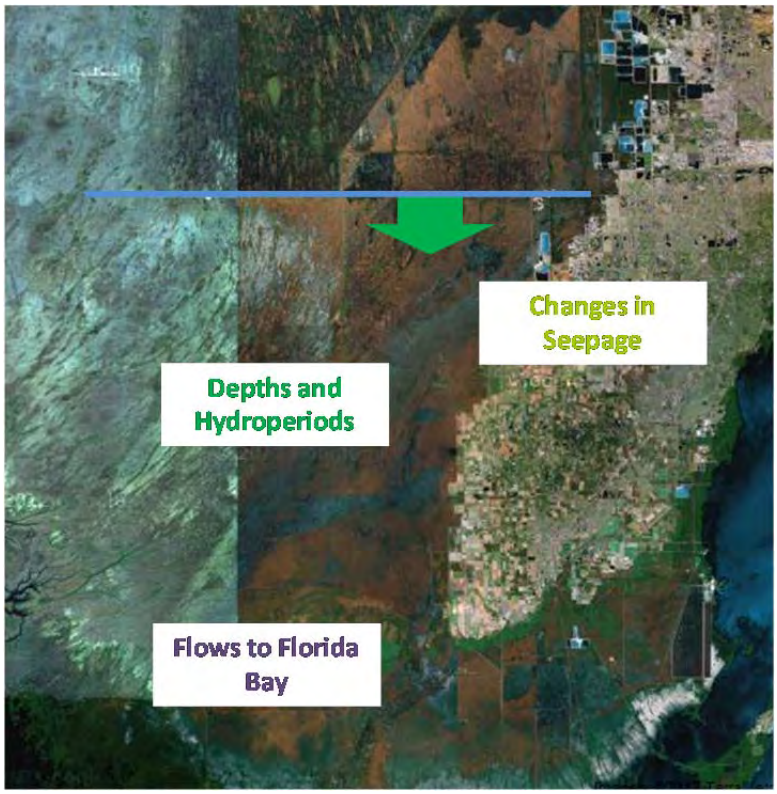

Figure 3.14. Conceptual Areas of Interest for Blueline and Yellowline RSMGL Screening; Changes in Seepage affect LEC canal and Southern Estuary Discharge Performance

The Blueline RSMGL sensitivity runs consist of five scenarios derived from a May 2012 version of the CEPP RSMGL FWO run and produced subsequent to North of Redline screening, concurrent with Redline RSMGL screening and prior to Greenline and Yellowline screening. These model runs were solely performed to assist with up-front screening and understanding of the model output and performance measure trends for Central Everglades planning prior to determination of a final array of alternatives. Given the expectation that CEPP would provide additional flow through the system in the vicinity of the Blueline (the magnitude of which was undetermined at the time of screening), the modeling strategy employed for the Blueline sensitivities focuses on imposing percentages of NSM Transect 18 (eastern ENP) volumes of water into the L-29 canal without specifying the source or conveyance route of this water. As

such, only RSMGL outputs at and downstream of L29 are valid for evaluation. Water deliveries to Everglades National Park are imposed as follows:

- S12s, S333 & S355s discharges imposed as internal boundary conditions per the CEPP 2050 FWO scenario (i.e., not simulated).
- S-356 is operated up to 500 cfs. L-29 stage constraint for operation of S-356 assumed to be 7.5 ft, NGVD. G-3273 constraint for operation of S-356 assumed to be 6.8 ft, NGVD.
- No S-334 flood control releases simulated.
- 6.7 miles of Tamiami Trail Bridge as approximated per Alternative 6E of the 2010 Tamiami Trail Modifications: Next Steps EIS Report are modeled as weirs. Located east of the L67 extension and west of the S334 structure.
- Volumes of water imposed as internal boundary conditions into the L-29 canal based on Transect 18 flow differences between NSM4.6.2 and CEPP 2050 FWO as follows:
    - NSM0 = No additional flow
    - NSM25 = Additional flow equal to 25% of difference between NSM4.6.2 and CEPP 2050 FWO at TR18.
    - NSM50 = Additional flow equal to 50% of difference between NSM4.6.2 and CEPP 2050 FWO at TR18.
    - NSM75 = Additional flow equal to 75% of difference between NSM4.6.2 and CEPP 2050 FWO at TR18.
    - NSM100 = Additional flow equal to 100% of difference between NSM4.6.2 and CEPP 2050 FWO at TR18.

The Blueline NSM0, NSM25, NSM50, NSM75 and NSM1000 modeling scenarios were reviewed from the perspective of ensuring that localized effects of project implementations were observed as expected and that regional performance was considered reasonable. While many performance indicators were provided to the project team (in particular maps showing hydroperiod and ponding conditions), only a subset of the results are shown in this document to illustrate that the various scenarios did indeed meet the modeling intent. Trends in eastern inflow into ENP were as expected as shown in **Figure 3.15** and variability across the scenarios in other portions of the system were observed and trended as expected.

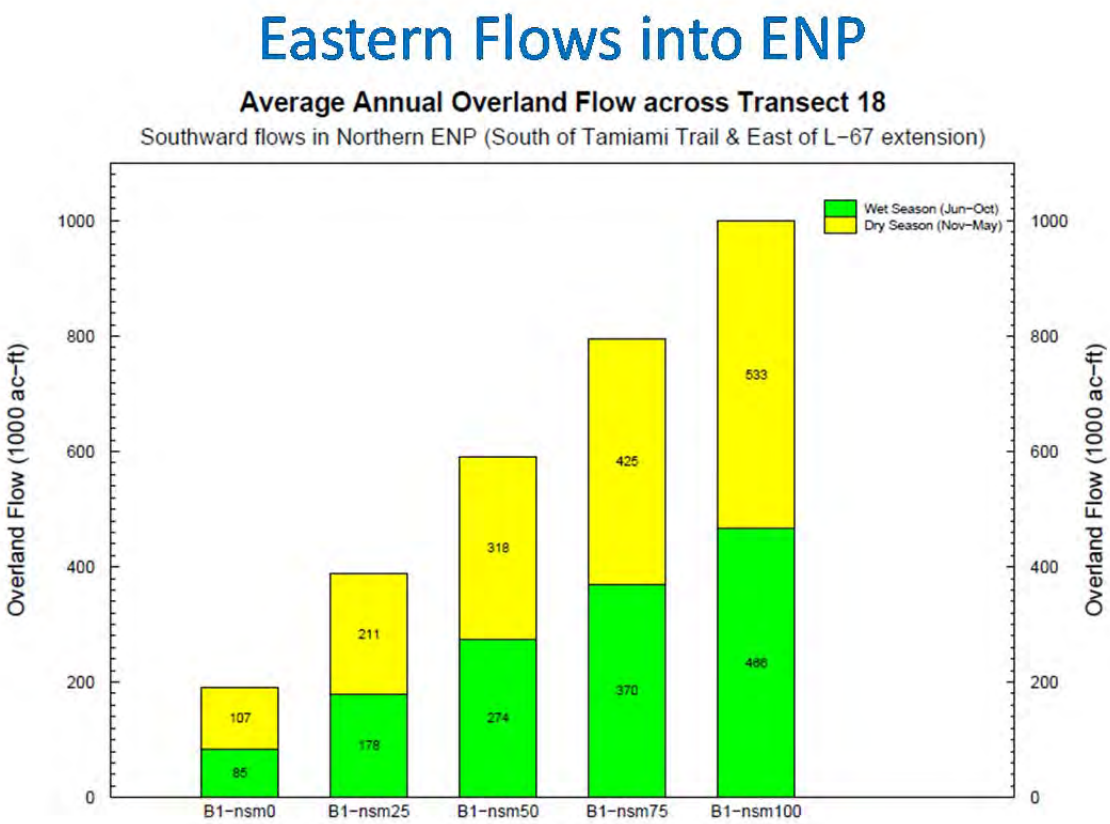

Figure 3.15. Flow differences between Blueline RSMGL scenarios in eastern ENP

The "Round 1" Yellowline RSMGL sensitivity runs consist of four scenarios derived from the Blueline NSM25 run and produced concurrent with Greenline screening. These model runs were performed to further examine the potential performance of the S356, S331 and S337 structures prior to determination of a final array of CEPP alternatives. The scenarios identified for the Round 1 Yellowline are as follows:

- BL_NSM25 = NSM25 Blueline sensitivity run (used as a baseline for comparison)
- WS2 = NSM25 run plus utilize the entire capacity of S-357 (500 cfs), restrict S-331 and G-211 for water supply use only and set L-29 canal stage constraint to 9.7 ft.
- WS3 = WS2 run plus increase S-356 capacity to 1000 cfs
- WS3.1 = WS3 run plus no "seepage constraint" operations for S356 pump and flood control open/close criteria for S356 set at the same levels as current G211 criteria.
- WS4 = WS2 run plus increase S-356 capacity to 1000 cfs and set L-29 canal stage constraint to 8.5 ft.

The Round 1 Yellowline modeling scenarios were reviewed from the perspective of ensuring that localized effects of project implementations were observed as expected and that regional performance was considered reasonable. Changes in flows at the structures of interest were analyzed by the CEPP water supply sub team.

The "Round 2" Yellowline RSMGL sensitivity runs consist of six scenarios derived from the Yellowline Round 1 WS3.1 run and produced as a final screening step prior to identification of the final array of alternatives. These model runs were performed to further examine the potential performance of various proposed seepage management features. Using a similar technique as in the Blueline screening, the modeling strategy employed for the Yellowline Round 2 sensitivities imposed internal boundary conditions in the model based on information from the Greenline iModel work. Green1 flows were imposed along the L67 and at S-333 and the S12s in order to achieve higher stages in WCA3B and ENP for the purpose of testing seepage management features. As such, only RSMGL outputs at and downstream of L67 are valid for evaluation. The scenarios identified for the Round 2 Yellowline are as follows:

- YL0 = Revised S-356, S331 and S357 operations based on feedback from Round1 Yellowline work
- YL1 = YL0 plus fully penetrating seepage barrier (no groundwater flow and/or levee seepage) from S-335 to S-334 and extending ~ 1 mile south of Tamiami Trail adjacent to L-31N; S356 capacity to 1000 cfs
- YL2 = YL0 plus Partially penetrating seepage barrier (still allows reduced groundwater flow and/or levee seepage) from the northern Pennsuco to G-211; S356 capacity to 1000 cfs
- YL3 = YL0 plus convey discharges south more aggressively; utilize G-211 and S-331 to convey water supply and flood releases south; convey water through C-1W @ S-338, C-102 @ S-194, C-103 @ S-196 during dry season; convey water toward 332s during wet season
- YL4 = YL0 plus distributed pumping: series of 100 cfs pumps along L-30, L-31N (S-356 remains 500 cfs); conceptually shown in **Figure 3.16**
- YL5 = YL0 plus ~ 1/2 mile wide impoundment area in ENP; inflows S356 @500 cfs and new pump @500 cfs; allow Pennsuco to be higher, but maintain an improved DBLEV canal by adding pump near south end of Pennsuco; conceptually shown in **Figure 3.16**

Specific operational criteria may be referenced in **Appendix B** for the South Dade area.

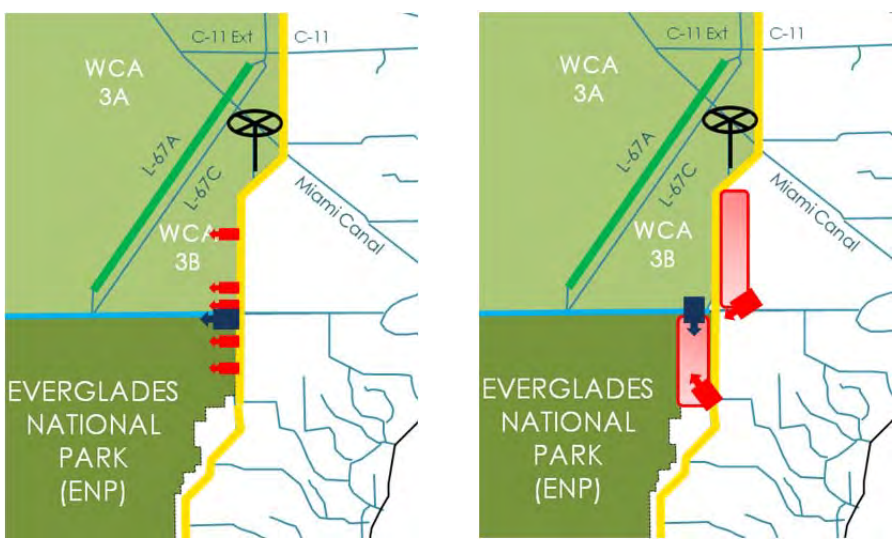

Figure 3.16. Conceptual configurations of YL4 (left) and YL5 (right) scenarios

The Yellowline Round 2 YL0, YL1, YL2, YL3, YL4 and YL5 modeling scenarios were reviewed from the perspective of ensuring that localized effects of project implementations were observed as expected and that regional performance was considered reasonable. While many performance indicators were provided to the project team (in particular measurements of seepage and LEC canal/groundwater conditions graphics), only a subset of the results are shown in this document to illustrate that the various scenarios did indeed meet the modeling intent. Variability in seepage across the scenarios were as expected as shown in **Table 3.10.** Expected structural flow changes or feature utilization were observed in YL3, YL4 and YL5 as shown in **Figures 3.18**, **3.19 and 3.20**. Variability across the scenarios in other portions of the system were observed and trended as expected.

Table 3.10. Average annual seepage (kac-ft) from Everglades marsh cells into adjacent LEC canals for selected Yellowline scenarios and baselines. Geographic locations for the identified reaches are shown in **Figure 3.17**.

	Levee Seepage from Marsh Cell				
	ECB	FWO	YL0	YL1	YL2
L-30 between S-335 and the bridge	129	124	176	197	67
L-30 south of S-335	92	83	101	0	0
L-31N north of G-211	150	164	344	289	94

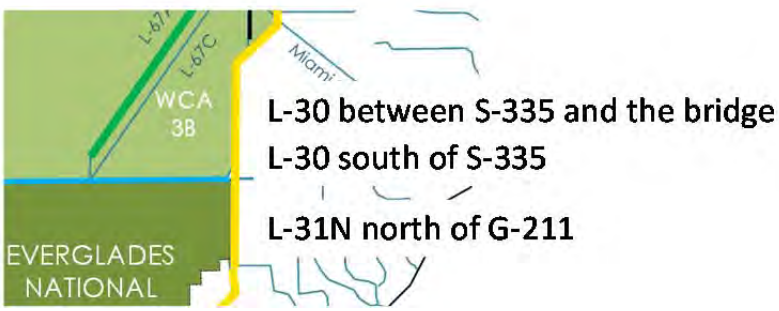

Figure 3.17. Geographic locations for the reaches identified in **Table 3.10**.

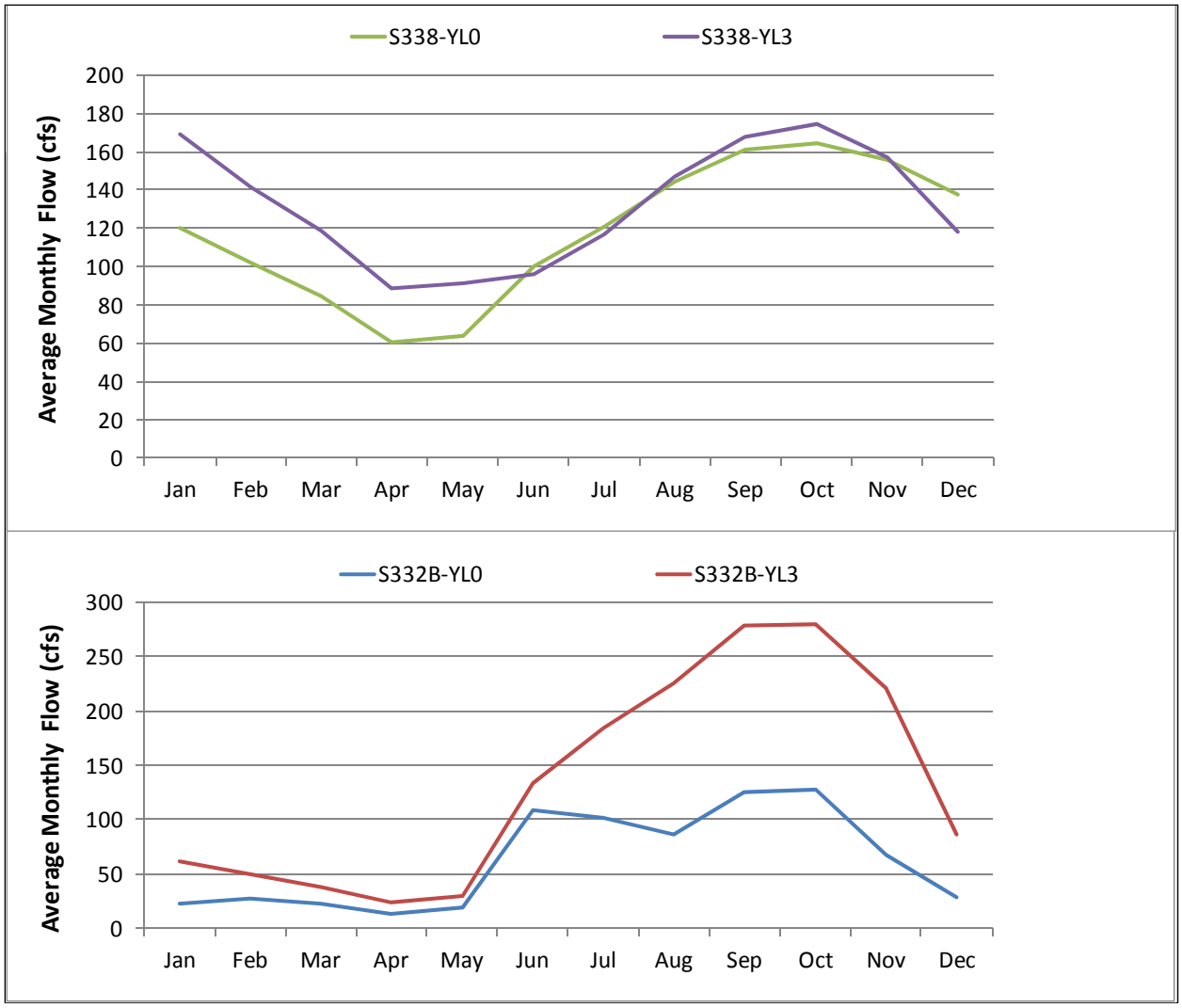

Figure 3.18. Example increases in seasonal flow volumes in YL3 relative to YL0 for dry season discharges toward coastal areas (top) and wet season discharges into the ENP buffer reservoirs (bottom)

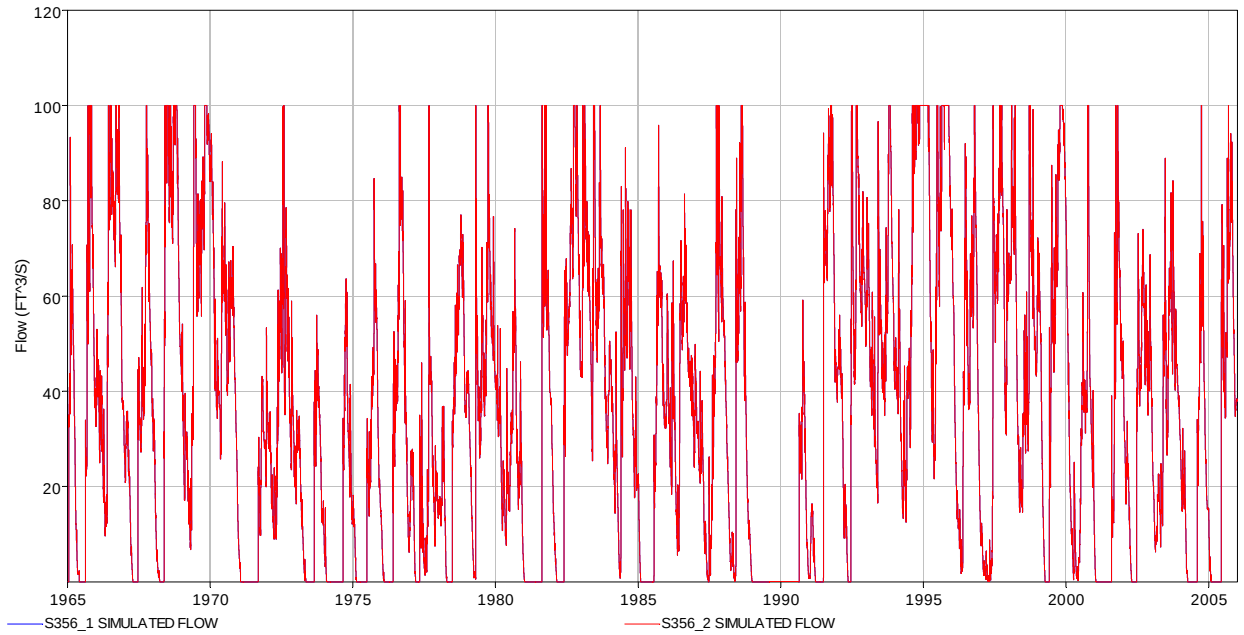

Figure 3.19. Utilization of the assumed L31N seepage return pumps in YL4.

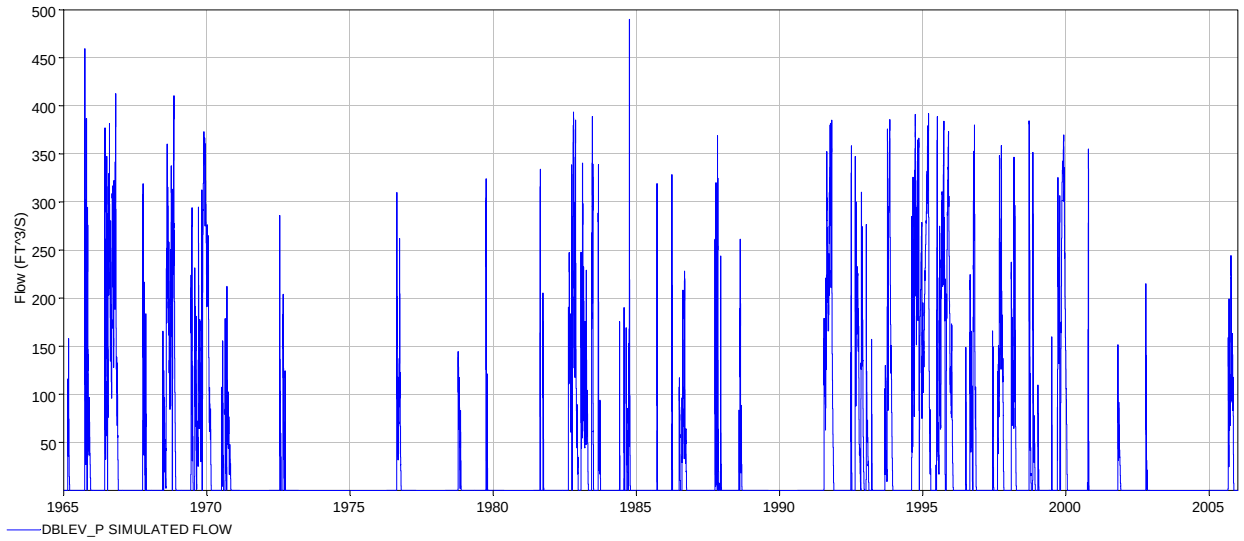

Figure 3.20. Seepage return from east of Pennsuco in YL5.

4.0 Identification of Screening Products

Final CEPP modeling products have been uploaded to the CERP Model Management System (MMS), a geographic information system (GIS) based application that includes model input data, select model output data, source code/executable files and documentation. This system can be accessed at http://www.evergladesplan.org/pm/progr_mms.aspx. CEPP modeling products in MMS can be accessed directly at the project page:

http://cerpmap1.cerpzone.org/arcgisapps/CERPMMS/CerpReport/ProjectReport.aspx?projectID=687

Due to the large size of many of the CEPP modeling files, the majority of the modeling output has been archived in the Data Access Storage and Retrieval (DASR) application of CERPzone at www.cerpzone.org. CEPP modeling products in DASR can be accessed within the project modeling folder:

P:\IMC_Final_Modeling_Results\PROJ 51 - Central Everglades Planning

While the modeling products have been archived in the above systems, **Table 4.1** lists more specific information including model version, inputs used and detailed DASR archival location. Version numbers and "svnroot" paths refer to a model version control system found on the SFWMD network that is not generally accessible, but inputs, model executables and source code have been copied into the MMS system for ease of access.

In summary, the suite of screening modeling products identified in **Table 4.1** and as reviewed in Section 3 were deemed to adequately represent the intended project features assessed in screening and when used in the overall context of CEPP plan formulation (initial screening followed by more detailed modeling assessment as summarized in the other CEPP MDRs), were deemed to be suitable for use in various stages of project decision making.

Table 4.1. Version information and model file locations

Area	Model	Date	Simulation(s)	Notes	Input/Output
North of Redline	RESOPS V3.6	5/31/2012	Screening	DR6, DR12, etc…	Input: svnroot/trunk/CentEver/resops/Feature_Screening/
	RESOPS V3.6	5/31/2012	HML Flows	Screening_HML.xls	Input: svnroot/trunk/CentEver/resops/HML_Flows/RESOPS(V3.6)_Screening_HML.xls
	LOOPS v6.01beta	5/11/2012	HML Flows	high-scenarios, med-scenarios, low-scenarios	Input: svnroot/trunk/CentEver/loops/LOOPS_*.xlsm
	C43 Model v2.0	5/11/2012	HML Flows	HighEvg, MedEvg, LowEvg	Input: svnroot/trunk/CentEver/loops/C43_*.xlsm
Redline	RSMGL	7/31/2012	RLN_ALT1		Input: svnroot/trunk/CentEver/rsmgl/redline/RLN_ALT1, RLN_ALT2, RLN_ALT3, RLN_ALT4 Output (DASR): …/2PlanFormulation/3ConveyanceSeepage/Screening/redline/rsmgl_sensitivities/073112/rsmgl_model_output/RLN1,RLN2,RLN3,RLN4
		7/31/2012	RLN_ALT2		
		7/31/2012	RLN_ALT3		
		7/31/2012	RLN_ALT4		
Greenline	iModel	10/13/2012	Step 1	Green 1,Green2	Input: svnroot/trunk/CentEver/iModel/Step1_EqualWeights/
		10/19/2012	Step 2	3A-4, 3A-ZoneA, ENP_Marl, L29_8.0, L29_8.5, NO_L6, Site71_3BSeep,etc…	Input: svnroot/trunk/CentEver/iModel/Step2_TargetRefinement/
		10/25/2012	Step 3	10 options	Input: svnroot/trunk/CentEver/iModel/Step3_IdentifyInfrastructure/Round1
Blueline	RSMGL	07/27/2012	BL1_nsm0		Input: svnroot/trunk/CentEver/rsmgl/blueline/072712/BL1_nsm0, BL1_nsm25, BL1_nsm50, BL1_nsm75, BL1_nsm100 Output (DASR): …/2PlanFormulation/3ConveyanceSeepage/Screening/blueline/rsmgl_sensitivities_072712/rsmgl_model_output/NSM0, NSM25, NSM50, NSM75, NSM100
			BL1_nsm25		
			BL1_nsm50		
			BL1_nsm75		
			BL1_nsm100		
Yellowline	RSMGL	11/05/2012 Round1	BL1_nsm25_WS		Input: svnroot/trunk/CentEver/rsmgl/yellowline/Round1/BL1_nsm25, BL1_nsm25_WS2, BL1_nsm25_WS3, BL1_nsm25_WS3.1, BL1_nsm25_WS4 Output (DASR): …/2PlanFormulation/3ConveyanceSeepage/Screening/yellowline/rsmgl_sensitivities_110512/rsmgl_model_output/WS2, WS3, WS4
			BL1_nsm25_WS2		
			BL1_nsm25_WS3		
			BL1_nsm25_WS3.1		
			BL1_nsm25_WS4		
		11/13/2012 Round2	YL0		Input: svnroot/trunk/CentEver/rsmgl/yellowline/Round2/YL0, YL1, YL2, YL3, YL4, YL5 Output (DASR): …/2PlanFormulation/3ConveyanceSeepage/Screening/yellowline/rsmgl_sensitivities_111312/rsmgl_model_output/YL0, YL1, YL2, YL3, YL4, YL5
			YL1		
			YL2		
			YL3		
			YL4		
			YL5		

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Appendix A
Screening Products from North of Redline RESOPS Screening

Table A.1. CEPP RESOPS Screening Products.

Graph ID #*	General Vicinity	Tier	Horizontal Axis	Vertical Axis	Performance Surface (Optional)	Eco - Logic (Optional)	Notes
1	Red Line	1	Shallow Reservoir (4 ft)	STA in addition to 3+4 and Comp B.	Total Flows to Everglades		Constrained to Maintain Lake O. Performance and meet WQBEL; Limit axis ranges to Talisman footprint; Display costs
2	Red Line	1	Shallow Reservoir (4 ft)	STA in addition to 3+4 and Comp B.	Everglades Dry Standard Score	Muck Fire Index / Soil Oxidation	Constrained to Maintain Lake O. Performance and meet WQBEL; Limit axis ranges to Talisman footprint; Display costs
3	Red Line	1	Shallow Reservoir (4 ft)	STA in addition to 3+4 and Comp B.	% Reduction in Damaging Northern Estuary Discharges	Oyster Viability	Constrained to Maintain Lake O. Performance and meet WQBEL; Limit axis ranges to Talisman footprint; Display costs
4	Red Line	1	Deep Reservoir (12 ft)	STA in addition to 3+4 and Comp B.	Total Flows to Everglades		Constrained to Maintain Lake O. Performance and meet WQBEL; Limit axis ranges to Talisman footprint; Display costs
5	Red Line	1	Deep Reservoir (12 ft)	STA in addition to 3+4 and Comp B.	Everglades Dry Standard Score	Muck Fire Index / Soil Oxidation	Constrained to Maintain Lake O. Performance and meet WQBEL; Limit axis ranges to Talisman footprint; Display costs
6	Red Line	1	Deep Reservoir (12 ft)	STA in addition to 3+4 and Comp B.	% Reduction in Damaging Northern Estuary Discharges	Oyster Viability	Constrained to Maintain Lake O. Performance and meet WQBEL; Limit axis ranges to Talisman footprint; Display costs
7	Red Line	1	Deep Reservoir (6 ft)	STA in addition to 3+4 and Comp B.	Total Flows to Everglades		Constrained to Maintain Lake O. Performance and meet WQBEL; Limit axis ranges to Talisman footprint; Display costs
8	Red Line	1	Deep Reservoir (6 ft)	STA in addition to 3+4 and Comp B.	Everglades Dry Standard Score	Muck Fire Index / Soil Oxidation	Constrained to Maintain Lake O. Performance and meet WQBEL; Limit axis ranges to Talisman footprint; Display costs
9	Red Line	1	Deep Reservoir (6 ft)	STA in addition to 3+4 and Comp B.	% Reduction in Damaging Northern Estuary Discharges	Oyster Viability	Constrained to Maintain Lake O. Performance and meet WQBEL; Limit axis ranges to Talisman footprint; Display costs
10	Red Line	1	Flow-Through Wetland	STA in addition to 3+4 and Comp B.	Total Flows to Everglades		Constrained to Maintain Lake O. Performance and meet WQBEL; Limit axis ranges to Talisman footprint; Display costs
11	Red Line	1	Flow-Through Wetland	STA in addition to 3+4 and Comp B.	Everglades Dry Standard Score	Muck Fire Index / Soil Oxidation	Constrained to Maintain Lake O. Performance and meet WQBEL; Limit axis ranges to Talisman footprint; Display costs
12	Red Line	1	Flow-Through Wetland	STA in addition to 3+4 and Comp B.	% Reduction in Damaging Northern Estuary Discharges	Oyster Viability	Constrained to Maintain Lake O. Performance and meet WQBEL; Limit axis ranges to Talisman footprint; Display costs

Graph ID #*	General Vicinity	Tier	Horizontal Axis	Vertical Axis	Performance Surface (Optional)	Eco - Logic (Optional)	Notes
~~13~~	~~Red Line~~	~~1~~	~~Total Flows to Everglades~~	~~"Pulse Flow" Measure of Everglades Inflow Variability~~		~~Hydrologic Surrogate for Flow Velocity~~	~~Constrained to meet WQBEL. Assumes no "Clean" storage.~~ Note: Tier 1 outcomes indicate relatively small changes in performance when "pulse" operations of monthly duration are attempted. Non-modeling sources of information should be considered (e.g., STA vegetation viability, engineering considerations, etc….) in assessing the feasibility of "pulse" discharges.
~~14~~	~~Red Line~~	~~1~~	~~STA in addition to 3+4 and Comp B.~~	~~Shallow Reservoir (4 ft)~~	~~STA Supplemental Water Supply from Lake~~		~~Constrained to Maintain Lake O. Performance and meet WQBEL;~~ ~~Limit axis ranges to Talisman footprint~~ Note: Tier 1 outcomes indicate relatively small water supply need in STAs due to Lake environmental release operations; this will be further examined during detailed modeling.
~~15~~	~~Red Line~~	~~1~~	~~Strategic ASR~~	~~STA Supplemental Water Supply from Lake~~			~~Illustrate for multiple STA sizing configurations.~~ Note: Tier 1 outcomes indicate relatively small water supply need in STAs due to Lake environmental release operations; this will be further examined during detailed modeling.
16	Red Line	2	Storage & STA Components	Total Flows to Everglades			Constrained to Maintain Lake O. Performance and meet WQBEL; Illustrate for different types of storage (shallow, deep, flow-through wetland)
17	Red Line	2	Storage & STA Components	Everglades Dry Standard Score			Constrained to Maintain Lake O. Performance and meet WQBEL; Illustrate for different types of storage (shallow, deep, flow-through wetland)
18	Red Line	2	Storage & STA Components	% Reduction in Damaging Northern Estuary Discharges			Constrained to Maintain Lake O. Performance and meet WQBEL; Illustrate for different types of storage (shallow, deep, flow-through wetland)
19	Red Line	2	High Lake O. Performance	Low Lake O. Performance			Used to identify operational flexibilities in Lake Okeechobee; Will assume feasible flows south from Tier 1 outputs.
20	Red Line	2	High Lake O. Performance	Low Lake O. Performance	% Reduction in Damaging Northern Estuary Discharges	Oyster Viability	Used to identify operational flexibilities in Lake Okeechobee; Will assume feasible flows south from Tier 1 outputs.
21	Red Line	2	High Lake O. Performance	LOSA Water Supply Performance			Used to identify operational flexibilities in Lake Okeechobee; Will assume feasible flows south from Tier 1 outputs.
22	Red Line	2	High Lake O. Performance	Low flows to Caloosahatchee Estuary			Used to identify operational flexibilities in Lake Okeechobee; Will assume feasible flows south from Tier 1 outputs.

Graph ID #*	General Vicinity	Tier	Horizontal Axis	Vertical Axis	Performance Surface (Optional)	Eco - Logic (Optional)	Notes
23	Red Line	2	% Reduction in Damaging Northern Estuary Discharges	Low flows to Caloosahatchee Estuary		Hydrologic Surrogate for Flow Velocity	Constrained to meet WQBEL. Assumes availability of "Clean" storage.
~~24~~	~~Red Line~~	~~2~~	~~Total Flows to Everglades~~	~~"Pulse Flow" Measure of Everglades Inflow Variability~~		~~Hydrologic Surrogate for Flow Velocity~~	~~Constrained to meet WQBEL. Assumes availability of "Clean" storage~~. Note: Tier 1 outcomes indicate relatively small changes in performance when "pulse" operations of monthly duration are attempted. Non-modeling sources of information should be considered (e.g., STA vegetation viability, engineering considerations, etc…) in assessing the feasibility of "pulse" discharges.
25	Red Line	2	Flows to Holeyland (from STA34)	Everglades Dry Standard Score			Constrained to meet WQBEL & Holeyland inflow water quality standards.
26	Red Line	2	Flows to Holeyland (from STA34)	Total Flows to Everglades			Constrained to meet WQBEL & Holeyland inflow water quality standards.
27	Red Line	2	Flows to Holeyland (from Talisman)	Everglades Dry Standard Score			Constrained to meet WQBEL & Holeyland inflow water quality standards.
28	Red Line	2	Flows to Holeyland (from Talisman)	Total Flows to Everglades			Constrained to meet WQBEL & Holeyland inflow water quality standards.
29	Red Line	1	Storage & STA Components	Trend Lines for Everglades and Estuary Performance			Shallow Reservoir (4 ft); Display Multiple Axes
30	Red Line	1	Storage & STA Components	Trend Lines for Everglades and Estuary Performance			Deep Reservoir (12 ft); Display Multiple Axes
31	Red Line	1	Storage & STA Components	Trend Lines for Everglades and Estuary Performance			Deep Reservoir (6 ft); Display Multiple Axes
32	Red Line	1	Storage & STA Components	Trend Lines for Everglades and Estuary Performance			Flow-Through Wetland; Display Multiple Axes
33	Red Line	1	Deep Reservoir (12 ft)	STA in addition to 3+4 and Comp B.	Total Flows to Everglades		Constrained to Maintain Lake O.Performance and meet WQBEL; Display axis ranges beyond Talisman footprint; Display costs
34	Red Line	1	Shallow Reservoir (4 ft)	STA in addition to 3+4 and Comp B.	% Reduction in Damaging Northern Estuary Discharges	Oyster Viability	Constrained to Maintain Lake O.Performance and meet WQBEL; Display axis ranges beyond Talisman footprint; Display costs

*Graph ID #s refer to PDT #6 presentation graphics (in DASR under Project 51-Central Everglades Planning, Model_Documentation)

Appendix B
Structure Operations in South Miami-Dade County for CEPP Yellowline Round 2 Runs

In **Table B.1**, the list of structures is color-coded in three groupings:

green	Structures on the L-67, L-28, and L-29 canals. Structures included are S-345, S-349, S-344, S-343A-B, S-12A-D, S-333, S-334, S-355, and S-356
blue	Structures on the L-30 and part of the L-31 canals Structures included are S-337, S-151, S-335, S-338, G-211, S-173 & S-331P (COMBQ), S-176 and S-174
yellow	Structures on part of the L-31 canal and L-31W and C-111 canals Structures included are S-332A-D, S-357, S-332, S-175, S-200, S-199, S-177, S-18C, S-197 and S-332E

Table B.1 includes the six Yellowline Round 2 runs (YL0, YL1, YL2, YL3, YL4 and YL5).

Table B.1 Yellowline Round 2 Alternatives (YL0, YL1, YL2, YL3, YL4, YL5)

Canal	Structure	YL0 (RSMGL)	YL1 (RSMGL)
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-67	S-345*	Non-existent	Non-existent
	S-349*	Non-existent	Non-existent
L-28	S-344*	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15
	S-343A-B*	Special code 1) Closed Nov 1- Jul15 2) flood control only	Special code 1) Closed Nov 1- Jul15 2) flood control only
L-29	S-12A-D*	Not operated, flows are imposed	Not operated, flows are imposed
	S-333*	Not operated, flows are imposed	Not operated, flows are imposed
	S-334	Non-existent Special code 1) Flood Control 2) No open/close ops, structure flow is based on L31N stage 4) Design Q=1230 cfs	Non-existent Special code 1) Flood Control 2) No open/close ops, structure flow is based on L31N stage 4) Design Q=1230 cfs
	S-355*	1) S355 A and B Modeled Design Q = 1000 cfs each, 2) Flood control only 3) Not operated per special code (FC). Any available water u/s is passed thru the structure under gravity.	1) S355 A and B Modeled Design Q = 1000 cfs each, 2) Flood control only 3) Not operated per special code (FC). Any available water u/s is passed thru the structure under gravity.
	S-356*	Special code 1) Pumping limited to the amount of seepage into L-31N 2) Flood control 3) Pumped into L-29 4) L-29 constraint 9.7, G3273 constraint 6.8. 5) S356 = 1000 cfs.	Special code 1) Pumping limited to the amount of seepage into L-31N 2) Flood control 3) Pumped into L-29 4) L-29 constraint 9.7, G3273 constraint 6.8. 5) S356 = 1000 cfs.

Canal	Structure	**YL2 (RSMGL)**	**YL3 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-67	S-345*	Non-existent	Non-existent
	S-349*	Non-existent	Non-existent
L-28	S-344*	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15
	S-343A-B*	Special code 1) Closed Nov 1- Jul15 2) flood control only	Special code 1) Closed Nov 1- Jul15 2) flood control only
L-29	S-12A-D*	Not operated, flows are imposed	Not operated, flows are imposed
	S-333*	Not operated, flows are imposed	Not operated, flows are imposed
	S-334	Non-existent Special code 1) Flood Control 2) No open/close ops, structure flow is based on L31N stage 4) Design Q=1230 cfs	Non-existent Special code 1) Flood Control 2) No open/close ops, structure flow is based on L31N stage 4) Design Q=1230 cfs
	S-355*	1) S355 A and B Modeled Design Q = 1000 cfs each, 2) Flood control only 3) Not operated per special code (FC). Any available water u/s is passed thru the structure under gravity.	1) S355 A and B Modeled Design Q = 1000 cfs each, 2) Flood control only 3) Not operated per special code (FC). Any available water u/s is passed thru the structure under gravity.
	S-356*	Special code 1) Pumping limited to the amount of seepage into L-31N 2) Flood control 3) Pumped into L-29 4) L-29 constraint 9.7, G3273 constraint 6.8. 5) S356 = 1000 cfs.	Flood Control, Pumpedinto L29. S356 dischar=500; Rule Curve s356 SeepFC designCap 01jan-31may = 0 cfs; 01jun-15jul=500 cfs; 16jul-30nov=0 cfs; 01dec-31dec=500cfs: Rule curve s356 Seep designCap 01jan-31may=500cfs; 01jun-15jul=0 cfs; 16jul-30nov=500 cfs; 01dec-31dec=0: S cfs. Special code s356 Open=6.0 ft; s356 Close=5.5 ft; L29 constr=9.7 ft; G3273=9.5 ft.

Canal	Structure	**YL4 (RSMGL)**	**YL5 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-67	S-345*	Non-existent	Non-existent
	S-349*	Non-existent	Non-existent
L-28	S-344*	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15
	S-343A-B*	Special code 1) Closed Nov 1- Jul15 2) flood control only	Special code 1) Closed Nov 1- Jul15 2) flood control only
L-29	S-12A-D*	Not operated, flows are imposed	Not operated, flows are imposed
	S-333*	Not operated, flows are imposed	Not operated, flows are imposed
	S-334	Non-existent Special code 1) Flood Control 2) No open/close ops, structure flow is based on L31N stage 4) Design Q=1230 cfs	Non-existent Special code 1) Flood Control 2) No open/close ops, structure flow is based on L31N stage 4) Design Q=1230 cfs
	S-355*	1) S355 A and B Modeled Design Q = 1000 cfs each, 2) Flood control only 3) Not operated per special code (FC). Any available water u/s is passed thru the structure under gravity.	1) S355 A and B Modeled Design Q = 1000 cfs each, 2) Flood control only 3) Not operated per special code (FC). Any available water u/s is passed thru the structure under gravity.
	S-356*	Special code 1) Pumping limited to the amount of seepage into L-31N 2) Flood control 3) Pumped into L-29 4) L-29 constraint 9.7, G3273 constraint 6.8. 5) S356 designCap=500 cfs,dischar = 500 cfs, s356_1 designCap=100 cfs, dischar=100 cfs, open/close=6.0/5.5; s356_2 designCap=100 cfs dischar=100 cfs open/close=6.0/5.5.	Special code 1) Pumping limited to the amount of seepage into L-31N 2) Flood control 3) Pumped into L-29 4) L-29 constraint 9.7, G3273 constraint 6.8. 5) S356 = 500 cfs.

Canal	Structure	**YL0 (RSMGL)**	**YL1 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-30	S337	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)
		mse_unit inlet L30; L30 localLevel=7.0 mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_ECB.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml	mse_unit inlet L30; L30 localLevel=7.0 mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_ECB.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml
	S-151*	Not operated, flows are imposed	Not operated, flows are imposed
	S-335	**7.5/ 7.2** open/closed wet &dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 localLevel=7.0 mse_unit inlet for L31NC; localLevel=99.0 Seepage across L30 south of S335 Kmd=2.5926E-05; Kms=1.474070E-02; Mash cell id=2983	**7.5/ 7.2** open/closed wet &dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 localLevel=7.0 mse_unit inlet for L31NC; localLevel=99.0 Seepage across L30 south of S335 Kmd=0.0000000E-00; Kms=0.0000000E-00; Marsh cell id=2983

Canal	Structure	**YL2 (RSMGL)**	**YL3 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-30	S337	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)
		mse_unit inlet L30; L30 localLevel=7.0 mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_ECB.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml	mse_unit inlet L30; L30 localLevel=7.0 mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_ECB.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml
	S-151*	Not operated, flows are imposed	Not operated, flows are imposed
	S-335	**7.5/ 7.2** open/closed wet &dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 localLevel=7.0 mse_unit inlet for L31NC; localLevel=99.0 Seepage across L30 south of S335 Kmd=2.5926E-05; Kms=1.474070E-02; Mash cell id=2983	**7.5/ 7.2** open/closed wet &dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 localLevel=7.0 mse_unit inlet for L31NC; localLevel=99.0 Seepage across L30 south of S335 Kmd=2.5926E-05; Kms=1.474070E-02; Mash cell id=2983

Canal	Structure	YL4 (RSMGL)	YL5 (RSMGL)
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-30	S337	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)
		Water Supply & Flood Control designCap=1100 cfs; mse_unit inlet L30; L30 localLevel=7.0 mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_ECB.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml	mse_unit inlet L30; L30 localLevel=7.0 mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_ECB.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml
	S-151*	Not operated, flows are imposed	Not operated, flows are imposed
	S-335	**7.5/ 7.2** open/closed wet &dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0; s335_1 flood control designCap=100 cfs dischar=100 cfs open/close=7.5/7.2 ft; s335_2 flood control designCap=100 cfs, dischar=100 cfs, open/close=7.5/7.2 ft; s335_3 flood control designCap=100 cfs, dischar=100 cfs, open/close=7.5/7.2 cfs. mse_unit outlet for L30; L30 localLevel=7.0 mse_unit inlet for L31NC; localLevel=99.0 Seepage across L30 south of S335 Kmd=2.5926E-05; Kms=1.474070E-02; Mash cell id=2983	**7.5/ 7.2** open/closed wet &dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 localLevel=7.0 mse_unit inlet for L31NC; localLevel=99.0 Seepage across L30 south of S335 Kmd=2.5926E-05; Kms=1.474070E-02; Mash cell id=2983

Canal	Structure	**YL0 (RSMGL)**	**YL1 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N	S-338	**5.8 / 5.5** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0 mse_unit inlet for L31NC; localLevel=99.0	**5.8 / 5.5** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0 mse_unit inlet for L31NC; localLevel=99.0
	G-211	**6.0 / 5.5** open/closed wet & dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply only 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N; L31N localLevel=99.0 no rulecurve; Seepage across L31N north of G211 Kmd=2.6041670E-03; Kms=6.7778771E-03; Marsh cell id=7542	**6.0 / 5.5** open/closed wet & dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply only 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N;L31N localLevel=99.0 no rulecurve; Seepage across L31N north of G211 Kmd=0.0000000E-00; Kms=0.0000000E-00; Marsh cell id=7542
	S-173 & S-331P (COMBQ) *	1) Water Supply only 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.	1) Water Supply only 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.

Canal	Structure	YL2 (RSMGL)	YL3 (RSMGL)
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N	S-338	**5.8 / 5.5** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0 mse_unit inlet for L31NC; localLevel=99.0 Seepage across L30 south of S335 Kmd and Kms values changed at several marsh cell id relative to those at YL0. Marsh cell ids are 3208, 3437, 3663, 3664, 3666, 3672, 2983.	Rule Curve s338 Open 01jan = 5.6 ft; 31may=5.6 ft; 01jun=5.8 ft; 31dec=5.8 ft: Rule curve s338 Close 01jan=5.4s; 31may=5.4 ft; 01jun=5.5 ft; 31dec=5.5 ft.
	G-211	**6.0 / 5.5** open/closed wet & dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply only 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N; L31N localLevel=99.0 no rulecurve; Seepage across L31N. Kmd and Kms values changed relative to YL0 at 7542, 7540, 7551, 7550, 2972, 2971, 3186, 2966.	**6.0 / 5.5** open/closed wet & dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply only 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N;L31N localLevel=99.0 no rulecurve.
	S-173 & S-331P (COMBQ) *	1) Water Supply only 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.	1) Water Supply only 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.

Canal	Structure	**YL4 (RSMGL)**	**YL5 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N	S-338	**5.8 / 5.5** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0 mse_unit inlet for L31NC; localLevel=99.0	**5.8 / 5.5** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0 mse_unit inlet for L31NC; localLevel=99.0
	G-211	**6.0 / 5.5** open/closed wet & dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply only 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N; L31N localLevel=99.0 no rulecurve; Seepage across L31N north of G211 Kmd=2.6041670E-03; Kms=6.7778771E-03; Marsh cell id=7542	**6.0 / 5.5** open/closed wet & dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply only 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N;L31N localLevel=99.0 no rulecurve.
	S-173 & S-331P (COMBQ) *	1) Water Supply only 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.	1) Water Supply only 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.

Canal	Structure	**YL0 (RSMGL)**	**YL1 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N (cont)	S-173 & S-331P (COMBQ) * (cont)	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations
	S-176	**5.0 / 4.75** open/closed wet & dry season 1) Water Supply / Flood Control 2) design Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)	**5.0 / 4.75** open/closed wet & dry season 1) Water Supply / Flood Control 2) design Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)
	S-174*	S174 not in model; canal is blocked near structure	S174 not in model; canal is blocked near structure

Canal	Structure	**YL2 (RSMGL)**	**YL3 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N (cont)	S-173 & S-331P (COMBQ) * (cont)	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations
	S-176	**5.0 / 4.75** open/closed wet & dry season 1) Water Supply / Flood Control 2) design Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)	**5.0 / 4.75** open/closed wet & dry season 1) Water Supply / Flood Control 2) design Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)
	S-174*	S174 not in model; canal is blocked near structure	S174 not in model; canal is blocked near structure

Canal	Structure	**YL4 (RSMGL)**	**YL5 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N (cont)	S-173 & S-331P (COMBQ) * (cont)	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations
	S-176	**5.0 / 4.75** open/closed wet & dry season 1) Water Supply / Flood Control 2) design Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)	**5.0 / 4.75** open/closed wet & dry season 1) Water Supply / Flood Control 2) design Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)
	S-174*	S174 not in model; canal is blocked near structure	S174 not in model; canal is blocked near structure

Canal	Structure	YL0 (RSMGL)		YL1 (RSMGL)	
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	
L-31N (cont)	S-332A, B,C,D (pumps)	S332A Non-Existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A Non-Existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A Non-Existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A Non-Existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65
		S332A =300 cfs S332B =325 cfs S332BN =250cfs S332C = 575 cfs S332D = 500 cfs Jul16-Nov30, 325cfs Dec 1-Jan31, 165cfs Feb 1-Jul15 All Flood Control		S332A =300 cfs S332B =325 cfs S332BN =250cfs S332C = 575 cfs S332D = 500 cfs Jul16-Nov30, 325cfs Dec 1-Jan31, 165cfs Feb 1-Jul15 All Flood Control	
	S-357 (pump)	s357A flood control designCap=250 cfs. twHeadLimit=12.17 ft; rule curve s357A Open 01nov-31may 5.7 ft 01jun-31oct=5.2 ft; rule curve s357A Close 01nov-31may 5.4 ft 01jun-31oct 4.9 ft; s357B flood control designCaop=250 cfs, twHeadLimit=12.17 ft rule curve s357B Open 01nov-31may=6.0 ft 01jun-31oct=5.5 ft; rule curve s357B Close 01nov-31may=5.7 01jun-310ct=5.2 ft:		**6.2 / 5.7** open/closed wet & dry season s357A flood control designCap=250 cfs. twHeadLimit=12.17 ft; rule curve s357A Open 01nov-31may 5.7 ft 01jun-31oct=5.2 ft; rule curve s357A Close 01nov-31may 5.4 ft 01jun-31oct 4.9 ft; s357B flood control designCaop=250 cfs, twHeadLimit=12.17 ft rule curve s357B Open 01nov-31may=6.0 ft 01jun-31oct=5.5 ft; rule curve s357B Close 01nov-31may=5.7 01jun-310ct=5.2 ft:	
L-31W	S-332 (pumps)*	s332BN 5.0/4.7 ft twHeadLimit 8.789 ft; s332B 5.0/4.7 ft twHeadLimit 7.866 ft; s332C 5.0/4.7 twHeadLimit 7.866 ft		s332BN 5.0/4.7 ft twHeadLimit 8.789 ft; s332B 5.0/4.7 ft twHeadLimit 7.866 ft; s332C 5.0/4.7 ft twHeadLimit 7.866 ft	
	S-175	Non-existent		Non-existent	
C-111	S-200	S-200A=75cfs; **3.8 / 3.6** S-200B=75cfs; **3.9 / 3.6** S-200C=75cfs; **4.0 / 3.6**		S-200A=75cfs; **3.8 / 3.6** S-200B=75cfs; **3.9 / 3.6** S-200C=75cfs; **4.0 / 3.6**	
	S-199	S-200A=75cfs; **3.8 / 3.6** S-200B=75cfs; **3.9 / 3.6** S-200C=75cfs; **4.0 / 3.6**		S-200A=75cfs; **3.8 / 3.6** S-200B=75cfs; **3.9 / 3.6** S-200C=75cfs; **4.0 / 3.6**	
	S-177	**4.2 / 3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.		**4.2 / 3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.	
	S-18C	**2.6 / 2.3** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.		**2.6 / 2.3** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.	
	S-197*	****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.		****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.	
	S-332E (pump)	Non-existent		Non-existent	

* SFWMM uses special code. Open/Close may or may not be used in operations.

**** S-197 Ops: Open 3 gates if S-177 full open & S-177>4.1 ft or S-18C> 2.8 ft
Open 7 gates if S-177 > 4.2 ft for 24 hrs or S-18C > 3.1 ft
Open 13 gates if S-177 > 4.3 ft or S-18C > 3.3 ft
Close when all the conditions below are met

1) S-176 < 5.2 ft and S-177 < 4.2 ft
2) Storm moved away from basin
3) After 1 and 2 are met, keep the number of S-197 culverts open necessary only to match residual flow through S-176

Canal	Structure	YL2(RSMGL)		YL3 (RSMGL)	
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	
L-31N (cont)	S-332A, B,C,D (pumps)	S332A Non-Existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A Non-Existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A Non-Existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A Non-Existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65
		S332A =300 cfs S332B =325 cfs S332BN =250cfs S332C = 575 cfs S332D = 500 cfs Jul16-Nov30, 325cfs Dec 1-Jan31, 165cfs Feb 1-Jul15 All Flood Control		S332A =300 cfs S332B =325 cfs S332BN =250cfs S332C = 575 cfs S332D = 500 cfs Jul16-Nov30, 325cfs Dec 1-Jan31, 165cfs Feb 1-Jul15 All Flood Control	
	S-357 (pump)	**6.2 / 5.7** open/closed wet & dry season s357A flood control designCap=250 cfs. twHeadLimit=12.17 ft; rule curve s357A Open 01nov-31may 5.7 ft 01jun-31oct=5.2 ft; rule curve s357A Close 01nov-31may 5.4 ft 01jun-31oct 4.9 ft; s357B flood control designCaop=250 cfs, twHeadLimit=12.17 ft rule curve s357B Open 01nov-31may=6.0 ft 01jun-31oct=5.5 ft; rule curve s357B Close 01nov-31may=5.7 01jun-310ct=5.2 ft:		**6.2 / 5.7** open/closed wet & dry season s357A flood control designCap=250 cfs. twHeadLimit=12.17 ft; rule curve s357A Open 01nov-31may 5.7 ft 01jun-31oct=5.2 ft; rule curve s357A Close 01nov-31may 5.4 ft 01jun-31oct 4.9 ft; s357B flood control designCaop=250 cfs, twHeadLimit=12.17 ft rule curve s357B Open 01nov-31may=6.0 ft 01jun-31oct=5.5 ft; rule curve s357B Close 01nov-31may=5.7 01jun-310ct=5.2 ft:	
L-31W	S-332 (pumps)*	s332BN 5.0/4.7 ft twHeadLimit 8.789 ft; s332B 5.0/4.7 ft twHeadLimit 7.866 ft; s332C 5.0/4.7 twHeadLimit 7.866 ft		s332BN 5.0/4.7 ft twHeadLimit 8.789 ft; s332B 5.0/4.7 ft twHeadLimit 7.866 ft; s332C 5.0/4.7 ft twHeadLimit 7.866 ft	
	S-175	Non-existent		Non-existent	
C-111	S-200	S-200A=75cfs; **3.8/3.6** S-200B=75cfs; **3.9/3.6** S-200C=75cfs; **4.0/3.6**		S-200A=75cfs; **3.8/3.6** S-200B=75cfs; **3.9/3.6** S-200C=75cfs; **4.0/3.6**	
	S-199	S-200A=75cfs; **3.8/3.6** S-200B=75cfs; **3.9/3.6** S-200C=75cfs; **4.0/3.6**		S-200A=75cfs; **3.8/3.6** S-200B=75cfs; **3.9/3.6** S-200C=75cfs; **4.0/3.6**	
	S-177	**4.2/3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.		**4.2/3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.	
	S-18C	**2.6 / 2.3** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.		**2.6 / 2.3** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.	
	S-197*	****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.		****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.	
	S-332E (pump)	Non-existent		Non-existent	

* SFWMM uses special code. Open/Close may or may not be used in operations.

**** S-197 Ops: Open 3 gates if S-177 full open & S-177>4.1 ft or S-18C> 2.8 ft
Open 7 gates if S-177 > 4.2 ft for 24 hrs or S-18C > 3.1 ft
Open 13 gates if S-177 > 4.3 ft or S-18C > 3.3 ft
Close when all the conditions below are met

1) S-176 < 5.2 ft and S-177 < 4.2 ft
2) Storm moved away from basin
3) After 1 and 2 are met, keep the number of S-197 culverts open necessary only to match residual flow through S-176

Canal	Structure	YL4 (RSMGL)		YL5 (RSMGL)	
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	
L-31N (cont)	S-332A, B,C,D (pumps)	S332A Non-Existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A Non-Existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A Non-Existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A Non-Existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65
		S332A =300 cfs S332B =325 cfs S332BN =250cfs S332C = 575 cfs S332D = 500 cfs Jul16-Nov30, 325cfs Dec 1-Jan31, 165cfs Feb 1-Jul15 All Flood Control		S332A =300 cfs S332B =325 cfs S332BN =250cfs S332C = 575 cfs S332D = 500 cfs Jul16-Nov30, 325cfs Dec 1-Jan31, 165cfs Feb 1-Jul15 All Flood Control	
	S-357 (pump)	**6.2 / 5.7** open/closed wet & dry season s357A flood control designCap=250 cfs. twHeadLimit=12.17 ft; rule curve s357A Open 01nov-31may 5.7 ft 01jun-31oct=5.2 ft; rule curve s357A Close 01nov-31may 5.4 ft 01jun-31oct 4.9 ft; s357B flood control designCaop=250 cfs, twHeadLimit=12.17 ft rule curve s357B Open 01nov-31may=6.0 ft 01jun-31oct=5.5 ft; rule curve s357B Close 01nov-31may=5.7 01jun-310ct=5.2 ft:		**6.2 / 5.7** open/closed wet & dry season s357A flood control designCap=250 cfs. twHeadLimit=12.17 ft; rule curve s357A Open 01nov-31may 5.7 ft 01jun-31oct=5.2 ft; rule curve s357A Close 01nov-31may 5.4 ft 01jun-31oct 4.9 ft; s357B flood control designCaop=250 cfs, twHeadLimit=12.17 ft rule curve s357B Open 01nov-31may=6.0 ft 01jun-31oct=5.5 ft; rule curve s357B Close 01nov-31may=5.7 01jun-310ct=5.2 ft:	
L-31W	S-332 (pumps)*	s332BN 5.0/4.7 ft twHeadLimit 8.789 ft; s332B 5.0/4.7 ft twHeadLimit 7.866 ft; s332C 5.0/4.7 twHeadLimit 7.866 ft		Non-existent	
	S-175	Non-existent		Non-existent	
C-111	S-200	S-200A=75cfs; **3.8 / 3.6** S-200B=75cfs; **3.9 / 3.6** S-200C=75cfs; **4.0 / 3.6**		S-200A=75cfs; **3.8 / 3.6** S-200B=75cfs; **3.9 / 3.6** S-200C=75cfs; **4.0 / 3.6**	
	S-199	S-200A=75cfs; **3.8 / 3.6** S-200B=75cfs; **3.9 / 3.6** S-200C=75cfs; **4.0 / 3.6**		S-200A=75cfs; **3.8 / 3.6** S-200B=75cfs; **3.9 / 3.6** S-200C=75cfs; **4.0 / 3.6**	
	S-177	**4.2 / 3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.		**4.2 / 3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.	
	S-18C	**2.6 / 2.3** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.		**2.6 / 2.3** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.	
	S-197*	****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.		****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.	
	S-332E (pump)	Non-existent		Non-existent	

* SFWMM uses special code. Open/Close may or may not be used in operations.

**** S-197 Ops: Open 3 gates if S-177 full open & S-177>4.1 ft or S-18C> 2.8 ft
Open 7 gates if S-177 > 4.2 ft for 24 hrs or S-18C > 3.1 ft
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Close when all the conditions below are met

1) S-176 < 5.2 ft and S-177 < 4.2 ft
2) Storm moved away from basin
3) After 1 and 2 are met, keep the number of S-197 culverts open necessary only to match residual flow through S-176

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Central Everglades Planning Project (CEPP) Baseline Runs Model Documentation Report

IMC MSR 368 **February 14, 2014**

1.0 Overview

Identification

The Central Everglades Planning Project (CEPP) is an expedited planning effort undertaken as part of the overall Comprehensive Everglades Restoration Plan (CERP), a program led by the United States Army Corps of Engineers (USACE) with the South Florida Water Management District (SFWMD) as local sponsor. The project worked throughout 2012 and 2013 to develop a Project Implementation Report (PIR) that combines planning and design activities for three primary areas of interest in the south Florida system as follows: 1) Storage & water treatment facilities in the Everglades Agricultural Area, 2) Decompartmentalization of levees within the Everglades Protection Area (EPA) and 3) Levee seepage management features along the Everglades / urban boundary in southeastern Florida. Modeling support to the CEPP effort was provided by a team comprised of modelers from the Hydrologic & Environmental Systems Modeling Section of the SFWMD and the Interagency Modeling Center (IMC), with direct support also provided by the USACE and Everglades National Park of the Department of the Interior (DOI). Modeling workflow and coordination were performed in a manner consistent with the procedures outlined in IMC Modeling Services Request (MSR) 368 and the CEPP Modeling Strategy (**SFWMD, 2012a**).

Scope and Objectives

Modeling support for CEPP focused on working with the larger project planning team and other interested parties to formulate and test project features leading to the ultimate identification and refinement of a tentatively selected plan (TSP). Modeling products were developed at the appropriate level of detail to support feature screening and detailed representation of project features and to provide information to all necessary evaluations required for plan development and documentation in the PIR. The project plan formulation framework is shown in **Figure 1.1** and illustrates a spatially determined workflow (moving north to south through the south Florida system) utilizing initial screening followed by detailed evaluation to identify final project planning alternatives and ultimately a TSP for the effort.

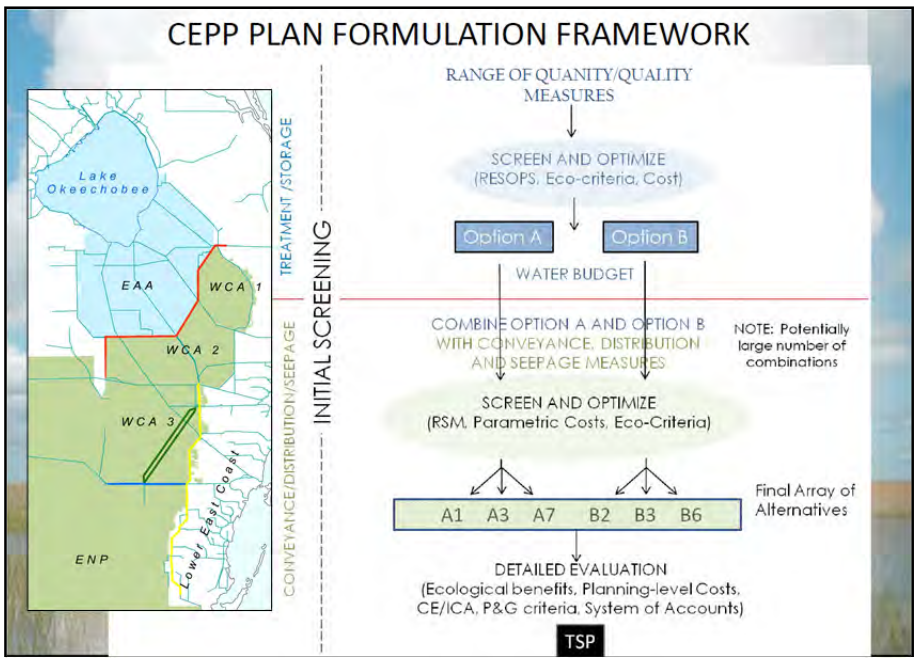


Figure 1.1. Central Everglades Planning Project Plan Formulation Framework

The CEPP Modeling Strategy document (**SFWMD, 2012a**) describes the modeling process and tools utilized, the associated rationale of the selection process and the means by which the tools could expediently support the project workflow. The primary model support tools utilized in CEPP are as follows:

Screening Tools:

- REservoir Sizing and OPerations Screening (RESOPS)
- Lake Okeechobee OPerations Screening (LOOPS)
- C-43 Spreadsheet Model
- iModel©

Detailed Planning Models:

- Regional Simulation Model Basins (RSMBN)
- Regional Simulation Model Glades-LECSA (RSMGL)
- Dynamic Model for Stormwater Treatment Areas (DMSTA)

From a modeling deliverable perspective, the entirety of the CEPP modeling support can be summarized by reviewing the following four Model Documentation Reports (MDRs):

1. CEPP Baseline Runs – Reviews the various non-CEPP model representations (e.g. current and future without project conditions) used in various aspects of the project planning (this document).
2. CEPP Final Array of Alternatives – Reviews four proposed with-CEPP project model representations examined during plan formation (**SFWMD & IMC, 2014b**).
3. CEPP Tentatively Selected Plan – Reviews the model representation of the CEPP TSP and subsequent refinements during final plan formulation and project assurance planning (**SFWMD & IMC, 2014c**).
4. CEPP Model Supported Screening Efforts – Reviews the various model-supported feature screening efforts undertaken at various points in the planning process (**SFWMD & IMC, 2014d**).

This Baseline Runs MDR describes the assumptions, model implementation steps and observed outcomes associated with modeling representations of the current and future without project condition model scenarios. These model runs were predominantly used as a basis of comparison for many of the evaluations performed in support of plan formulation or project assurances assessment. This document will focus on the modeling details of these scenarios; information on the use and rationale for the definition of these conditions is contained in the CEPP PIR (**USACE, 2013b**).

2.0 Basis

Project Assumptions

This Baseline Runs MDR describes the assumptions, model implementation steps and observed outcomes associated with modeling the following scenarios:

CEPP Final Plan Formulation Baselines - released 12/13/2012
- 2010 / 2011 Existing Condition Baseline (ECB)
- 2050 Future Without Project Baseline (FWO)

CEPP Final Project Assurances Baselines - released 6/3/2013
- 2012 Existing Condition Baseline (2012EC)
- 2050 Initial Operating Regime Baseline (IORBL1)

In general, the existing conditions baseline scenarios attempt to model assumed hydrologic conditions circa a defined date (e.g. November 2011 at CEPP project initiation for the ECB scenario) and include current system infrastructure assumptions and current operational practices. In general, the future projected 2050 conditions include, relative to existing conditions, additional representations of planned future project activities, including state, federal and CERP projects. It is important to note that since various parts of the CEPP planning effort initiated at different times (e.g. assurances work was subsequent to plan formulation work), the information available for any particular baseline may be slightly different as current system or future planned project activities evolve with time.

Detailed project assumption tables for each scenario are provided in **Appendix A** and key elements of model implementation are described in Section 3.

Model Limitations and Intended Use of Results

The primary modeling products of CEPP were evaluated based on outputs from the Regional Simulation Model (RSM; **SFWMD, 2005a** and **2005b**). The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g,. use available input-driven options to represent more complex project operations).

The RSMBN, RSMGL (**SFWMD, 2010** and **2011**), and DMSTA (**Walker & Kadlec, 2005**; **Wang, 2012**) models were reviewed through the USACE validation process for engineering software,

as part of the CEPP project. The RSM and DMSTA models were classified as "allowed for use" for South Florida applications in August 2012 and January 2013, respectively. Additionally, the RESOPS (**SFWMD, 2009**), LOOPS (**Neidrauer et al, 2006**), and C-43 spreadsheet model (**Starnes & Marlowe, 2007**) tools and the iModel optimization tool (**Ali, 2009**) used in CEPP underwent USACE Agency Technical Review (ATR). Approval of these modeling tools for CEPP application was completed in November, 2012.

3.0 Simulation

Modeling Tools Used

RSM version 2.3.5 was used to run both the RSMBN and RSMGL models.
Release date 12/6/2012, SVN Version #4730.

Model Set Up

The CEPP baseline scenarios were developed using the decoupled RSMBN and RSMGL models. Collectively, these two models cover the spatial extent of the project planning area as shown in **Figure 3.1**. The RSMBN modeling for CEPP was built as an extension of the Northern Everglades RSM (**SFWMD et al, 2009a** and **2009b**) with expanded capabilities in the areas generally south of Lake Okeechobee while the RSMGL modeling for CEPP was built from the baseline scenarios developed for the DECOMP project (**SFWMD, 2010; SFWMD, 2011**). The period of simulation for both models utilizes a climate record from 1965 to 2005.

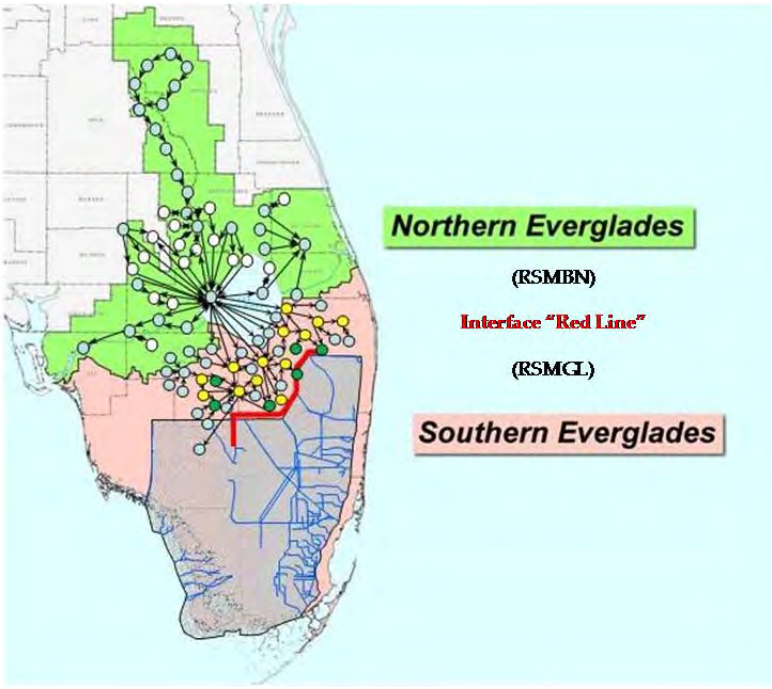


Figure 3.1. Decoupled CEPP Modeling Approach using RSMBN and RSMGL models.

Relative to the previous versions of the RSMBN and RSMGL models referenced, the following changes in model structure, extent or parameterization were made prior to or coincident with the development of the baseline scenarios:

- RSMBN simulation period was extended to a 1965-2005 period of simulation (NERSM modeling used 1970-2005); no additional verification was completed for the 1965-1969 period for CEPP application of RSMBN.
- The RSMBN was spatially expanded into areas south of Lake Okechobee, including the Everglades Agricultural Area (EAA) and the Western Basins.
- For the RSMBN Major EAA Basins (Miami, North New River-Hillsboro, West Palm Beach) the following modeling approach was implemented:
    - Major EAA and other, smaller basins (e.g. 298 districts) were delineated using GIS and stage-storage-surface area relationships were derived for each basin.
    - Three parameters (Kcalib for evapotranspiration, FcLevel & MaintLevel) were manually adjusted to match monthly simulated runoff and demand => total of 36 parameters
    - Matching of EAA runoff and demand based on long-term (1965-2005) monthly averages with the goal of close correspondence to the estimation produced by the South Florida Water Management Model (refrence to SFWMM primer), which is calibrated to historical data.
    - Example results are shown in **Figures 3.1 and 3.2** and **Table 3.1**.

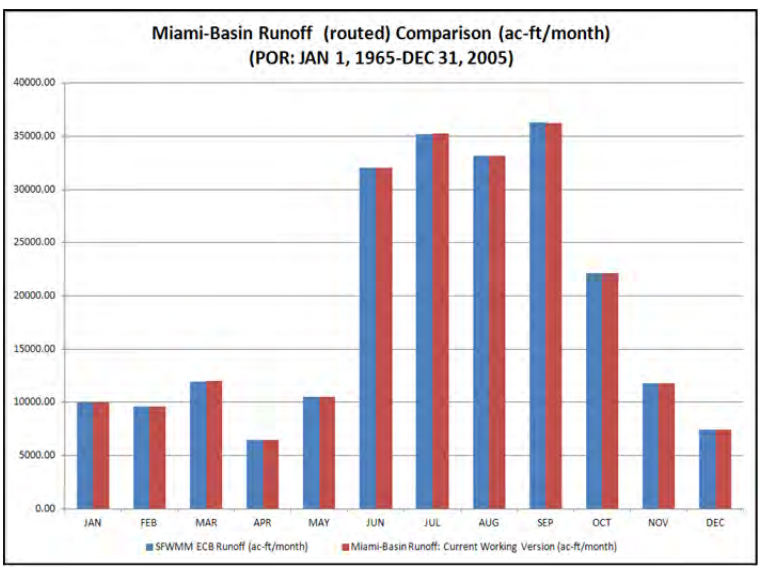


Figure 3.2. Validation of RSMBN Seasonal Runoff Variability for the Miami Canal Basin

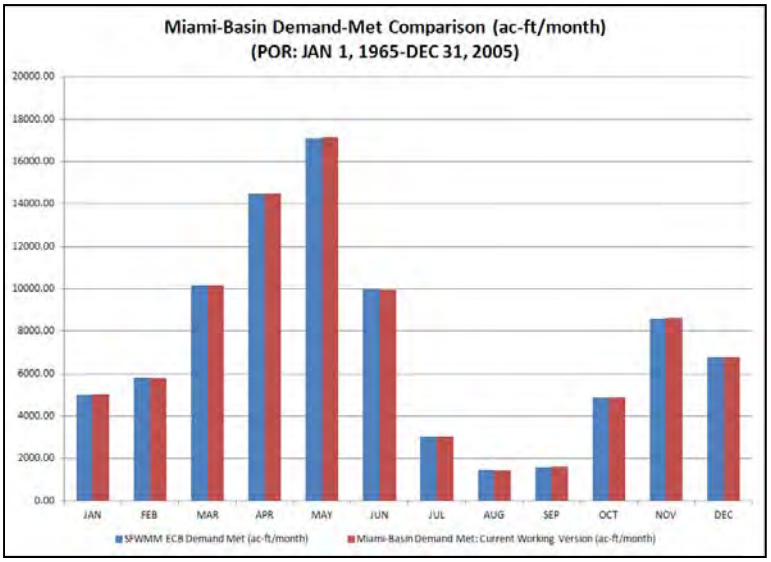


Figure 3.3. Validation of RSMBN Seasonal Supplemental Demand Variability for the Miami Canal Basin

Table 3.1. Long Term Average Validation of RSMBN Supplemental Demand and Runoff for Major EAA Basins

1965-2005 Annual Average Simulated EAA Runoff/Demand (kac-ft)						
	Runoff			Demand		
	SFWMM	RSMBN	%DIFF	SFWMM	RSMBN	%DIFF
MIAMI BASIN	226.5	226.6	0.01	88.8	88.9	0.04
NNR-HILLS BASIN	484.3	484.7	0.07	141.1	141.0	0.06
WPB BASIN	283.8	283.8	0.01	87.4	87.4	0.01

- For RSMBN Stormwater Treatment Areas (STA1, STA2, STA3/4, STA5 & STA6), the following modeling approach was implemented:
  - Flow within each STA was approximated using overland flow equation (weir outflow equation) used in the DMSTA model
  - "Soft" calibration was performed on standalone STA model applications
    - Rainfall reference evapotranspiration and total inflows were imposed
    - Stages, seepage and total outflows were simulated
    - Historical stages and flows (period-of-simulation varies by STA depending on available historical data) were matched by adjusting DMSTA flow coefficient

- In RSMBN application, these derived physical parameters were utilized and all rainfall, evapotranspiration and flows were once again simulated.

- For 298 Districts (South Florida Conservancy District, South Shore Drainage District, 715 Farms, East Shore Drainage District, East Beach Drainage District), the following modeling approach was implemented:
  - Evaportranspirtastion characteristics were assumed to be similar to adjacent primary EAA basins such that FcLevel and MaintLevel were the only parameters used in matching historical runoff
  - Validation of flows was performed for runoff data available from 1994-2005
  - Example results are shown in **Figure 3.3** and **Table 3.2.**

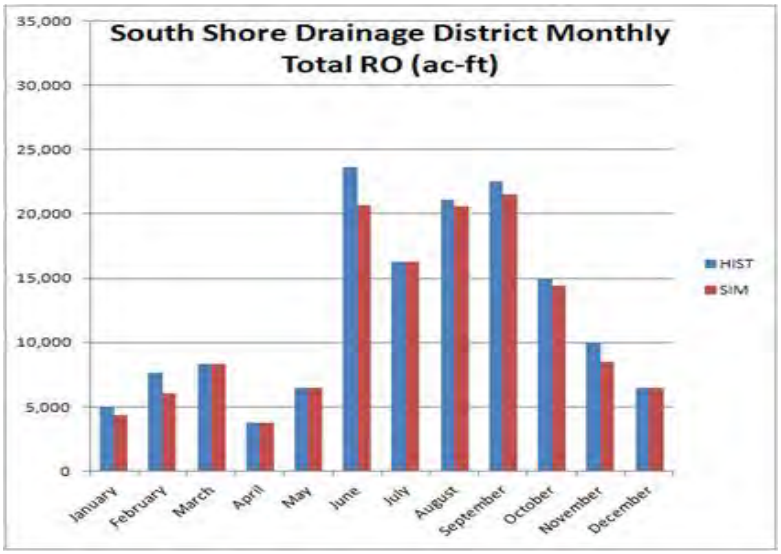


Figure 3.3. Validation of RSMBN Seasonal Runoff Variability for the South Shore Drainage 298 District

Table 3.2. Long Term Average Validation of RSMBN Runoff for 298 Districts

TOTAL RUNOFF FROM 298 DISTRICTS (May 1, 1994-Dec. 31, 2005)		
	WET SEASON (kac-ft)	DRY SEASON (kac-ft)
HISTORICAL	61.02	30.58
RSMBN	59.00	27.74
% DIFF	-3.31	-9.29

- For the Western Basins, the C139RSM implementation described by Flaig (2011a, 2011b), was coupled to the RSMBN model.
- RSMGL simulation period was extended to a 1965-2005 period of simulation (Decomp modeling used 1965-2000); no additional verification was completed for the 2001-2005 period for CEPP application of RSMGL.

- RSMGL parameters effecting the dynamics of levee seepage and regional groundwater flux (as described in the RSMGL calibration report) along the L31N reach in northern Miami-Dade county were revised based on provisional information obtained from field work being performed in that locality at the time of project initiation. Initial calibration of RSMGL was updated using application of an Analytic Element Model to refine the cross sectional hydrogeological representation in the model. This exercise resulted in a change in the relative ratio of flow into the L31N canal vs flow in the groundwater column of the surficial aquifer, moving from a previously assumed ~90/10 ratio to an updated ~70/30 ratio. It was verified that resulting changes to a re-run RSMGL calibration sensitivity did not significantly alter RSMGL calibration statistics or model goodness of fit measures.

The remainder of this section will focus on the project plan formation baselines of the ECB and FWO scenarios to describe model implementation. A short description near the end of the section will explain the relatively minor modifications included in the project assurances scenarios of 2012EC and IORBL1.

In general, the assumed modeled data sets (e.g. topography, water control districts, etc…) and/or system features (structure operations, etc…) are consistent with the previous planning exercises, unless identified as changed in this section or the assumptions tables in Appendix A. The CEPP project team identified the following primary datasets for use across all the baseline scenarios:

- Lake Okeechobee Service Area permit information as of 2/21/12 (**Figure 3.5**)
- LEC Public Water Supply: 2010 consumptive use permit information as documented in the C-51 Reservoir project (**Figure 3.6**)
- Industrial pumpage and Residential Self-Supplied using 2030 projected by SFWMD Water Supply Bureau (LECWSP)
- LEC Land Use: 2008-2009 coverage; consumptive use permits as of 2011 were used to update the land use in areas where it did not reflect the permit information.

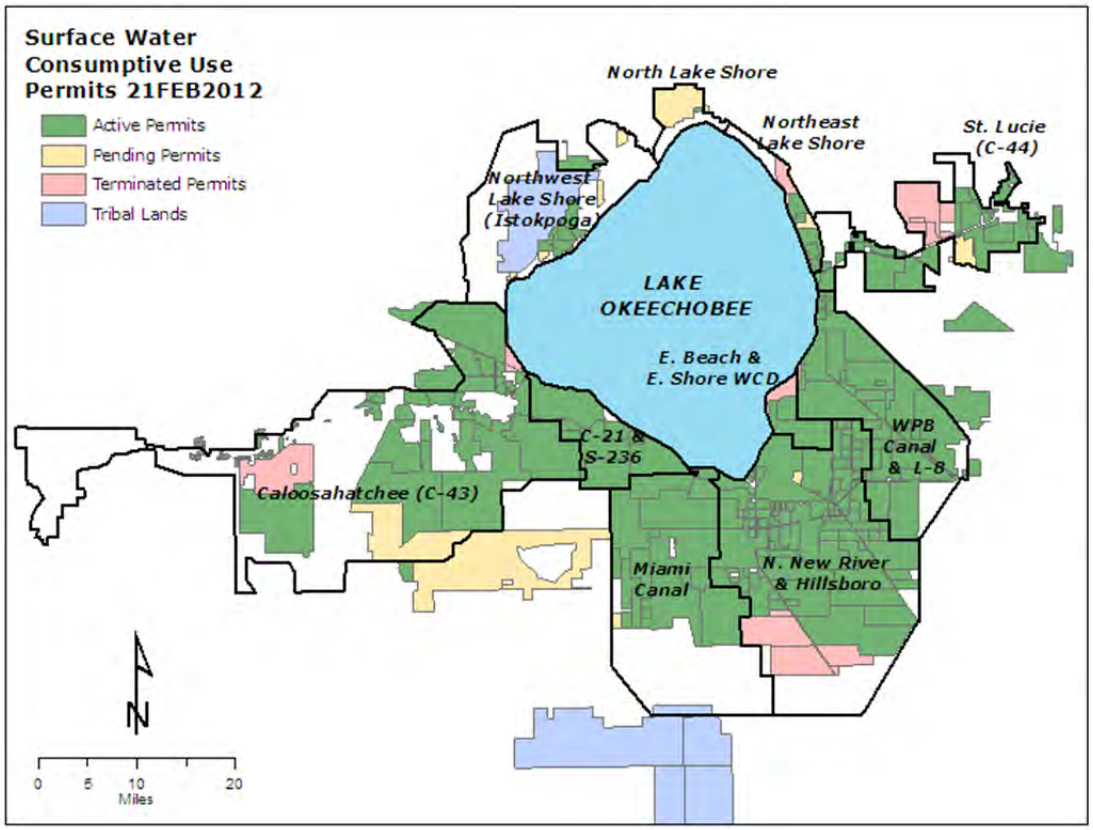


Figure 3.5 Lake Okeechobee Service Area permit information as of 2/21/2012.

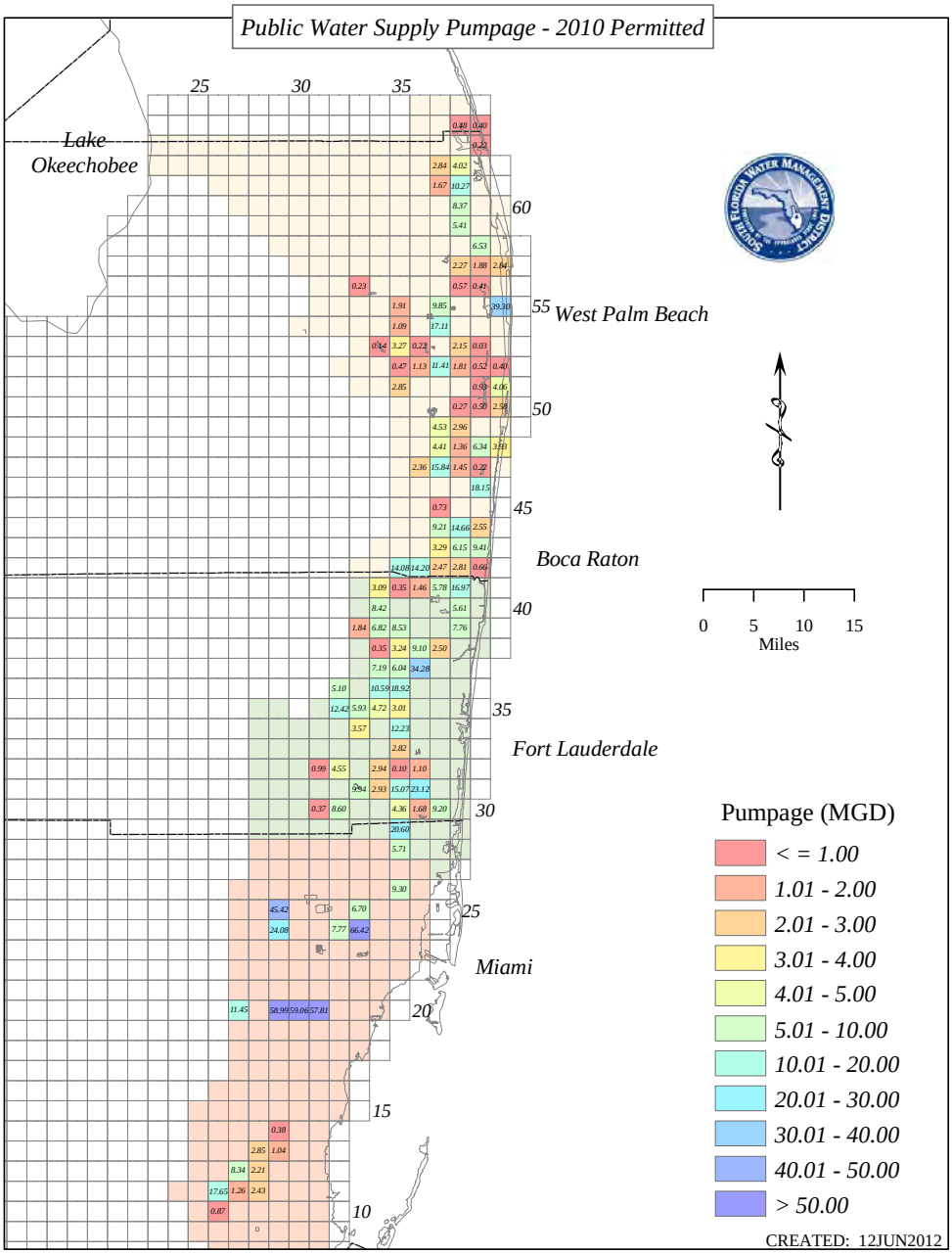


Figure 3.6. Lower East Coast Public Water Supply 2010 Consumptive Use permit information (Source: C-51 Reservoir Project)

The LORS08 schedule is used for operation of Lake Okeechobee in all CEPP baselines. Details of the model implementation of the schedule can be found in **Appendix B**.

A number of key model updates to assumed FWO projects were undertaken in CEPP as shown in **Figure 3.7**. The subsequent sub-sections will explain the modeling setup for each area as assumed in the ECB and FWO scenarios. Details about project intent can be found in the associated project reports for each effort.

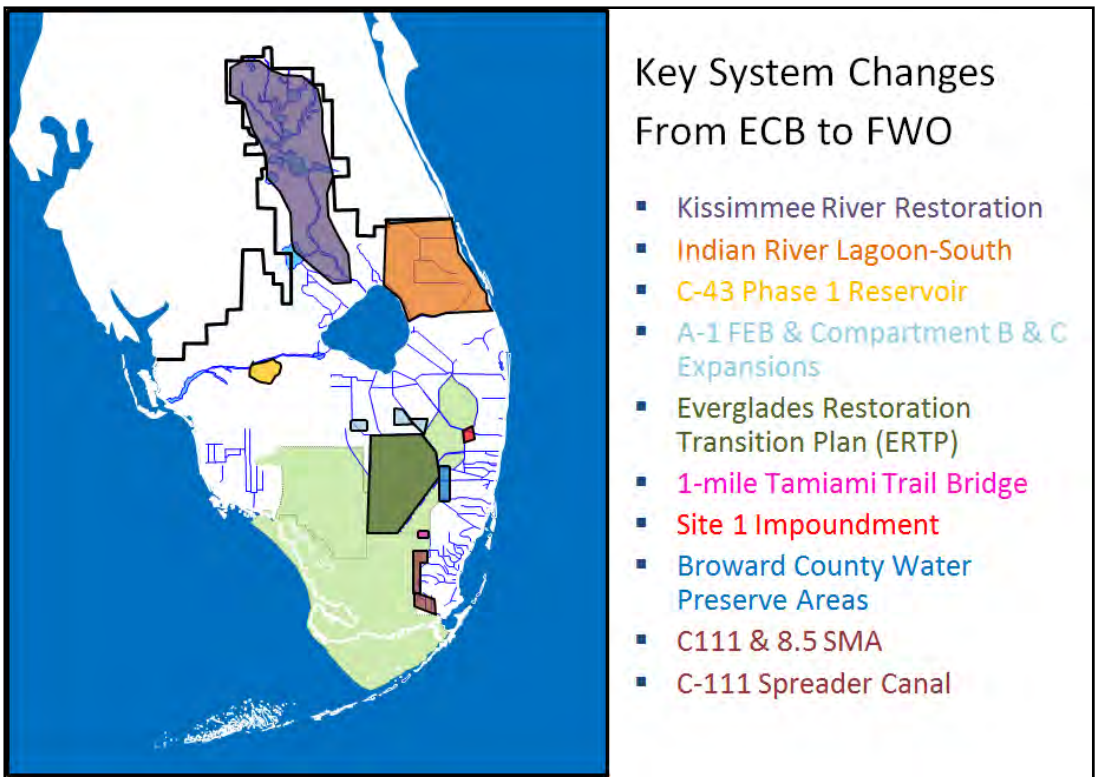


Figure 3.7. Key system updates differentiating the ECB (existing condition baseline) and FWO (future condition without project baseline) model runs.

Kissimmee River Restoration

Several projects seek to improve the water resource management and ecosystem performance for the Kissimmee River and the Upper Chain of Lakes (**SFWMD, 2007**). As considered in the RSMBN model, the following assumptions are made for operations at S65 and state of Kissimmee River restoration moving from ECB to FWO:

- Modification to the Lake Kissimmee regulation schedule for releases at S65 as seen in **Figures 3.8** and **3.9**.
- Physical alterations in the Lower Kissimmee River and flood plain representation as seen in **Figure 3.10**.

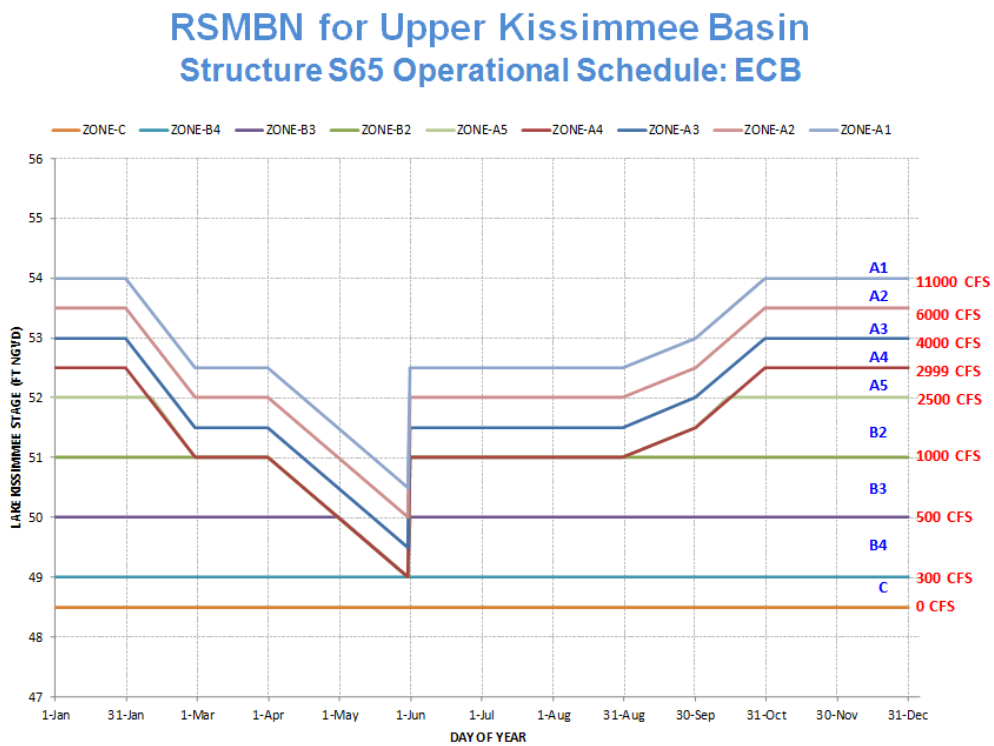


Figure 3.8. Lake Kissimmee Regulation Schedule for releases at S65 structure for the ECB run.

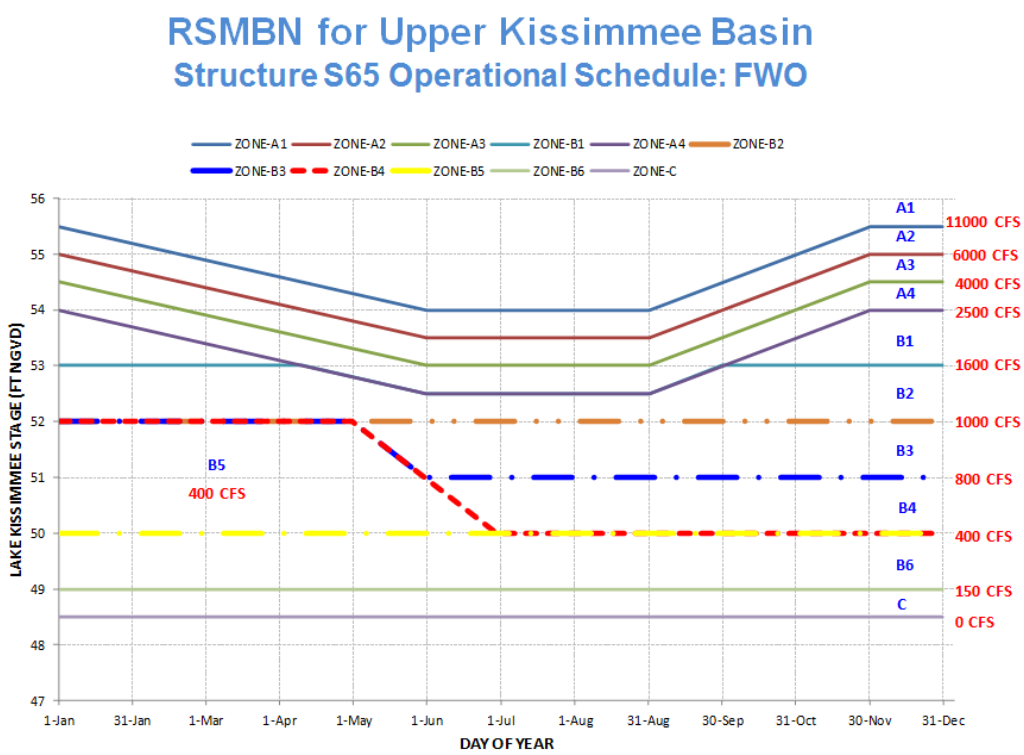


Figure 3.9. Lake Kissimmee Regulation Schedule for releases at S65 structure for the FWO run.

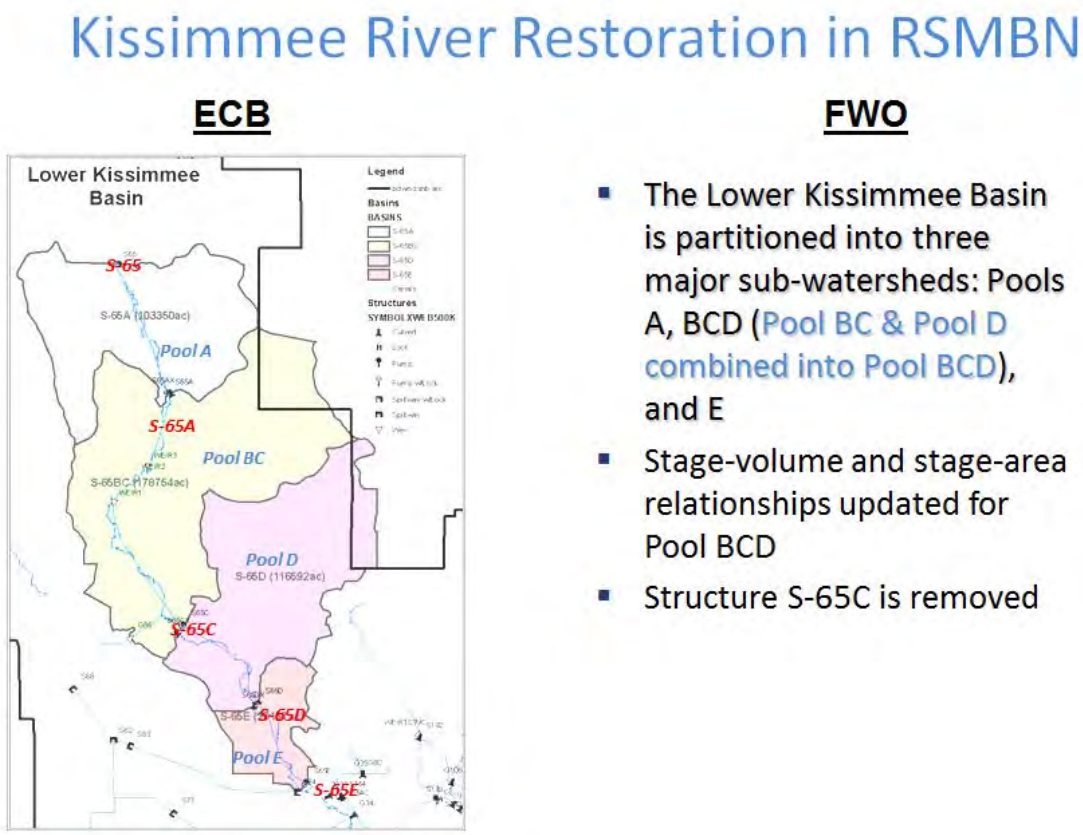


Figure 3.10. Physical alterations in the representation of the Lower Kissimmee River and flood plain between baseline runs ECB and FWO.

Indian River Lagoon-South

The purpose of the IRL South and Ten Mile Creek projects is to improve surface-water management in the C-23/C-24, C-25, and C-44 basins for habitat improvement in the Saint Lucie River Estuary and southern portions of the Indian River Lagoon**. Figures 3.11 and 3.12** show the model configuration for the RSMBN ECB and FWO run, respectively:

General FWO Project Features

- Consistent with latest CERP Indian River Lagoon – South DDRs that update the authorized 2004 PIR.
- Includes operational intent (Opti6) per St Lucie River Watershed Protection Plan (January 2009) to meet St. Lucie estuary environmental targets.
- Basin demands can be met by project features.

C44 Reservoir and STA

- Storage capacity: 50,246 acre-feet
- Footprint: 12,125 acres (assumed 9700 effective acres / 80%)
- Inlet: 1060 cfs capacity, modeled as pump; source: C44 Basin
- Inlet: 250 cfs capacity, modeled as pump; source: C23 Basin
- Outlet: 550 cfs capacity, modeled as pump; destination: C44 Basin
- Cannot divert Lake Okeechobee regulatory releases into storage

C23/24 Reservoir

- Storage capacity: 92,094 acre-feet
- Footprint: 8675 acres (assumed 6940 effective acres / 80%)
- Inlet: 900 cfs capacity, modeled as pump; source: C23 Bas
- Inlet: 900 cfs capacity, modeled as pump; source: C24 Basin
- Outlet: 300 cfs capacity, modeled as pump; destination: C23 Basin
- Outlet: 300 cfs capacity, modeled as pump; destination: C24 Basin
- Outlet: 200 cfs capacity, modeled as pump; destination: C23/C24 STA

C23/C24 STA

- Storage capacity: 3852 acre-feet
- Footprint: 3323 acres (assumed 2568 effective acres / 80%)
- Inlet: 200 cfs capacity, modeled as pump; source: C23/C24 Reservoir
- Outlet: 200 cfs capacity, modeled as pump; destination: TMC Basin

Ten Mile Creek Reservoir and STA

- Storage capacity: 7078 acre-feet
- Footprint: 820 acres (assumed 656 effective acres / 80%)
- Inlet: 360 cfs capacity, modeled as pump; source: TMC Basin
- Outlet: 200 cfs capacity, modeled as pump; destination: TMC Basin

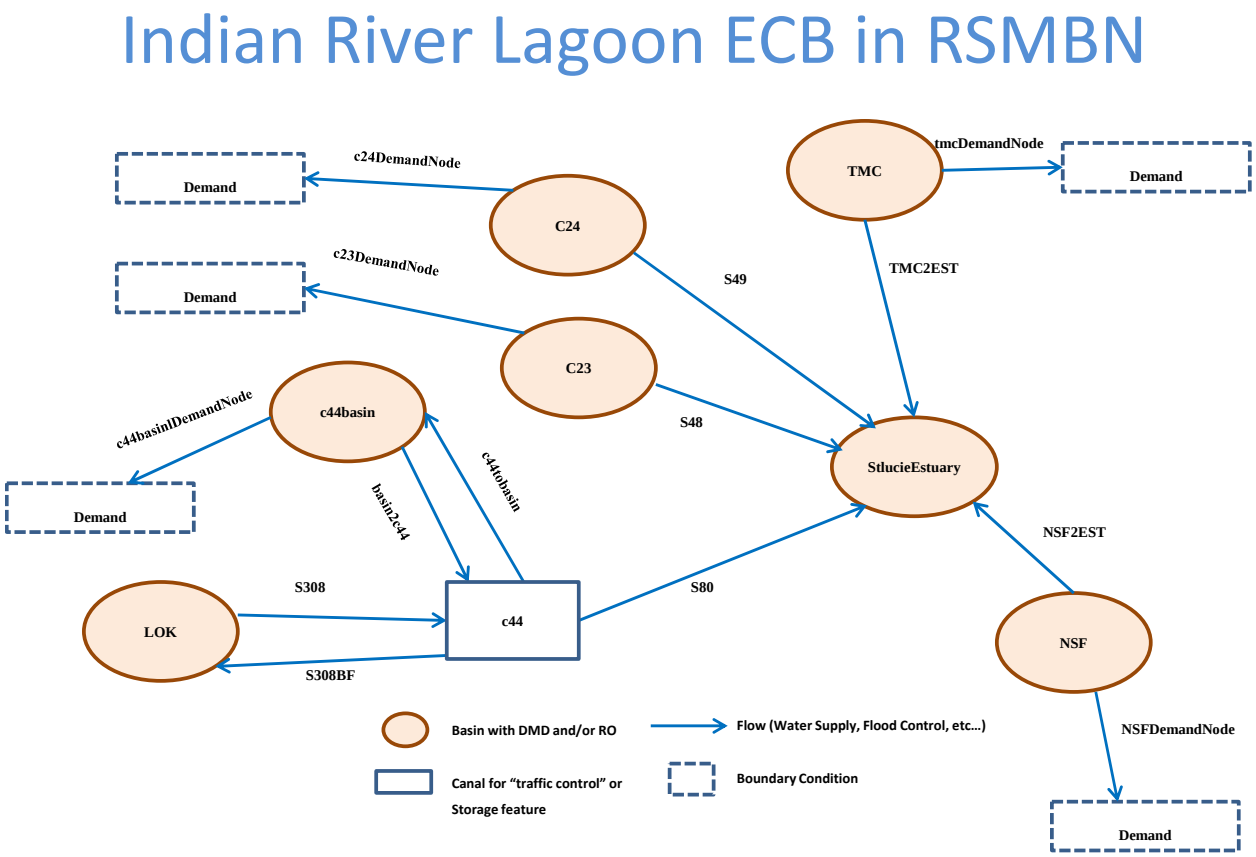


Figure 3.11. Indian River Lagoon-South routing in RSMBN for ECB run.

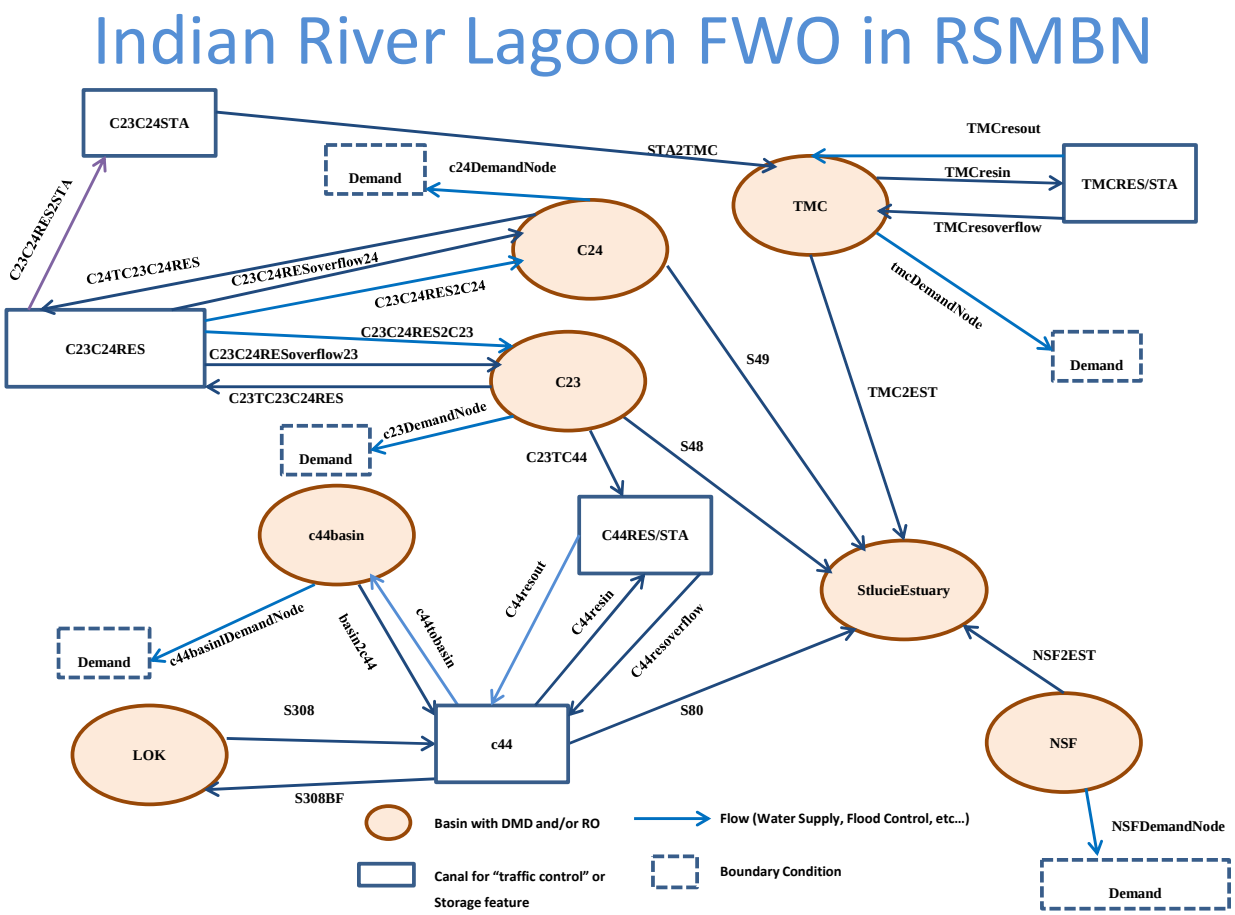


Figure 3.12. Indian River Lagoon-South routing in RSMBN for FWO run.

C-43 Phase 1 Reservoir

The purpose of the C-43 Basin Storage Reservoir - Part 1 project is to improve the timing, quantity, and quality of freshwater flows to the Caloosahatchee River estuary. **Figures 3.13 and 3.14** show the model configuration for the RSMBN ECB and FWO run, respectively:

- Modeled consistent with September 2007 PIR
- Storage capacity: 175,800 acre-feet
- Maximum footprint: 9,379 acres
- Inflow, capacity 1500 cfs, modeled as pump; destination: C43 Reservoir
- Outflow, capacity 1200 cfs modeled as pump; destination: C43 Canal
- Operates to meet estuary environmental target time-series (EST05)
- Can divert Lake Okeechobee regulatory releases into storage

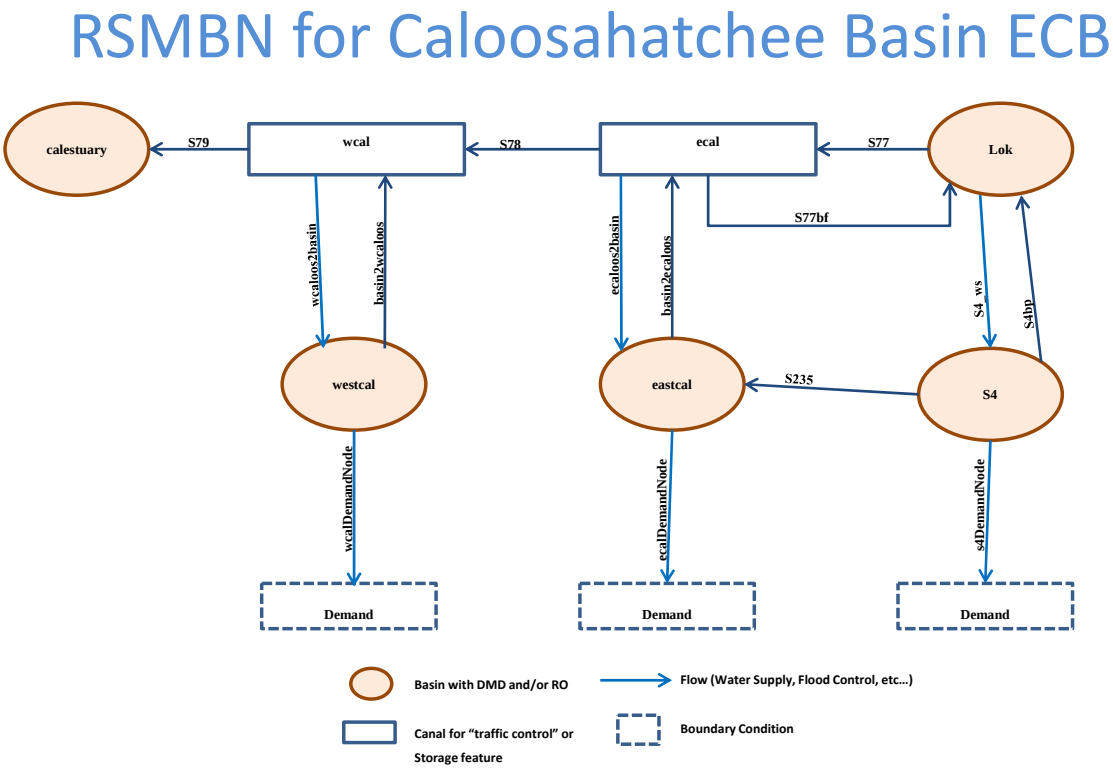


Figure 3.13. C43 Basin and Reservoir routing for ECB in RSMBN.

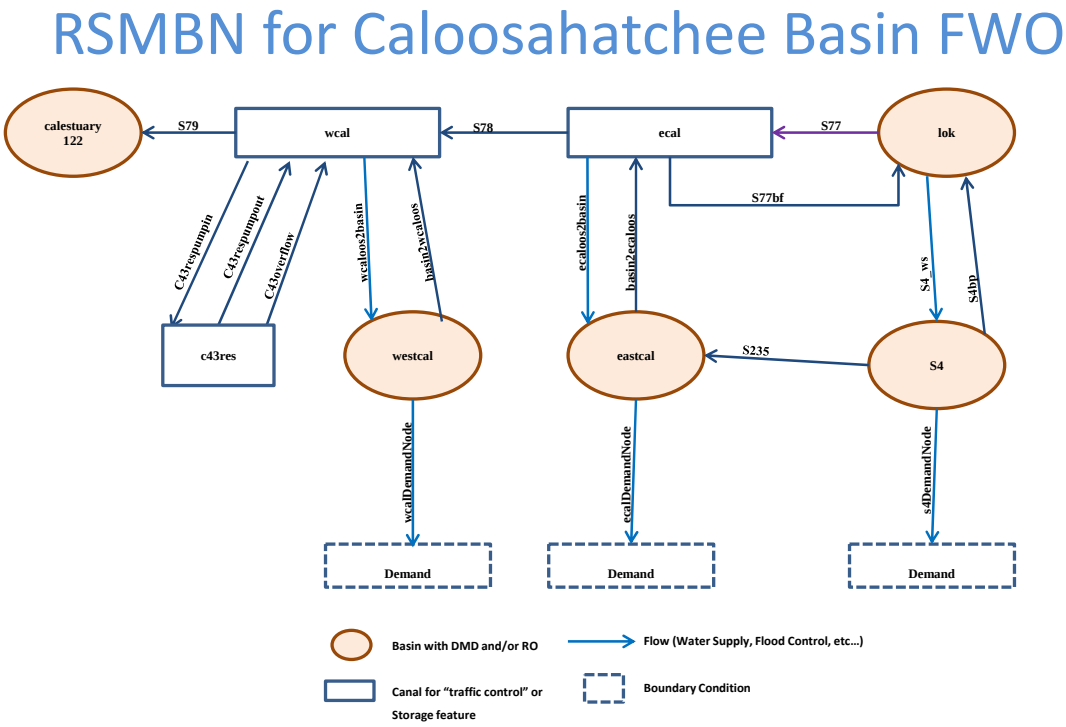


Figure 3.14. C43 Basin and Reservoir routing for FWO in RSMBN.

A-1 FEB & Compartment B & C Expansions

As part of the Everglades Construction Project and Restoration Strategies program, the state of Florida plans to expand water quality treatment facilities to improve the quality of water entering the Everglades Protection Area (see **Figure 3.15** for component locations). The FWO scenario assumes the following:

A-1 FEB Assumptions

- Assumed Flowage Equalization Basin Effective Footprint = 15,853 acres
- FEB operating limits:
  - EAA runoff accepted when FEB stage < 3.8 ft.
  - Lake Okeechobee flood control water can be accepted into FEB
  - Discharges discontinued when depths < 0.5 ft.
  - No supplemental water supply provided to FEB.
  - FEB outflows are used to help meet established inflow targets, as estimated using the Dynamic Model for Stormwater Treatment Areas (**Wang, 2012**) at STA-3/4, STA-2N, and STA-2S

Compartment C Build-out Components

	Inflow Capacity (cfs)	Outflow Capacity (cfs)	Total Area (acres)
STA5N	1329	limited by gravity and vegetative resistance	5025
STA5S	2180	limited by gravity and vegetative resistance	8494
STA6	1391	limited by gravity and vegetative resistance	3084

Compartment B Build-out Components

	Inflow Capacity (cfs)	Outflow Capacity (cfs)	Total Area (acres)
STA2	3885	limited by gravity and vegetative resistance	7775
North build-out + Cell4 (STA2N)	2140	limited by gravity and vegetative resistance	6534
South build-out (STA2S)	480	limited by gravity and vegetative resistance	3570

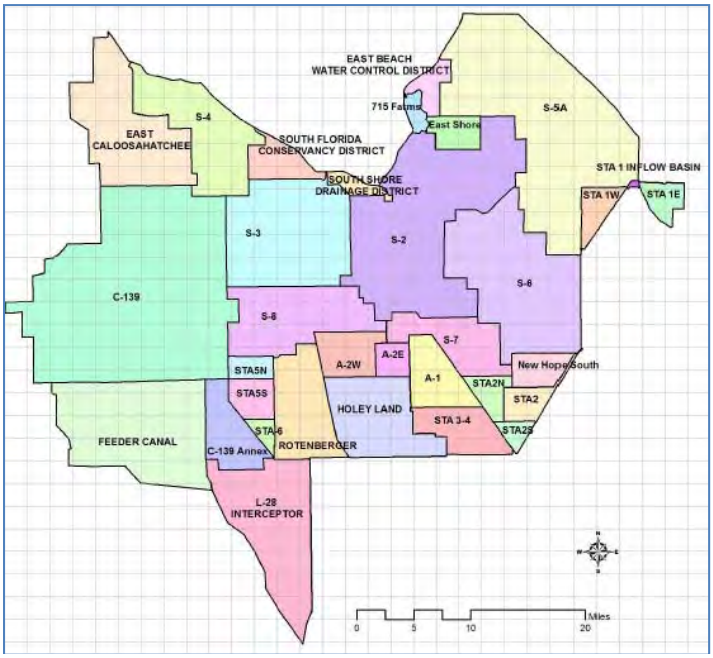


Figure 3.15. Location of A1, Comp B (STA2N and STA2S) and Comp C (STA5N, STA5S and STA6) basins in RSMBN.

Everglades Restoration Transition Plan (ERTP)

The Everglades Restoration Transition Plan (ERTP) supersedes the 2006 Interim Operational Plan (IOP) for the operations of WCA3a, inflows to ENP and protection of the Cape Sable Seaside Sparrow. As modeled in the FWO:

- Modeled as per Run 9E1 of March 2011 EIS (**USACE, 2011**).
- Revised WCA3A Regulation Schedule with lower Zone A line (**Figures 3.16** and **3.17**).
- Modifications to Tamiami Trail structure operations and closures consistent with Run 9E1 (e.g. S12 closure dates).
- L-29 stage constraint for operation of S-333 assumed to be 7.5 ft, NGVD.
- G-3273 constraint for operation of S-333 assumed to be 6.8 ft, NGVD.

Subsequent to the CEPP modeling delivery, an error was identified in this input set. The fraction of environmental target to be delivered to S333/S12s was inadvertently retained at 55%/45% instead of the ERTP recommended 80%/20%. This error is not deemed to be significant since the operational intent is dominated by the L29 and G-3273 constraints, not the target and since regional performance checks as shown in Section 4 was still reasonable. A subsequent sensitivity run verified this conclusion. This error is contained in all CEPP modeling representations of ERTP where the rainfall plan calculation is not superseded by CEPP rainfall driven operation targets (i.e. affects FWO, 2012EC and IORBL1).

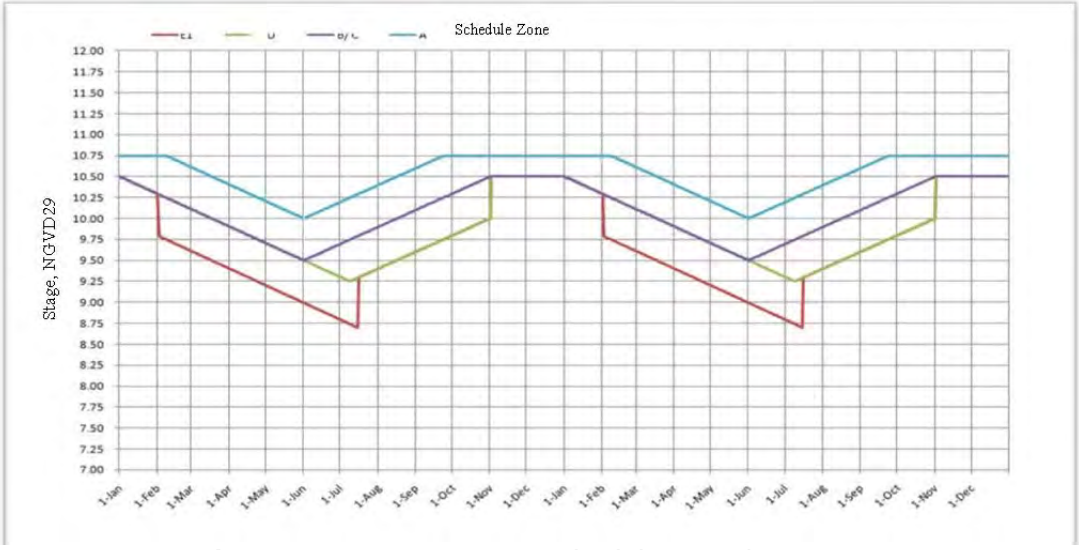


Figure 3.16: WCA3A IOP Schedule, ECB in RSMGL

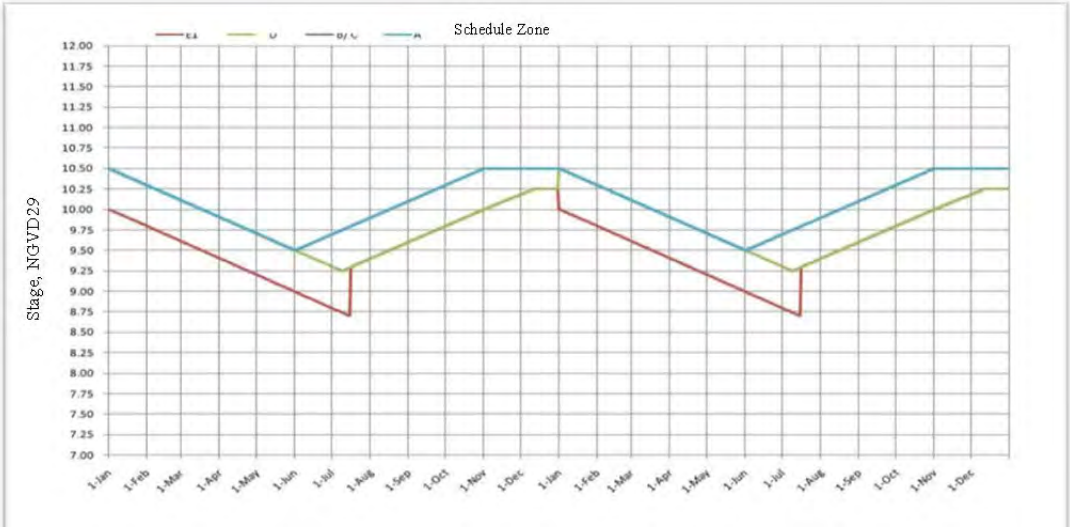


Figure 3.17: WCA3A ERTP Schedule, FWO in RSMGL

One-mile Tamiami Trail Bridge

Construction of the One-mile Tamiami Trail bridge per the 2008 Tamiami Trail Limited Reevaluation Report is intended to improve connectivity between ENP and upstream water bodies and allow for increased flow into northeastern ENP

- Modeled as a one-mile weir located east of the L67 extension and west of the S334 structure. Tamiami Trail culverts that fall within the one-mile location are removed.

Site 1 Impoundment

The Site 1 Impoundment Project (**Figure 3.18**) is designed to meet water supply demands in the LEC Service Area 1 through the collection of stormwater runoff from the Hillsboro canal that is currently discharged to tide. The project also intends to improve water levels in WCA-1/WCA-2A, provide long term storage for dry season water supply deliveries to the LWDD, and reduce demand from the regional system (Lake Okeechobee and WCA-1) to meet water supply needs.

- Footprint: Design: 1660 acres, Modeled: 1599 acres
- Inflow pump S-525A, capacity 650 cfs
- Pump on when G-56-H stage is > 7.7 ft (wet season) and 8.7 ft (dry season), and off when impoundment reaches 18.0 ft. NGVD
- Water supply outflows through S-526A culvert with discharge capacity 700 cfs
- Water supply priority for Hillsboro canal is first from the impoundment and second from S-39 regional supply

Assumed levee seepage coefficients in the southern L-40 reach were reduced by 75% to be consistent with best available information from the project field observations.

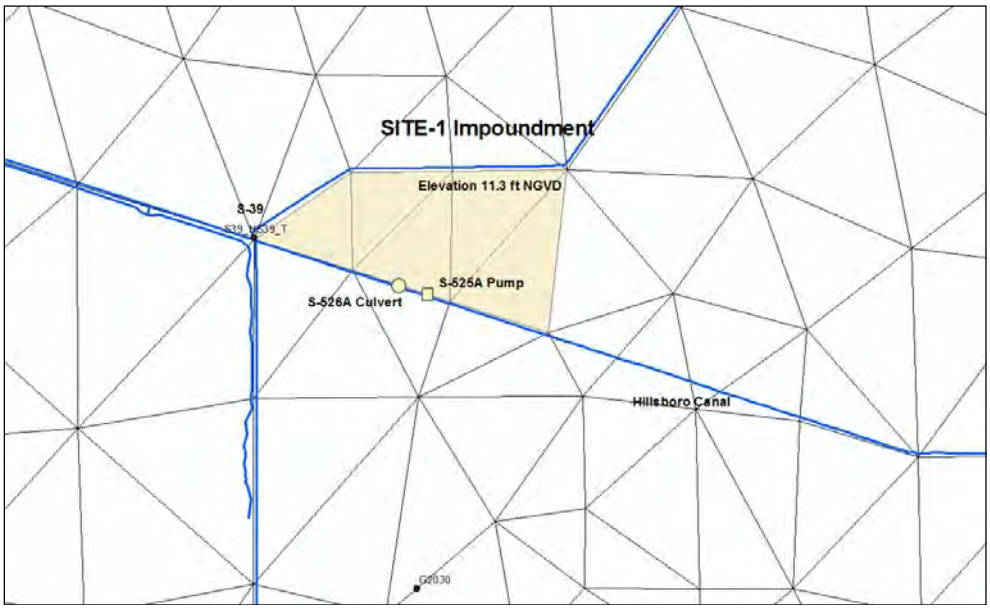


Figure 3.18. Site 1 Impoundment Project location with RSMGL mesh overlay.

Broward County Water Preserve Areas

The Broward County Water Preserve Areas Project in Broward County, is designed to reduce seepage losses from WCA-3A and WCA-3B and to capture and store excess runoff from the C-11 basin which is currently discharged untreated into WCA-3A via the S9 and S9A pumps. The project consists of two above ground impoundments, the C-11 impoundment (**Figure 3.19**) north of the C-11 canal, and the C-9 impoundment (**Figure 3.20**) north of the C-9 canal.

C-11 Impoundment

- Footprint: Design: 1078 acres, Modeled: 1355 acres
- Inflow pump S-503, capacity 1050 cfs
- Pump on when C-11 canal reaches 3.3 ft NGVD, and off when C-11 impoundment reaches 10.3 ft NGVD
- Outflow structure S-504 (1000 cfs) into C-9 impoundment when there is capacity
- Water supply outflow structure S-503A (200 cfs capacity)

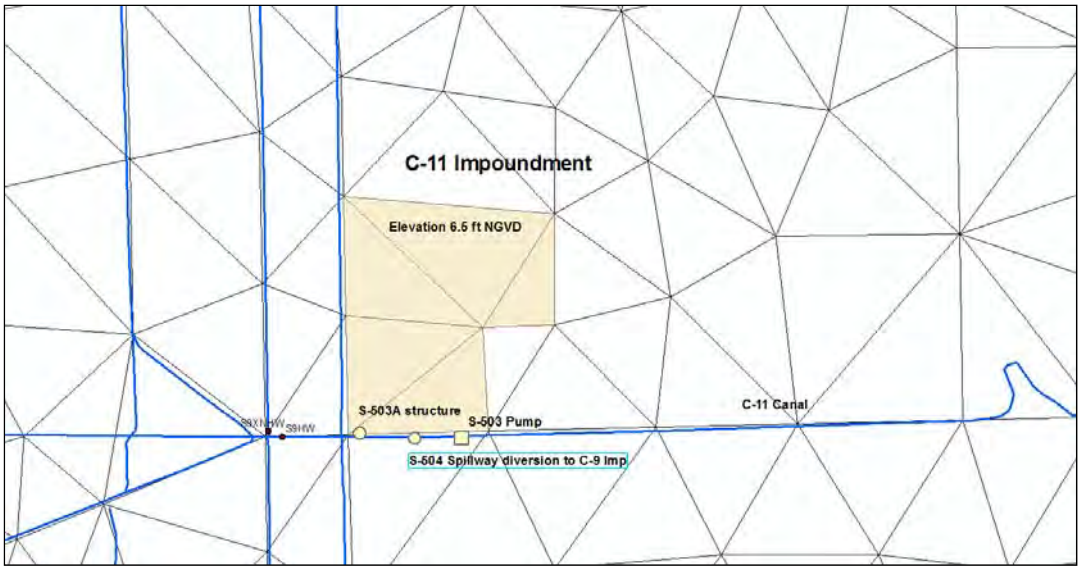


Figure 3.19. C-11 Impoundment Project location with RSMGL mesh overlay.

C-9 Impoundment

- Footprint: Design: 1641 acres, Modeled: 1970 acres
- Inflow Pump S-509, 1075 cfs capacity
- Pump on when C-9 canal stage above 2.7 ft NGVD and off when impoundment reaches 8.5 ft NGVD
- Outflow structure S-510, 500 cfs capacity
- Diversion flows into C-9 impoundment from C-11 impoundment through US27 canal and S-504 structure (capacity 1000cfs)

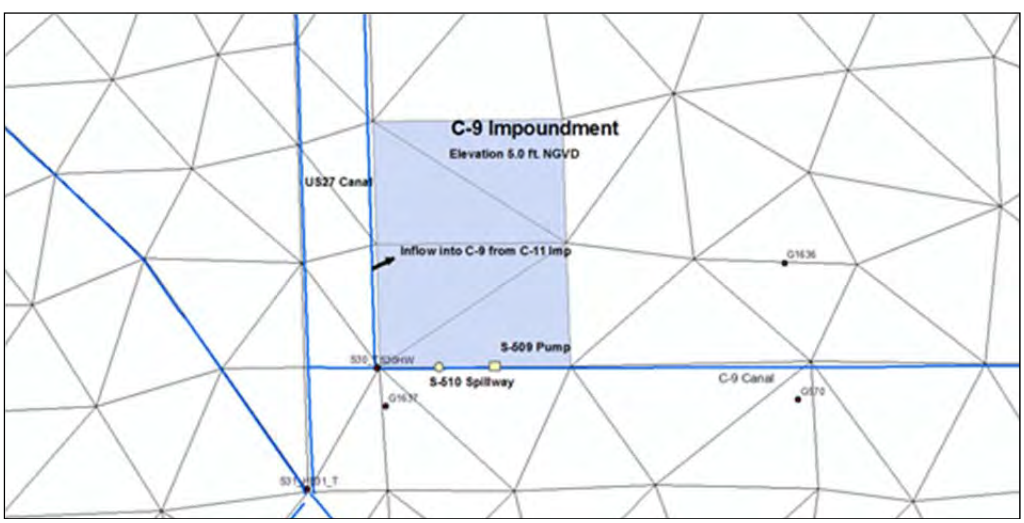


Figure 3.20. C-9 Impoundment Project location with RSMGL mesh overlay.

C111 & 8.5 Square Mile Area

The C-111 project is a federally authorized project that has altered the south Florida system over the last twenty years to improve seepage management from ENP and hydrologic

conditions in Taylor Slough. Consistent with a 1994 General Reevaluation Report, the project has constructed a number of shallow impoundments and associated water control structures along the south-eastern boundary of ENP (adjacent to urban development) and also altered levees and spoil mounds in the vicinity.

The 8.5 Square Mile Area Project (8.5 SMA) is a part of the Modified Water Deliveries (MWD) to ENP Project, authorized in the 2000 Water Resources Development Act and authorized specifically by the U.S. Congress in the 2003 Appropriations Act. Operations are based on the proposed water management operating criteria in this Environmental Assessment (**USACE, 2011**) which are interim and subject to change prior to completion of the ongoing long-term construction of the MWD Project and the Canal-111 South Dade Project.

Assumed project features are as follows and illustrated in **Figure 3.21**:
ECB:

- Partial construction of C-111 project reservoirs consistent with 2009 as-built information from USACE.
- 8.5 SMA project per Alternative 6D (**USACE, 2000 GRR**); operations per USACE 2011 Interim Operating Criteria.

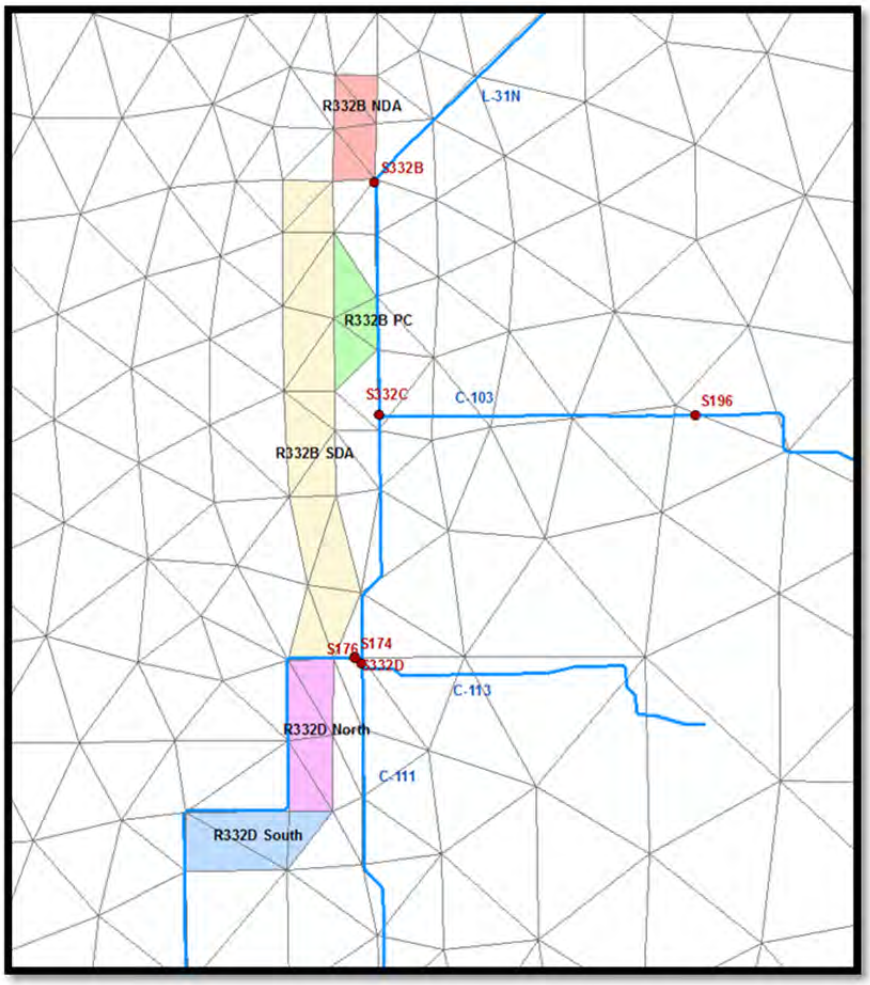


Figure 3.21: C-111 features as implemented in ECB

Five reservoirs (**Table 3.3**) are added as impoundments per 2009 as-built C-111 South Dade project:

Table 3.3: C-111 project reservoirs details

Reservoirs	Average topography (ft NGVD29)	Modeled area (acres)
R-332B North Detention Area (R-332B NDA)	6.5	257
R-332B South Detention Area (R-332B SDA)	6	1404
R-332 Partial Connector (R-332PC)	6	264
R-332 D North (R-332DN)	5.5	399
R-332 D South (R-332BN)	5.5	428

Table 3.4 shows the structures that are added for the purpose of flood control in S332 reservoir area.

Table 3.4: S332 reservoir flood control structures

	Type (as modeled)	capacity	upstream	downstream
S316D	gravity	400	R332B NDA	eastern cell
S322A	gravity	350	R332B SDA	R332PC
S322B	gravity	125	R332B SDA	R332PC
S322D	gravity	250	R332B SDA	R332PC
S322E	gravity	500	R332B SDA	R332PC
S322G	gravity	1500	R332B SDA	eastern cell
SDNWE	gravity	500	R332DN	R332DS
S329	gravity	1000	R332DS	south cell

Other information:
S-332, S-174 and S-175 are not operational. S-332A pump is not added.

FWO:
Assumed project features are as follows and illustrated in **Figure 3.22**:

- Full construction of C-111 project including addition of contract 8 and 9 features. Contract 9 includes degrading 500 feet of S-327, but the high head cell is not represented in the RSM due to resolution.
- 8.5 SMA project same as ECB, plus 1259 acre R-332B North Detention Area plus outflow assumed to the C-111 North Detention Area from 8.5 SMA through S-360E and S-360W structures.

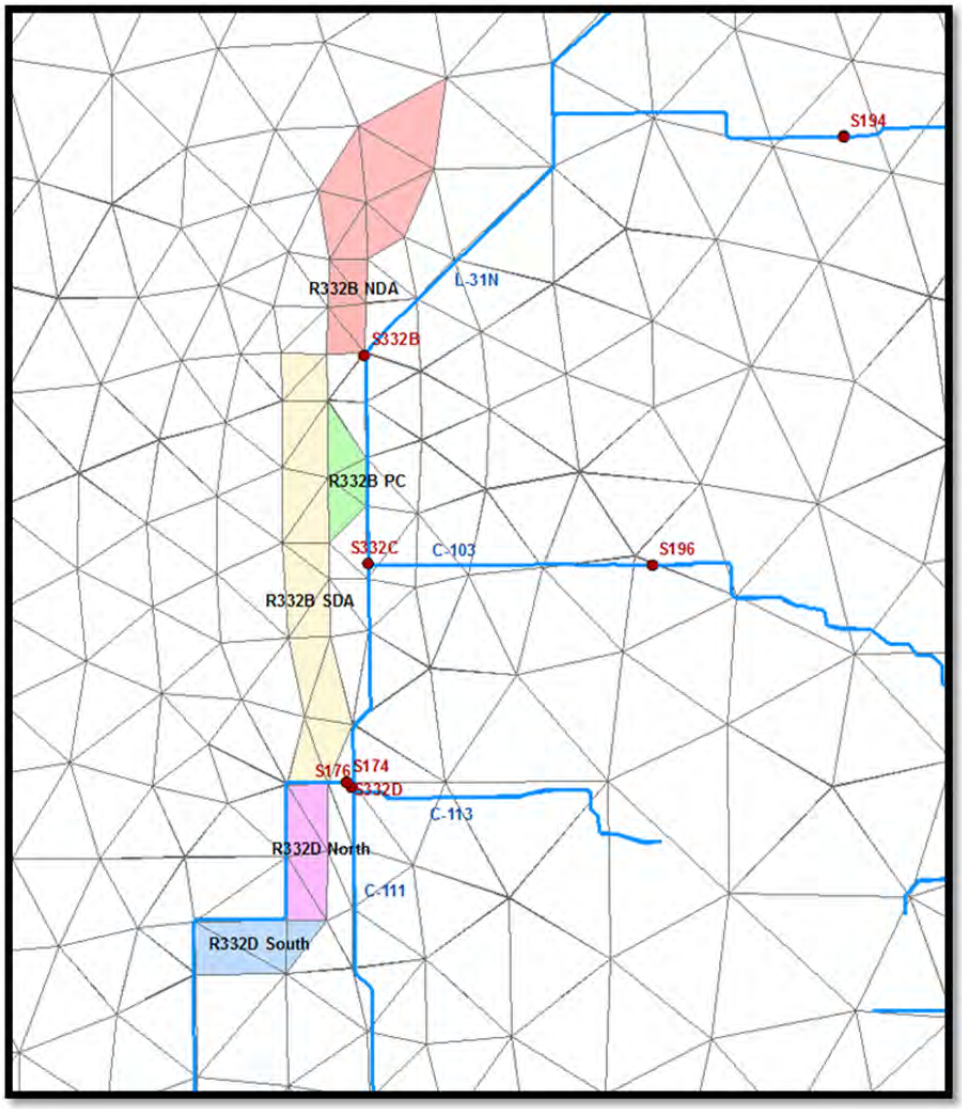


Figure 3.22: C-111 features as implemented in FWO

In addition to the flood control structures added in S-332 reservoir areas (shown in **Table 3.3**), following flood control structures are also added (**Table 3.5**):

Table 3.5: S332 reservoir flood control structures (in addition to ECB)

Structures	Type (as modeled)	capacity	upstream	downstream
S316A	gravity	500	R332B NDA	eastern cell
S316B	gravity	500	R332B NDA	eastern cell
S316C	gravity	500	R332B NDA	eastern cell
S322C	gravity	500	R332B SDA	R332PC
S322F	gravity	500	R332B SDA	eastern cell
S322H	gravity	500	R332B SDA	eastern cell

C-111 Spreader Canal

The C-111 Spreader Canal (SC) Western project is part of the original C-111 SC Project to assist operators in maximizing flows to Central Florida Bay via Taylor Slough, and improving hydroperiods within the Model Lands, while maintaining or improving the existing Central and Southern Florida Project purposes (e.g., flood damage reduction). The project proposes the construction of a set of features as shown in **Figure 3.23**, including the construction of the Frog Pond Detention Area, improvements to the Aerojet Canal and operations of new S199 and S200 pump stations:

- Frog Pond Detention Area (FPDA)
  - 590 Acres (including header canal)
- S-200 inflow pumps
  - Three 75 cfs pumps divert water to FPDA
- Added Aerojet Canal
  - S-199 inflow pumps
  - Three 75 cfs pumps divert water to Aerojet Canal
- Partial backfill of L31W Canal

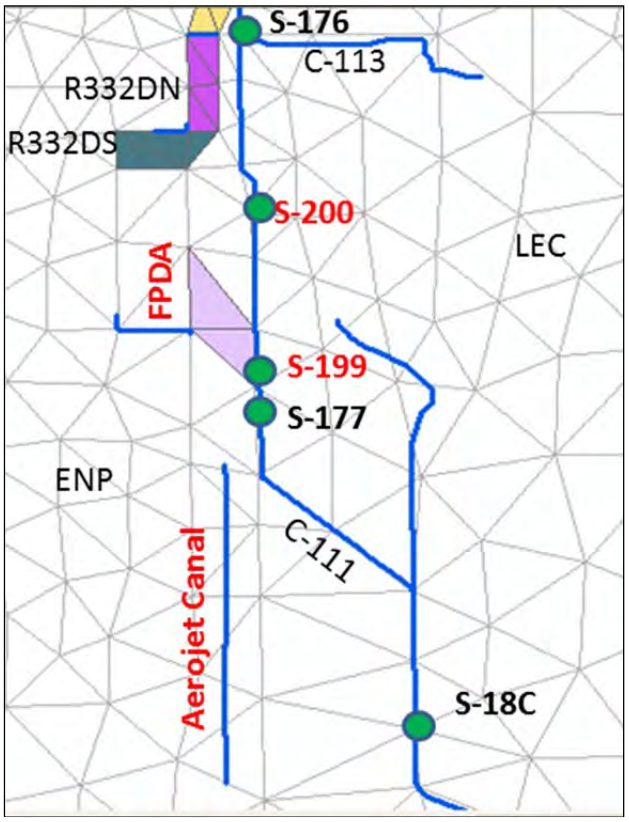


Figure 3.23. C-111 Spreader Canal Project location with RSMGL mesh overlay.

For additional information, a detailed list of operational assumptions in the vicinity of Miami-Dade County is provided in **Appendix C**.

Regarding the Project Assurances Baselines

The 2012EC and IORBL1 scenarios were developed in support of project assurances work and refinement to the CEPP TSP effort later in the project planning timeline. As a result, some updated information was available and utilized in these scenarios to reflect the best available information as shown below:

Changes from ECB to 2012EC:

- Incorporated ERTP operations
- Improved the representation of the L28 Weir by removing a small segment of the L28 canal downstream of the weir which, in the ECB, was allowing inter-basin transfer around the assumed weir from ponded water in the L28 triangle into the L28 canal north of I-75.
- Assumed levee seepage coefficients in the southern L-40 reach were reduced by 75% to be consistent with best available information from the Site 1 project (the 2012EC has the same assumed coefficients as the FWO, IORBL1 and all CEPP alternatives)

Changes from FWO to IORBL1

- Operational updates to Indian River Lagoon South (IRLS) project, consistent with Opti6-revised targets increasing flow down Ten Mile Creek (as conceptually shown by the red line) in **Figure 3.24.** Use of these revised targets will attempt to more frequently deliver water to meet demands assumed at the TMC2EST location (Gordy Rd structure), thereby increasing the utilization of the C23/C24 Reservoir/STA facilities and reducing discharges at S48 and S49.
- Improved the representation of the L28 Weir by removing a small segment of the L28 canal downstream of the weir which, in the FWO, was allowing inter-basin transfer around the assumed weir from ponded water in the L28 triangle into the L28 canal north of I-75.
- Operational refinement to Broward Water Preserve Areas project to reduce discharges to S29 and refine model representation of S9/S9A operations.
- High exchange between some assumed Lake cells and their adjacent canals was observed in the FWO scenario in northern Miami-Dade county. This resulted in excess volumes of water being conveyed to downstream structures. In the IORBL1, cells where this behavior was observed (as shown in **Figure 3.25**) were modified to utilize a reduced hydraulic conductivity value (K) for groundwater exchange with the canal. These IORBL1 K values were taken from the ECB scenario (in which the assumed Lakes had not yet expanded spatially to interact with these canal reaches).
- Refined 8.5 SMA representation, including expansion of assumed length of collector canals to prevent higher groundwater stages in the western portion of the 8.5 SMA.
- Modified operations of the S200 structures as shown in **Appendix C** to closer match real-world operational practices.

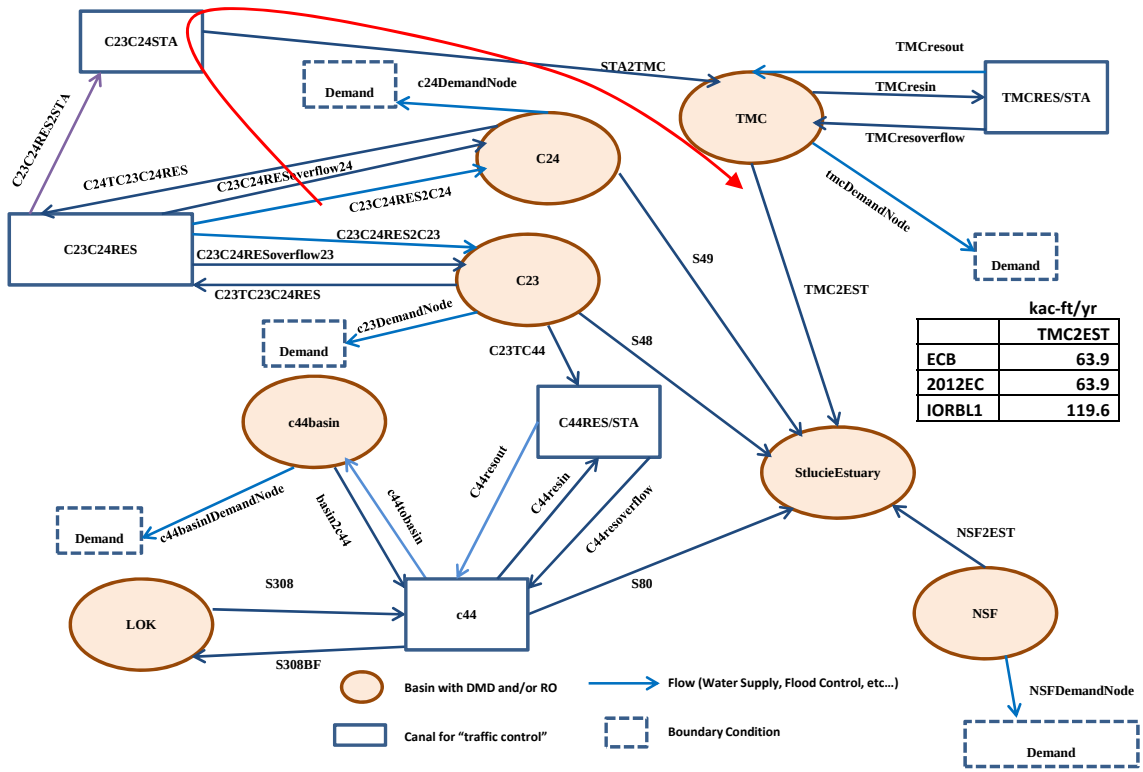
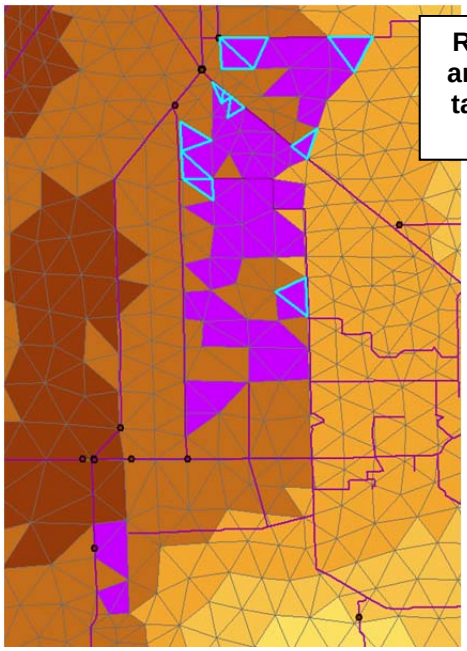


Figure 3.24. Changes to Indian River Lagoon-South routing in RSMBN for IORBL1 run (see also **Figures 3.11 and 3.12**).



RSMGL lake cells (shown in purple) that are highlighted in blue (and shown in the table below) utilized lower assumed K in IORBL1 compared to FWO

CellId	HighK_IORBL1	HighK_FWO
4854	11826.50	100000
4399	13941.10	100000
4409	14066.20	100000
4157	14142.60	100000
4161	13854.00	100000
4164	13727.30	100000
4644	14041.50	100000
4652	10649.00	100000
5100	12125.60	100000
7440	14214.70	100000
7442	14184.70	100000

Figure 3.25. RSMGL lake cells modified in the IORBL1 run

4.0 Results

Final CEPP modeling products have been uploaded to the CERP Model Management System (MMS), a geographic information system (GIS) based application that includes model input data, select model output data, source code/executable files and documentation. This system can be accessed at http://www.evergladesplan.org/pm/progr_mms.aspx. CEPP modeling products in MMS can be accessed directly at the project page:

http://cerpmap1.cerpzone.org/arcgisapps/CERPMMS/CerpReport/ProjectReport.aspx?projectID=687

Due to the large size of many of the CEPP modeling files, the majority of the modeling output has been archived in the Data Access Storage and Retrieval (DASR) application of CERPzone at www.cerpzone.org. CEPP modeling products in DASR can be accessed within the project modeling folder:

P:\IMC_Final_Modeling_Results\PROJ 51 - Central Everglades Planning

While the modeling products have been archived in the above systems, the table below lists more specific information including model version, inputs used and detailed DASR archival location. Version numbers and "svnroot" paths refer to a model version control system found on the SFWMD network that is not generally accessible, but inputs, model executables and source code have been copied into the MMS system for ease of access.

Version information and model file locations

RSMBN ECB 12132012	**RSM_v4728 and xml_v8948**
Input: …svnroot/trunk/CentEver/rsmbn/1Baselines/12132012/ECB Output (DASR): .../2PlanFormulation/1Baselines/Final_Output_121312/rsmbn_model_output/ECB	
RSMBN FWO 12132012	**RSM_v4728 and xml_v8948**
Input:…svnroot/trunk/CentEver/rsmbn/1Baselines/12132012/ECB Output (DASR): .../2PlanFormulation/1Baselines/Final_Output_121312/rsmbn_model_output/FWO	
RSMBN 2012EC 02282013	**RSM_v4728 and xml_v8948**
Input:…svnroot/trunk/CentEver/rsmbn/TSP_Assurances/Baselines/02282013/2012EC Output (DASR): …\3TSP_Assurances\1Baselines\Final_Output_022813\rsmbn_model_output\2012EC	
RSMBN IORBL1 06032013	**RSM_v4728 and xml_v9357**
Input:…svnroot/trunk/CentEver/rsmbn/OtherWRN_Sens/06032013/IORBL1 Output (DASR): …\4OtherWRN_Sens\Sens_Output_060313\rsmbn_model_output\IORBL1	
RSMGL ECB 12132012	**RSM_REL_2.3.5 and xml_v8885**
Input: ……svnroot/trunk/CentEver/rsmgl/ECB_2010-11 Output (DASR): .../2PlanFormulation/1Baselines/Final_Output_121312/rsmgl_model_output/ECB	
RSMGL FWO 12132012	**RSM_REL_2.3.5 and xml_v8886**
Input: …svnroot/trunk/CentEver/rsmgl/2050FWO Output (DASR): ../2PlanFormulation/1Baselines/Final_Output_121312/rsmgl_model_output/FWO	
RSMGL 2012EC 02282013	**RSM_REL_2.3.5 and xml_v9189**
Input: …svnroot/trunk/CentEver/rsmgl/Assurances/2012EC Output (DASR): .../3TSP_Assurances/1Baselines/Final_Output_022813/rsmgl_model_output/2012EC	
RSMGL IORBL1 06032013	**RSM_REL_2.3.5 and xml_v9361**
Input: …svnroot/trunk/CentEver/rsmgl/Assurances/IORBL1 Output (DASR):.../4OtherWRN_Sens/Sens_Output_060313/rsmgl_model_output/IORBL1	

Review of Local and Regional-Level Results

The RSMBN and RSMGL baseline modeling scenarios were reviewed from the perspective of ensuring that localized effects of project implementations were observed as expected and that regional performance was considered reasonable. Specific checks on RSM outputs included the following:

- Kissimmee area outcomes were cross validated to work from the Kissimmee Basin Modeling and Operations Study (KBMOS) team with resulting changes as shown in **Figure 4.1**
- Regional results for Lake Okeechobee and the Northern Estuaries demonstrated expected trends (reduced high discharge events, improved baseflow to the Caloosahatchee estuary, etc…) resulting from IRL, C43, A1FEB and other project activities as shown in **Figures 4.2** and **4.3**.
- Regional results for the WCAs and ENP demonstrated expected trends (lower WCA3A stages, increased flows to eastern ENP and decreased flows to western ENP, etc…) resulting from ERTP, Tamiami Trail and other project activities as shown in **Figures 4.4** to **4.7.**
- LEC and ENP buffer impoundment performance was reasonable and demonstrated expected sub-regional changes in LEC groundwater as shown in **Figures 4.8** through **4.11**.
- Expected trends moving from plan formulation baselines (ECB and FWO) to assurances baseline (2012EC and IORBL1), such as lower WCA3A stages in 2012EC and improved baseflow to the St. Lucie estuary in IORBL1 were observed as shown in **Figures 4.12** and **4.13**. Comparing back to FWO performance, it is also evident that locally triggered high discharge events to the St. Lucie Estuary are reduced due to the previously described reductions at S48 and S49.

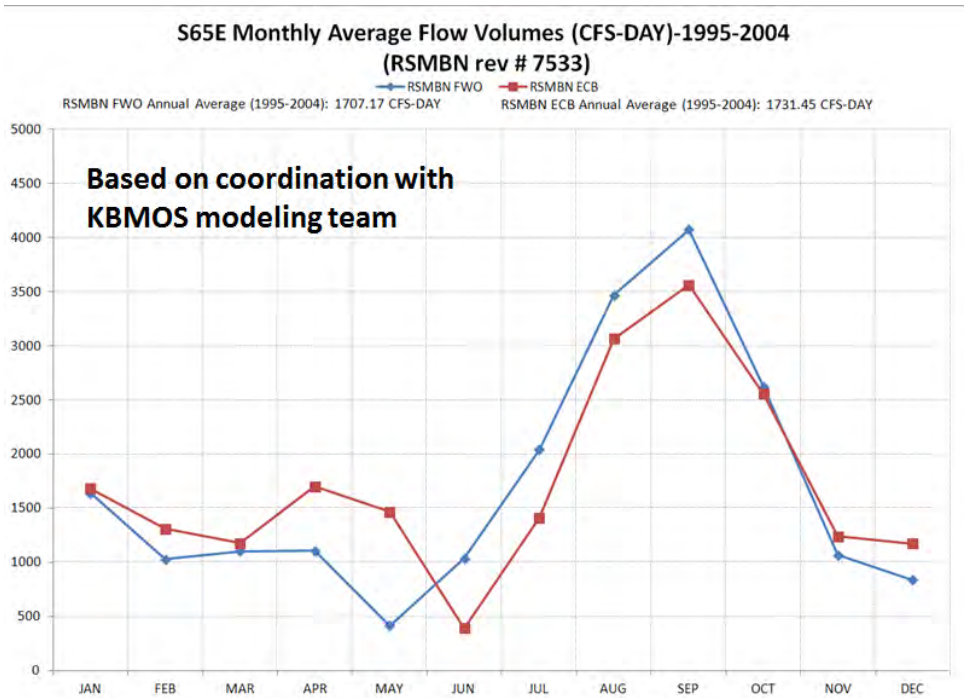


Figure 4.1. FWO and ECB results after cross-validation with Kissimmee Basin Modeling and Operations Study (KBMOS) outcomes.

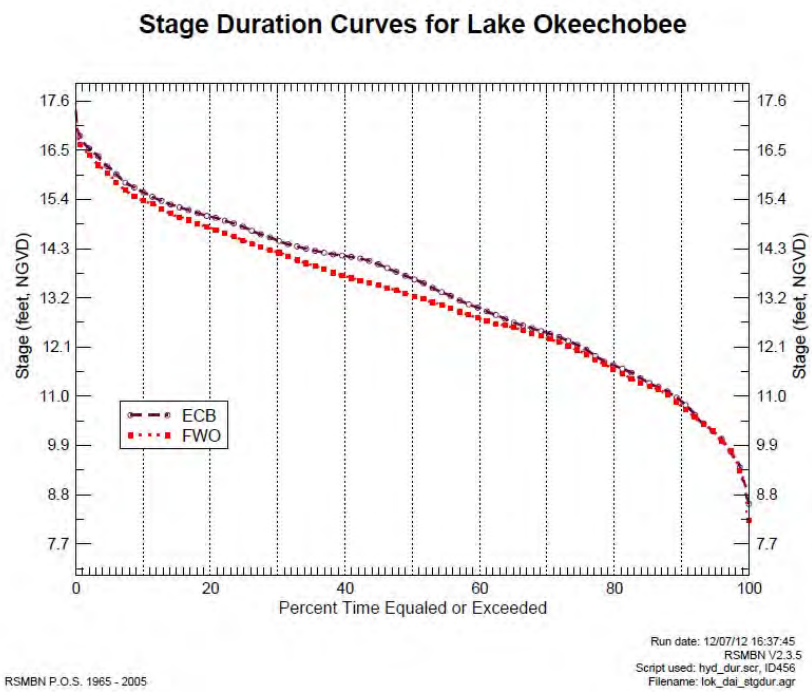


Figure 4.2. Lake Okeechobee demonstrated expected trends resulting from project activities included in the FWO run.

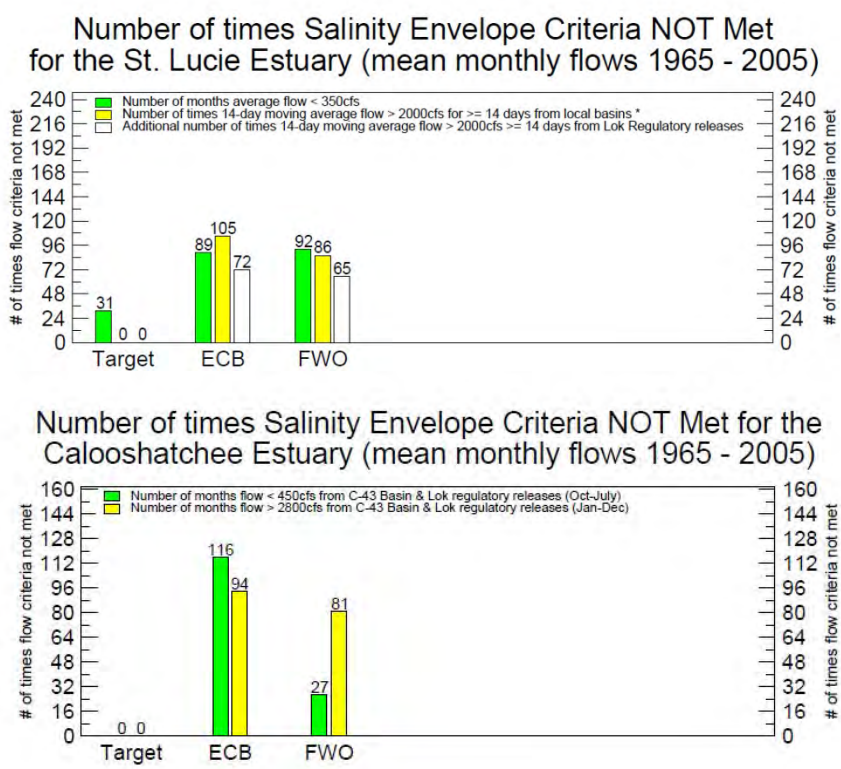


Figure 4.3. Northern Estuaries (St. Lucie and Caloosahatchee) demonstrated expected trends resulting from project activities included in FWO runs.

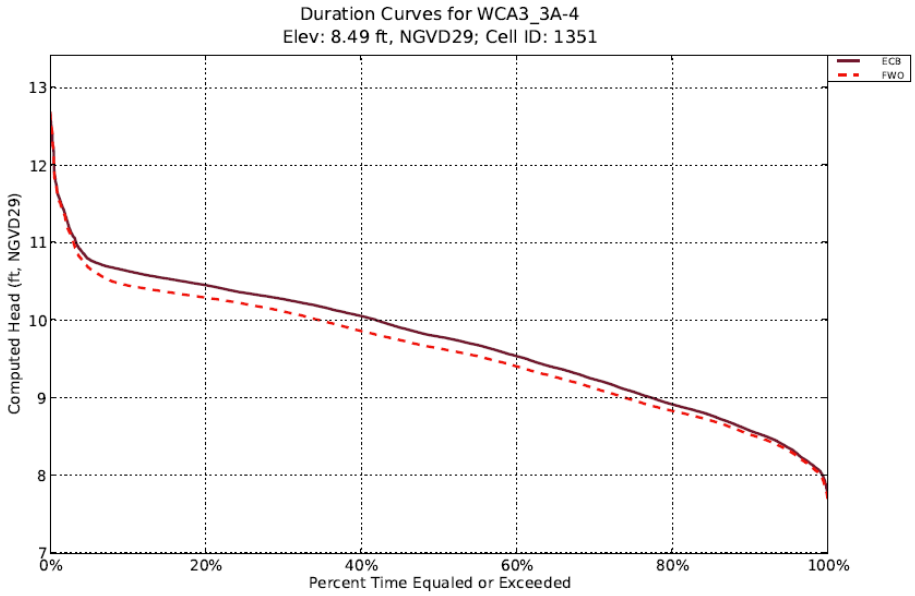


Figure 4.4. A representative gauge in WCA3A showing changes in stage duration between ECB (IOP schedule) and FWO (ERTP schedule)

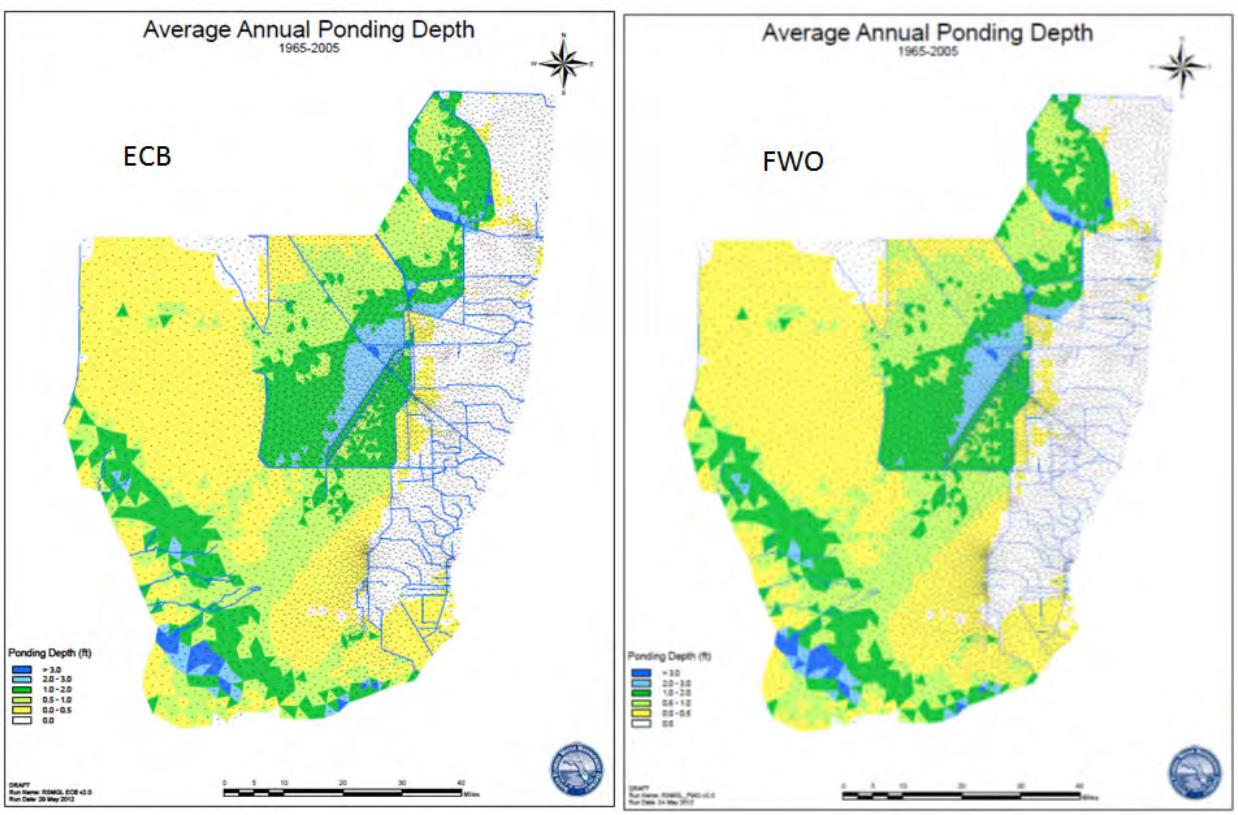


Figure 4.5. System-wide average ponding ECB (IOP schedule) and FWO (ERTP schedule)

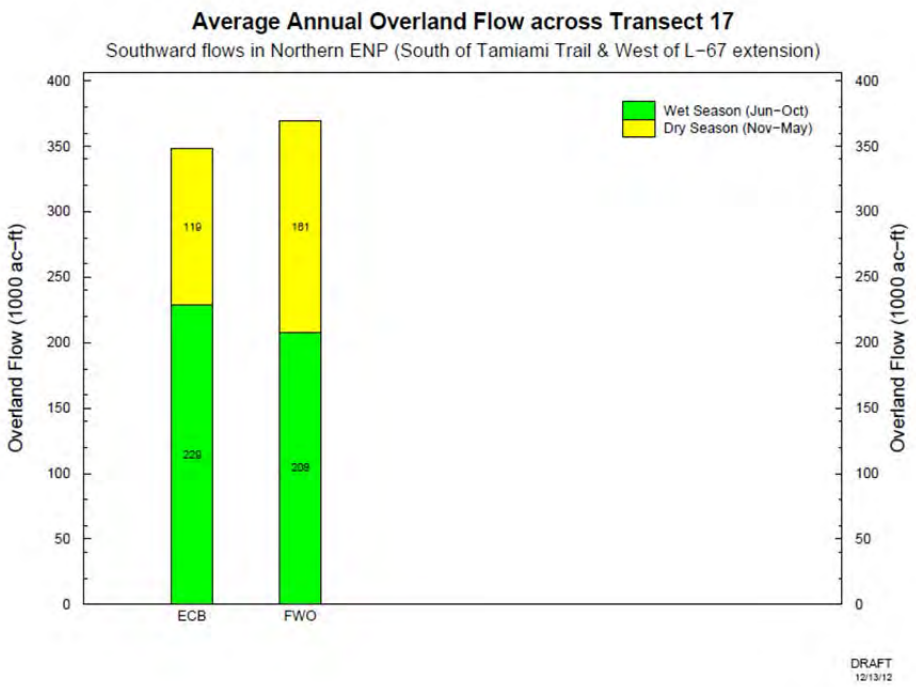


Figure 4.6. Flow differences between ECB and FWO at western Tamiami Trail.

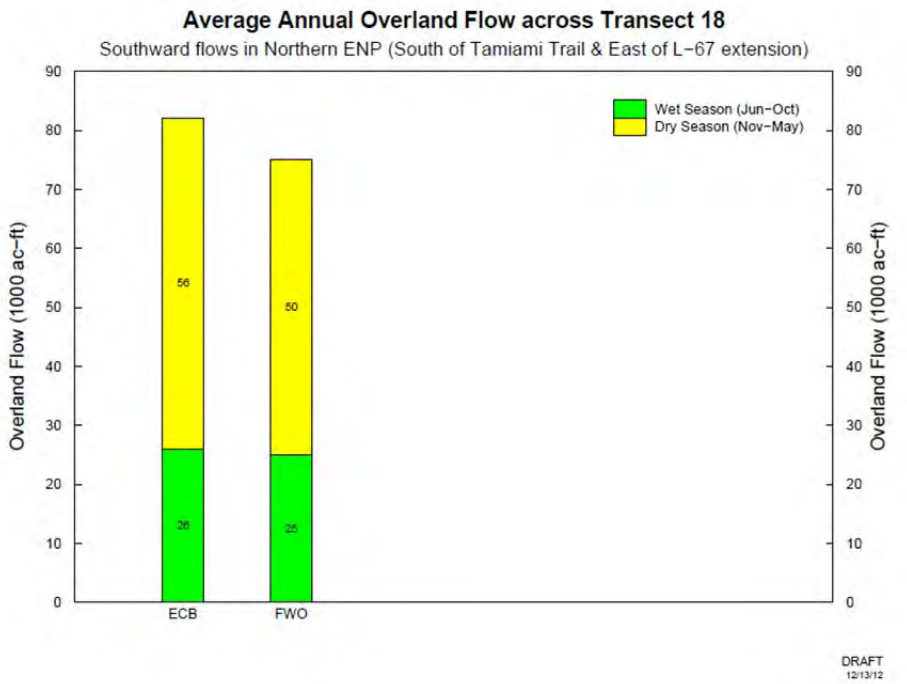


Figure 4.7. Flow differences between ECB and FWO at eastern Tamiami Trail.

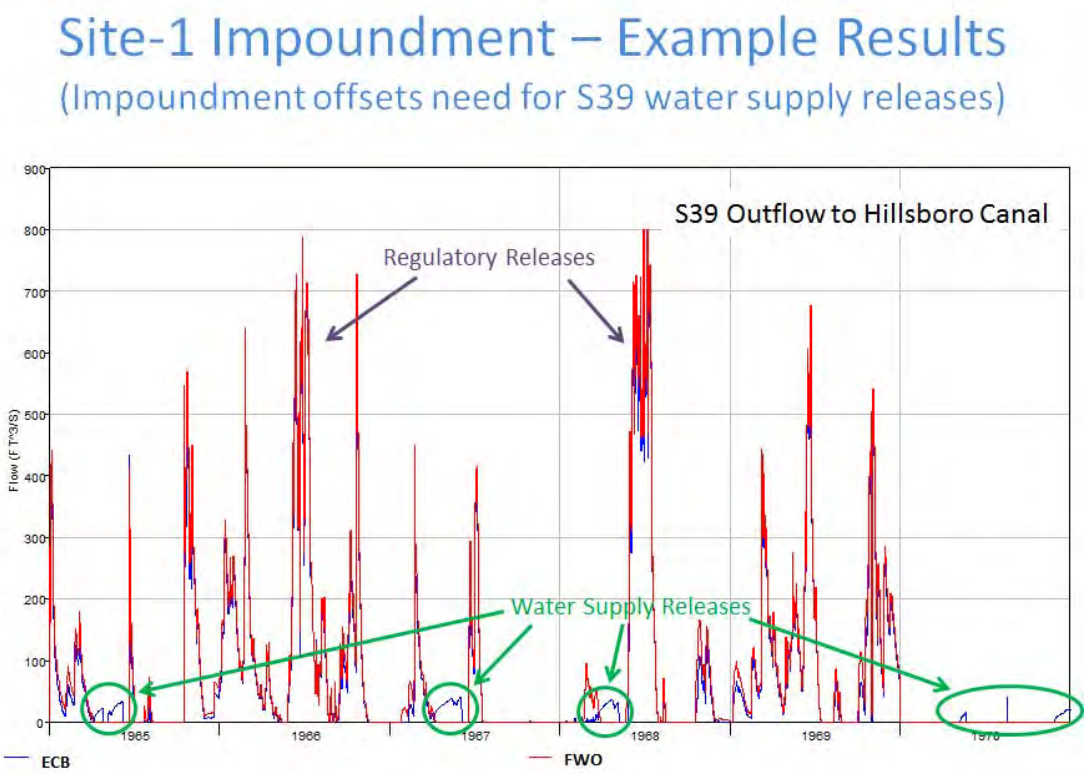


Figure 4.8. Site 1 Impoundment Implementation Example Results

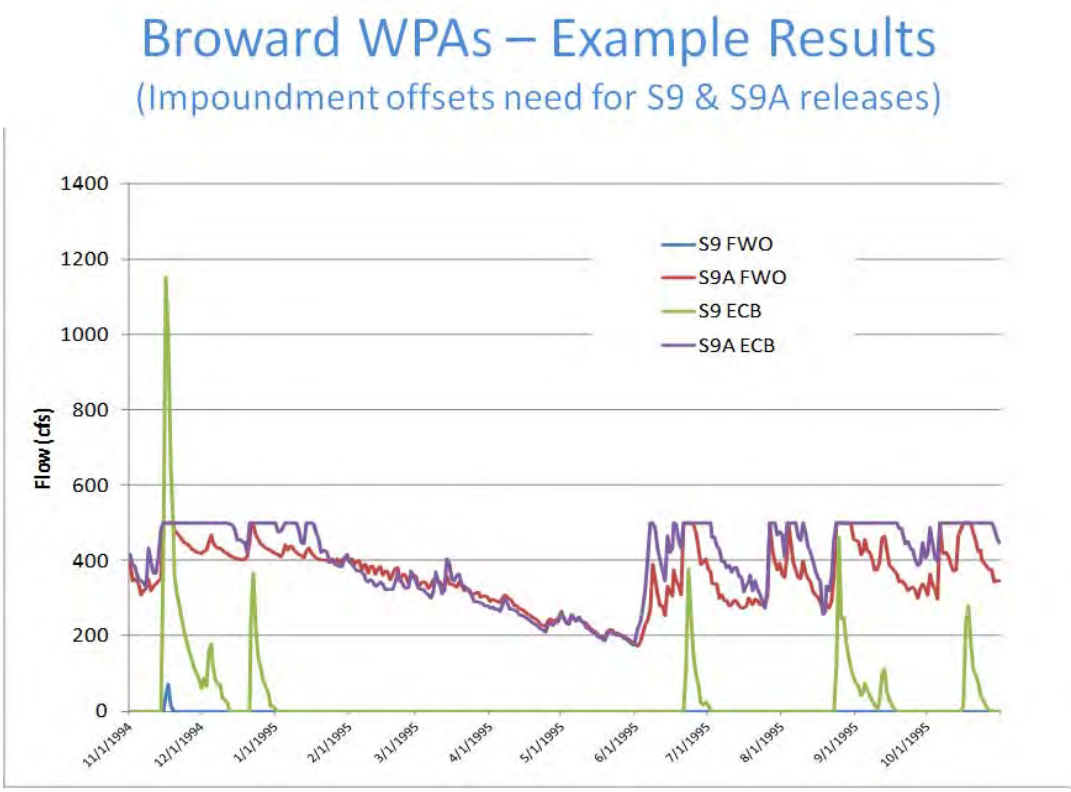


Figure 4.9. Broward County Water Preserve Areas Implementation Example Results

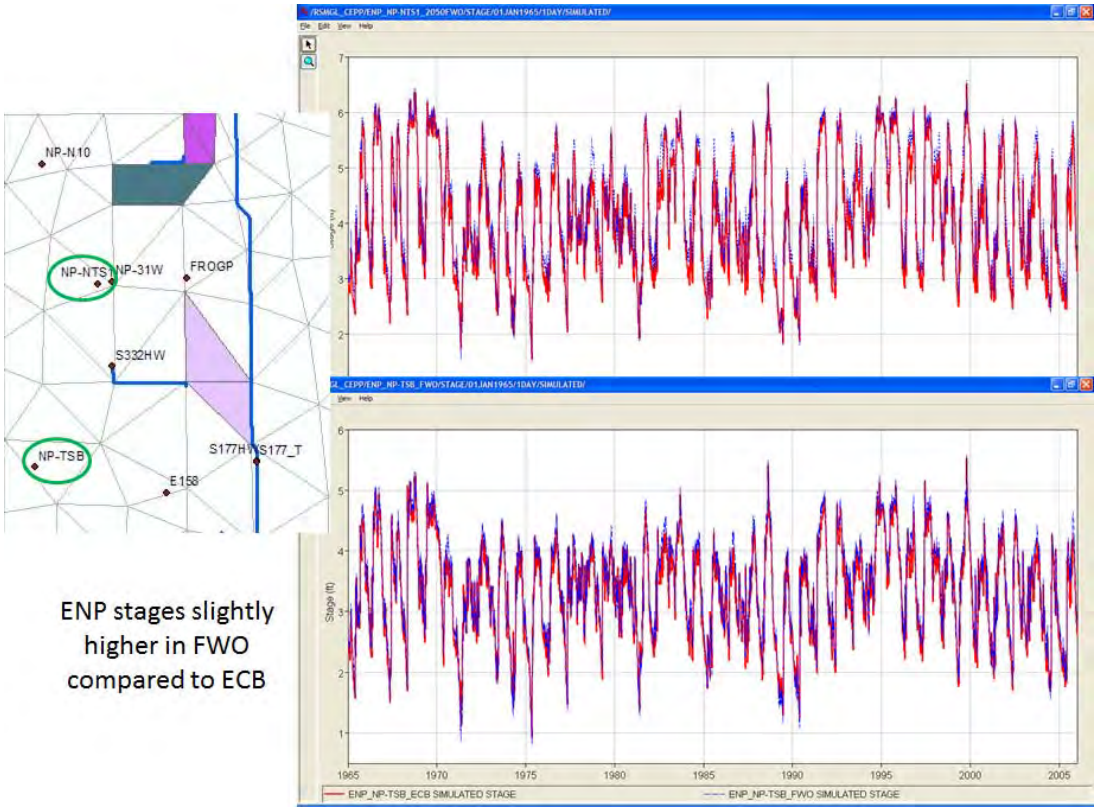


Figure 4.10. C-111 Spreader Canal Project Implementation Example Results

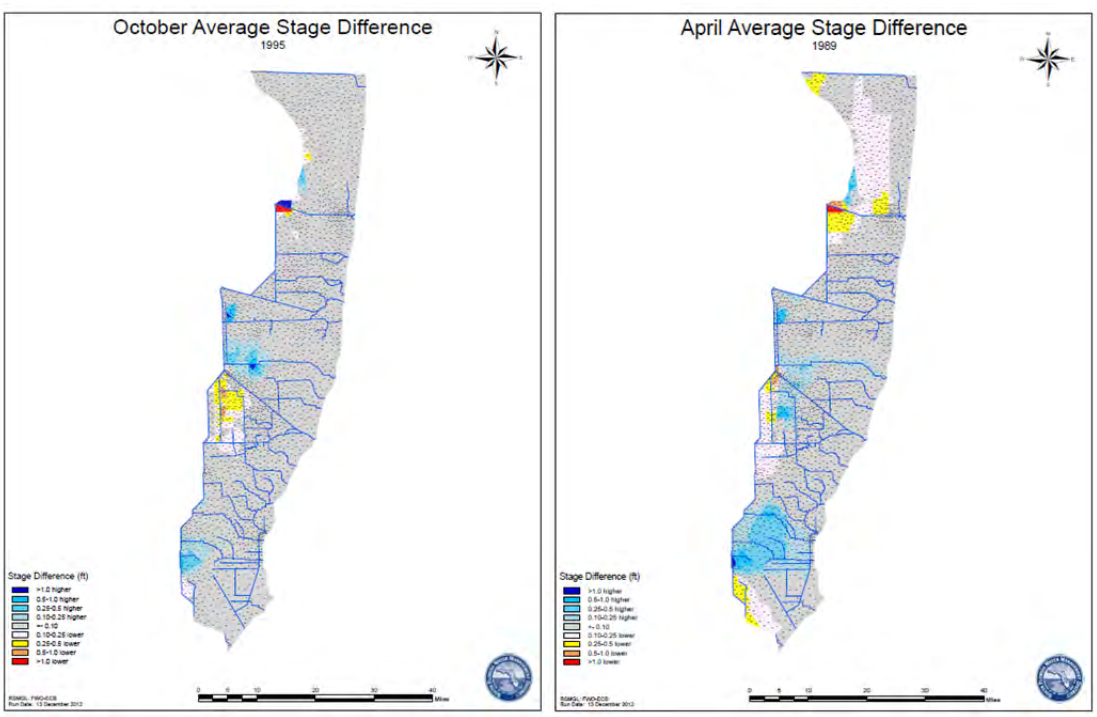


Figure 4.11. Difference between FWO and ECB stages in an average water year, in October 1995 (left) and April 1989 (right).

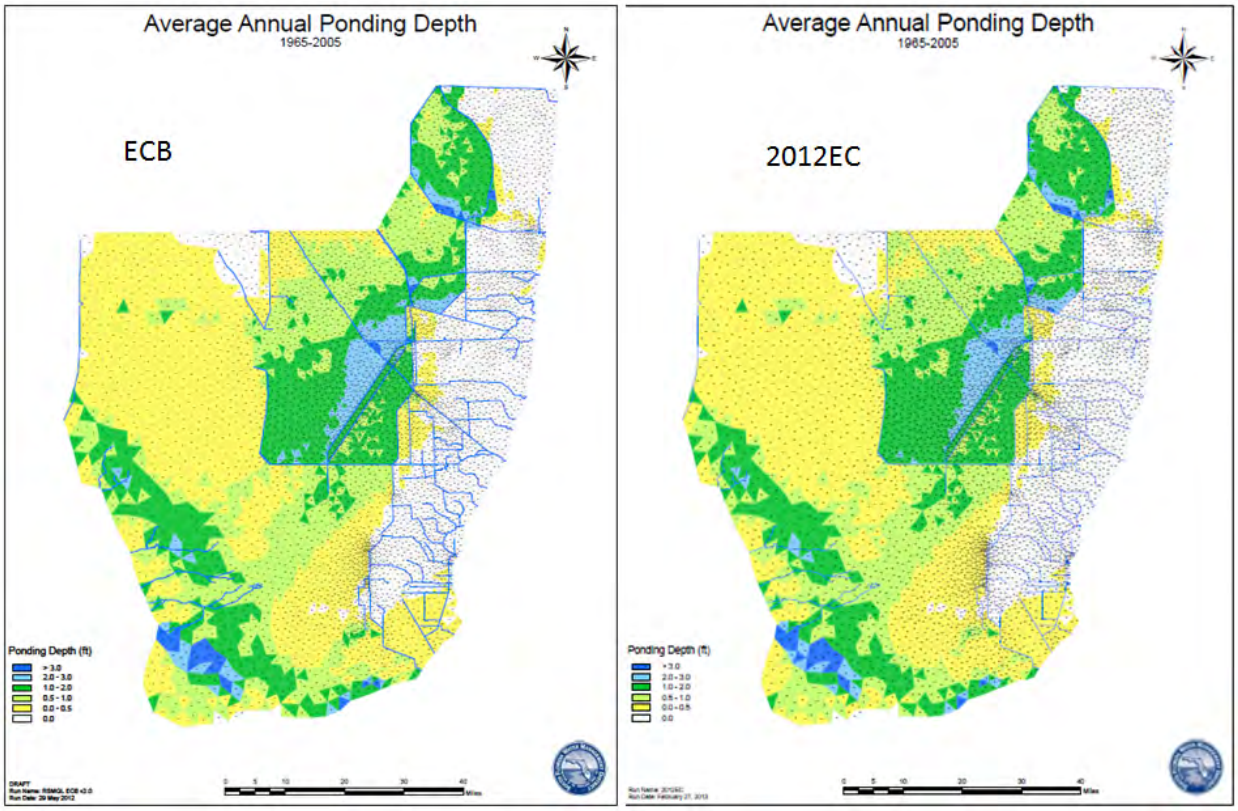


Figure 4.12. Differences between ECB (left) and 2012EC (right) average annual ponding depths throughout the RSMGL model domain.

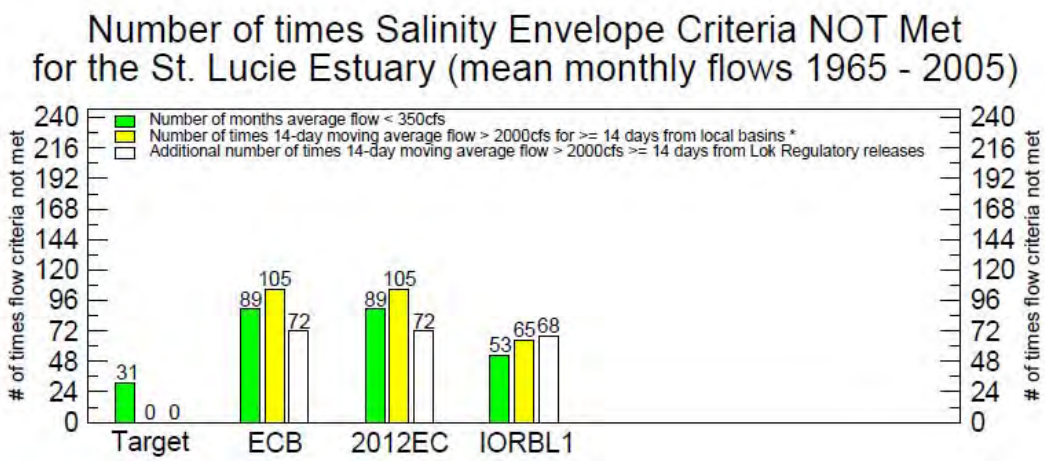


Figure 4.13. Increased St Lucie Estuary low flow counts in 2012EC and IORBL1 (relative to those shown in **Figure 4.3**)

In summary, the four delivered baseline runs provided to the CEPP project team are deemed to adequately represent the intended planning conditions and when utilized in conjunction with proposed with-CEPP project alternatives, provide a reasonable basis of comparison for the necessary evaluations required to draft the PIR.

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Appendix A – Tables of Assumptions

RSMBN:

- **ECB**
- **FWO**
- **2012EC**
- **IORBL1**

RSMGL:

- **ECB**
- **FWO**
- **2012EC**
- **IORBL1**

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Basins (RSMBN)
2010 / 2011 Existing Conditions Baseline (ECB)
Table of Assumptions

Feature	
Climate	• The climatic period of record is from 1965 to 2005 • Rainfall estimates have been revised and updated for 1965-2005 • Revised evapotranspiration methods have been used for 1965-2005
Topography	The Topography dataset for RSM was Updated in 2009 using the following datasets: • South Florida Digital Elevation Model, USACE, 2004 • High Accuracy Elevation Data , US Geological Survey 2007 • Loxahatchee River LiDAR Study, Dewberry and Davis, 2004 • St. Lucie North Fork LiDAR, Dewberry and Davis, 2007 • Palm Beach County LiDAR Survey, Dewberry and Davis, 2004 • Stormwater Treatment Area stage-storage-area relationships from G. Goforth spreadsheets.
Land Use	• Lake Okeechobee Service Area (LOSA) Basins were updated using consumptive use permit information as of 2/21/12, as reflected in the LOSA Ledger produced by the Water Use Bureau • C-43 Groundwater irrigated basins – Permitted as of 2010, the dataset was updated using land use, aerial imagery and 2010 consumptive use permit information • Dominant land use in EAA is sugar cane other land uses consist of shrub land, wet land, ridge and slough, and sawgrass
LOSA Basins	• Lower Istokpoga, North Lake Shore and Northeast Lake Shore demands and runoff estimated using the AFSIRS model and assumed permitted land use (see land use assumptions row).

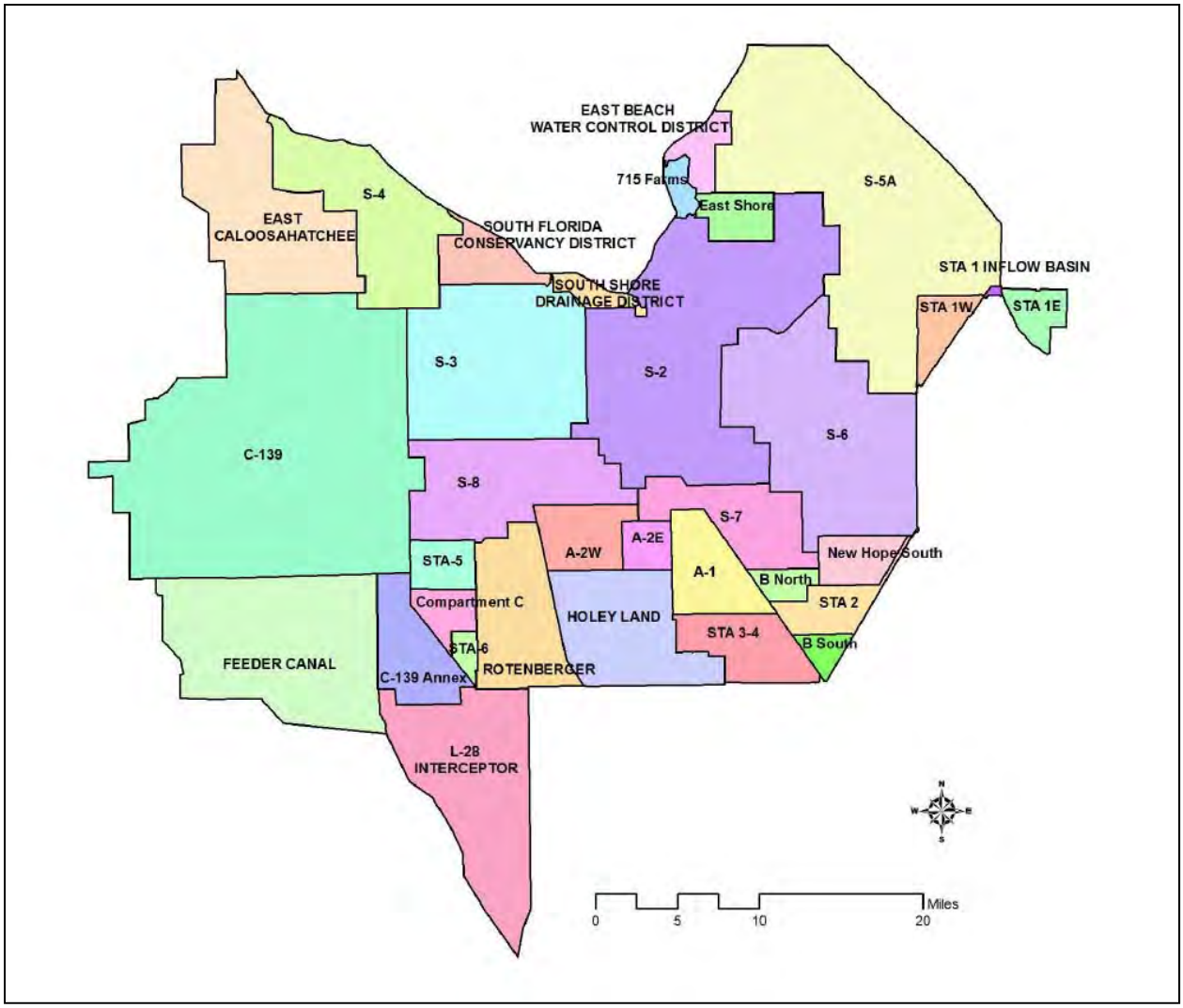
Lake Okeechobee	• Lake Okeechobee Regulation Schedule 2008 (LORS 2008)
	  o Includes Lake Okeechobee regulatory releases to tide via L8/C51 canals
	  o A regional hydrologic surrogate for the 2010 Adaptive Protocol operations utilized. This attempts to mimic desired timing of releases without estimating salinity criteria
	• Lake Okeechobee Water Shortage Management (LOWSM) Plan
	• Interim Action Plan (IAP) for Lake Okeechobee (under which backpumping to the lake at S-2 and s-3 is to be minimized)
	• "Temporary" forward pumps as follows:
	  o S354 – 400 cfs
	  o S351 – 600 cfs
	  o S352 – 400 cfs
	  o All pumps reduce to the above capacities when Lake Okeechobee stage falls below 10.2 ft and turn off when stages recover to greater than 11.2 ft.
	• No reduction in EAA runoff associated with the implementation of Best Management Practices (BMPs); No BMP makeup water

Feature	
	deliveries to the WCAs • Operational intent is to treat LOK regulatory releases to the south through STA-3/4 • Backpumping of 298 Districts and 715 Farms into lake minimized
Northern Lake Okeechobee Watershed Inflows	• Kissimmee River inflows based on interim schedule for Kissimmee Chain of Lakes using the UKISS model • Restored reaches / pools of Kissimmee River as of 2010 • Fisheating Creek, Istokpoga & Taylor Creek / Nubbin Slough Basin Inflows calculated from historical runoff estimates.
Caloosahatchee River Basin	• Caloosahatchee River Basin irrigation demands and runoff estimated using the AFSIRS model and assumed permitted land use as of February 2012 (see land use assumptions row). • Public water supply daily intake from the river is included in the analysis.
St. Lucie Canal Basin	• St. Lucie Canal Basin demands estimated using the AFSIRS model and assumed permitted land use as of February 2012(see land use assumptions row). • Basin demands include the Florida Power & Light reservoir at Indiantown.
Seminole Brighton Reservation	• Brighton reservation demands were estimated using AFSIRS method based on existing planted acreage • The 2 in 10 demand set forth in the Seminole Compact Work plan equals 2,262 MGM (million gallons/month). AFSIRS modeled 2 in 10 demands equaled 2,383 MGM • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per Table 7, Agreement 41-21 (Nov. 1992), tribal rights to these quantities are preserved • LOWSM applies to this agreement
Seminole Big Cypress Reservation	• Big Cypress Reservation irrigation demands and runoff were estimated using the AFSIRS method based on existing planted acreage • The 2 in 10 demand set forth in the Seminole Compact Work Plan equals 2,606 MGM • AFSIRS modeled 2 in 10 demands equaled 2,659 MGM • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per the District's Final Order and Tribe's Resolution establishing the Big Cypress Reservation entitlement, tribal rights to these quantities are preserved • LOWSM applies to this agreement
Everglades Agricultural Area	• Model water-body components as shown in Figure 1 below. • Simulated runoff from the North New River – Hillsboro basin will be apportioned based on the relative size of contributing basins via s7 route vs. S6 route. • G-341 routes water from S-5A Basin to Hillsboro Basin • EAA runoff and irrigation demand compared to SFWMM (ECB) simulated runoff and demand from 1965-2005 for reasonability

Feature	
	• Compartment C land in the Miami Canal Basin between STA-5 and STA-6 is not considered to be in production (shrub Land Use). Then, no irrigation demands are required in this area. • Compartment B (excluding cell 4) land in the North New River/Hillsboro is not considered to be in production (shrub Land Use). Then, no irrigation demands are required in this area.

Stormwater Treatment Areas	• STAs are simulated as single waterbodies
	• STA-1E: 6,546 acres total area
	• STA-1W: 7,488 acres total area
	• S-5A Basin runoff is to be treated in STA-1W first and when conveyance capacities are exceeded, rerouted to STA-1E
	• STA-2: includes first four cells: 9,910 acres total area
	• STA-3/4: 17,126 acres total area
	• STA-5: includes first 3 cells: 7,619 acres total area
	• STA-6: 2,486 acres total area
	• Assumed operations of STAs:
	  • 0.5 ft minimum depth below which supply for external sources is triggered
	  • 4 ft maximum depth above which inflows are discontinued
	• STA-3/4 receives Lake Okeechobee regulation target releases at or below 60,000 acre-feet annual average for entire period of record

Holey Land Wildlife Management Area	• G-372HL is the only inflow structure for Holey Land used for environmental purposes only • Operations are similar to the existing condition as in the 1995 base simulation for the Lower East Coast Regional Water Supply Plan (LECRWSP, May 2000), as per the memorandum of agreement between the FWC and the SFWMD
Rotenberger Wildlife Management Area	• Operational Schedule as defined in the Operation Plan for Rotenberger WMA (SFWMD, March 2010)
Public Water Supply and Irrigation	• Regional water supply demands to maintain Lower East Coast canals as simulated from RSMGL ECB.
Western Basins	• C139 RSM basin is being modeled. Period is 1965-2005. • C139 basin runoff is modeled as follows: G136 flows is routed to Miami Canal; G342s flows routed to STA5; G406 flows routed to STA6: C139 Annex flows routed to STA6 • C139 basin demand is met primarily by local groundwater
Water Shortage Rules	• Reflects the existing water shortage policies as in South Florida Water Management District Chapters 40E-21 and 40E-22, FAC, including Lake Okeechobee Water Shortage Management (LOWSM) Plan.



Water-Body Components:
Miami Water-Body = S3 + S8 + A-2W
NNR/HILLS Water-Body = S2 + S6 + S7 + A-2E + A-1 + B North
+ B South + New Hope South
WPB Water-Body = S-5A

Fig. 1 RSMBSN Basin Definition within the EAA: Existing Conditions Baseline Simulation

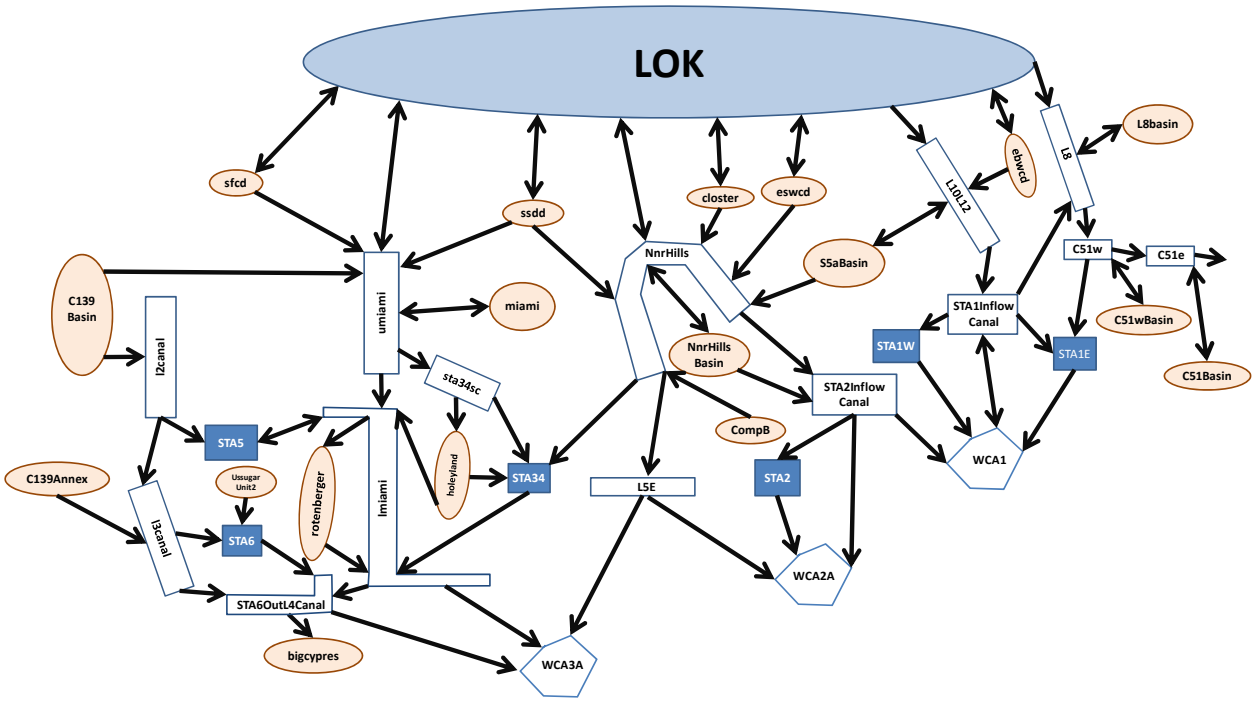


Fig. 2 RSMBSN Link-Node Routing Diagram: Existing Conditions Baseline Simulation

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the eastern and southern boundaries of the RSMBN model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Glades-LECSA Model (RSMGL). The SFWMM was the source of the eastern boundary groundwater/surface water flows, while the RSMGL was the source of the southern boundary structural flows.

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Basins (RSMBN)
2050 Future Without Project Baseline (FWO)
Table of Assumptions

Feature	
Climate	• The climatic period of record is from 1965 to 2005 • Rainfall estimates have been revised and updated for 1965-2005 • Revised evapotranspiration methods have been used for 1965-2005
Topography	The Topography dataset for RSM was Updated in 2009 using the following datasets: • South Florida Digital Elevation Model, USACE, 2004 • High Accuracy Elevation Data , US Geological Survey 2007 • Loxahatchee River LiDAR Study, Dewberry and Davis, 2004 • St. Lucie North Fork LiDAR, Dewberry and Davis, 2007 • Palm Beach County LiDAR Survey, Dewberry and Davis, 2004 • Stormwater Treatment Area stage-storage-area relationships from G. Goforth spreadsheets.
Land Use	• Lake Okeechobee Service Area (LOSA) Basins were updated using consumptive use permit information as of 2/21/2012, as reflected in the LOSA Ledger produced by the Water Use Bureau. • C-43 Groundwater irrigated basins – Permitted as of 2010, the dataset was updated using land use, aerial imagery and 2010 consumptive use permit information • Dominant land use in EAA is sugar cane other land uses consist of shrub land, wet land, ridge and slough, and sawgrass
LOSA Basins	• Lower Istokpoga, North Lake Shore and Northeast Lake Shore demands and runoff estimated using the AFSIRS model and assumed permitted land use (see land use assumptions row).

Lake Okeechobee	• Lake Okeechobee Regulation Schedule 2008 (LORS 2008)
	  o Includes Lake Okeechobee regulatory releases to tide via L8/C51 canals
	  o Releases via S-77 can be diverted into C43 Reservoir
	• Lake Okeechobee Water Shortage Management (LOWSM) Plan
	• Interim Action Plan (IAP) for Lake Okeechobee (under which backpumping to the lake at S-2 and s-3 is to be minimized)
	• "Temporary" forward pumps as follows:
	  o S354 – 400 cfs
	  o S351 – 600 cfs
	  o S352 – 400 cfs
	  o All pumps reduce to the above capacities when Lake Okeechobee stage falls below 10.2 ft and turn off when stages recover to greater than 11.2 ft.
	• No reduction in EAA runoff associated with the implementation of Best Management Practices (BMPs); No BMP makeup water deliveries to the WCAs

Feature	
	• Operational intent is to treat LOK regulatory releases to the south through STA-3/4 • Backpumping of 298 Districts and 715 Farms into lake minimized
Northern Lake Okeechobee Watershed Inflows	• Headwaters Revitalization schedule for Kissimmee Chain of Lakes using the UKISS model • Kissimmee River Restoration complete. • Fisheating Creek, Istokpoga & Taylor Creek / Nubbin Slough Basin Inflows calculated from historical runoff estimates.
Caloosahatchee River Basin	• Caloosahatchee River Basin irrigation demands and runoff estimated using the AFSIRS model and assumed permitted land use as of February 2012. (see land use assumptions row) • Public water supply daily intake from the river is included in the analysis. • Maximum reservoir height of 41.7 ft NGVD with a 9,379-acre footprint in Western C43 basin with a 175,800 acre-feet effective storage. • Proposed reservoir meets estuary demands while C-43 basin supplemental demands for surface water irrigation are met by Lake Okeechobee.

St. Lucie Canal Basin	• St. Lucie Canal Basin demands estimated using the AFSIRS model and assumed permitted land use as of February 2012(see land use assumptions row).
	• Basin demands include the Florida Power & Light reservoir at Indiantown.
	• Indian River Lagoon South Project features
	  • Ten-mile Creek Reservoir and STA: 7,078 acre-feet storage capacity at 10.79 maximum depth on 820 acre footprint; receives excess water from North Folk Basin
	  • C-44 reservoir: 50,246 acre-feet storage capacity at 5.18 feet maximum depth on 12,125 acre footprint
	  • C-23/C-24 reservoir: 92,094 acre-feet storage capacity at 13.27 maximum depth on 8,675 acre footprint
	  • C-23/C-24 STA: 3,852 acre-feet storage capacity at 1.5 maximum depth on 2,568 acre footprint
	  • All proposed reservoirs meet estuary demands

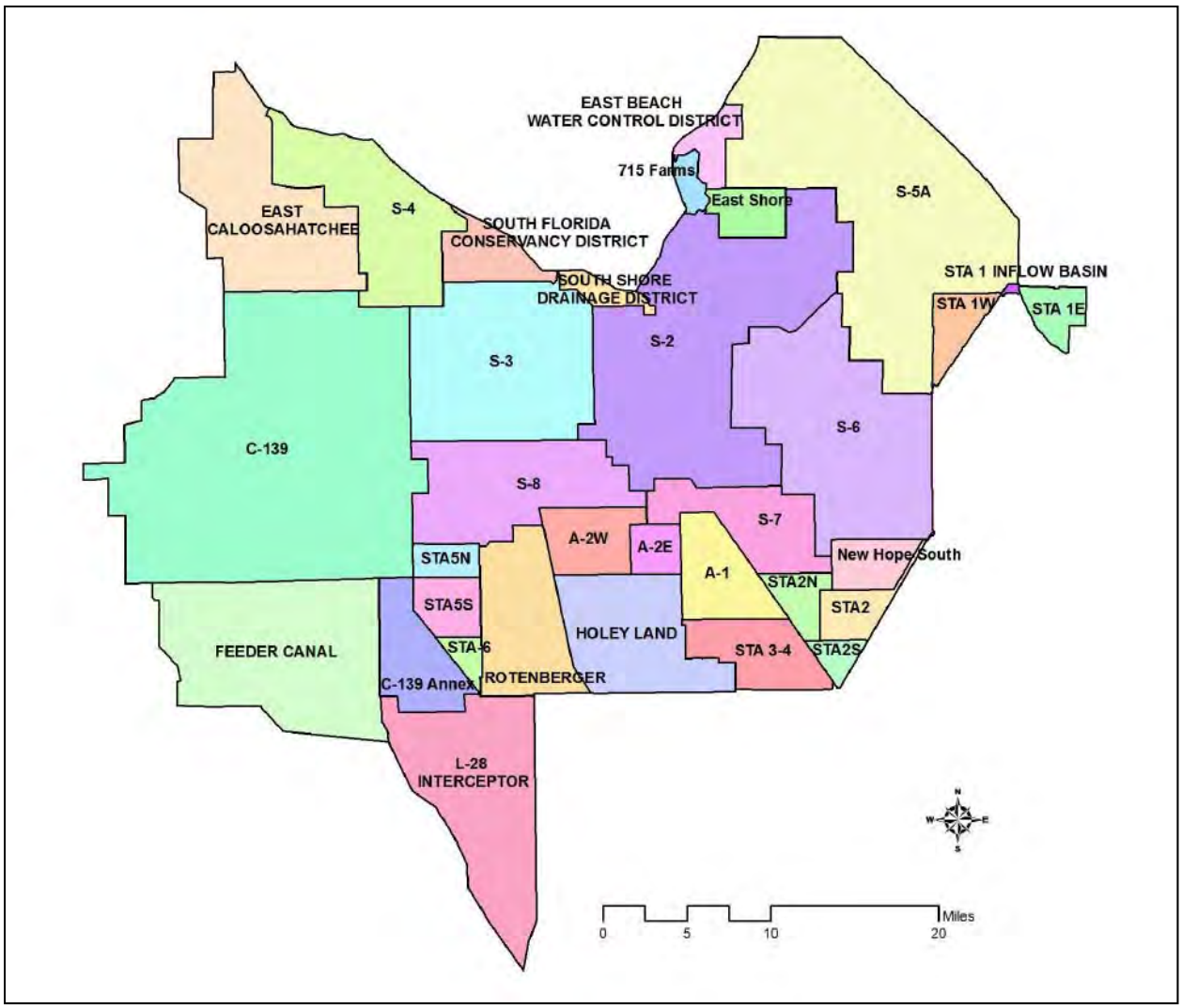
Seminole Brighton Reservation	• Brighton reservation demands were estimated using AFSIRS method based on existing planted acreage. • The 2 in 10 demand set forth in the Seminole Compact Work plan equals 2,262 MGM (million gallons/month). AFSIRS modeled 2 in 10 demands equaled 2,383 MGM • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per Table 7, Agreement 41-21 (Nov. 1992), tribal rights to these quantities are preserved • LOWSM applies to this agreement

Feature	
Seminole Big Cypress Reservation	• Big Cypress Reservation irrigation demands and runoff were estimated using the AFSIRS method based on existing planted acreage • The 2 in 10 demand set forth in the Seminole Compact Work Plan equals 2,606 MGM • AFSIRS modeled 2 in 10 demands equaled 2,659 MGM • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per the District's Final Order and Tribe's Resolution establishing the Big Cypress Reservation entitlement, tribal rights to these quantities are preserved • LOWSM applies to this agreement
Everglades Agricultural Area	• Model water-body components as shown in Figure 1. • Simulated runoff from the North New River – Hillsboro basin apportioned based on the relative size of contributing basins via s7 route vs. S6 route. • G-341 routes water from S-5A Basin to Hillsboro Basi • RSMBN ECB EAA runoff and irrigation demand compared to SFWMM ECB simulated runoff and demand from 1965-2005 for reasonability.

Everglades Construction Project Stormwater Treatment Areas	• STAs are simulated as single waterbodies
	• STA-1E: 6,546 acres total area
	• STA-1W: 7,488 acres total area
	• S-5A Basin runoff is to be treated in STA-1W first and when conveyance capacities are exceeded, rerouted to STA-1E
	• STA-2: cells 1,2 & 3: 7,681 acres total area
	• STA-2N: cells 4,5 & 6; refers to Comp B-North; 6,531 acres total area
	• STA-2S: cells 7 & 8; refers to Comp B-South; 3,570 acres total area
	• STA-3/4: 17,126 acres total area
	• STA-5N: includes cells 1 & 2: 5,081 acres total area
	• STA-5S: includes cells 3, 4 & 5; uses footprint of Compartment C: 8,469 acres total area
	• STA-6: expanded with phase 2: 3,054 acres total area
	• Assumed operations of STAs:
	  • 0.5 ft minimum depth below which supply for external sources is triggered
	  • 4 ft maximum depth above which inflows are discontinued
	• STA-3/4 receives Lake Okeechobee regulation target releases at or below 60,000 acre-feet annual average for entire period of record

Holey Land Wildlife Management Area	• G-372HL is the only inflow structure for Holey Land used for environmental purposes only • Operations are similar to the existing condition as in the 1995 base simulation for the Lower East Coast Regional Water Supply Plan (LECRWSP, May 2000), as per the memorandum of agreement between the FWC and the SFWMD

Feature	
Rotenberger Wildlife Management Area	• Operational Schedule as defined in the Operation Plan for Rotenberger WMA (SFWMD, March 2010)
Public Water Supply and Irrigation	• Regional water supply demands to maintain Lower East Coast canals as simulated from RSMGL FWO.
Western Basins	• C139 RSM basin is being modeled. Period is 1965-2005. • C139 basin runoff is modeled as follows: G136 flows is routed to Miami Canal; G342s flows routed to STA5; G406 flows routed to STA6: C139 Annex flows routed to STA6 • C139 basin demand is met primarily by local groundwater
Water Shortage Rules	• Reflects the existing water shortage policies as in South Florida Water Management District Chapters 40E-21 and 40E-22, FAC, including Lake Okeechobee Water Shortage Management (LOWSM) Plan



Water-Body Components:
Miami Water-Body = S3 + S8
NNR/HILLS Water-Body = S2 + S6 + S7 + A-2E + A-1+ New Hope South
WPB Water-Body = S-5A

Fig. 1 RSMBSN Basin Definition within the EAA: Future Without Project Baseline Simulation

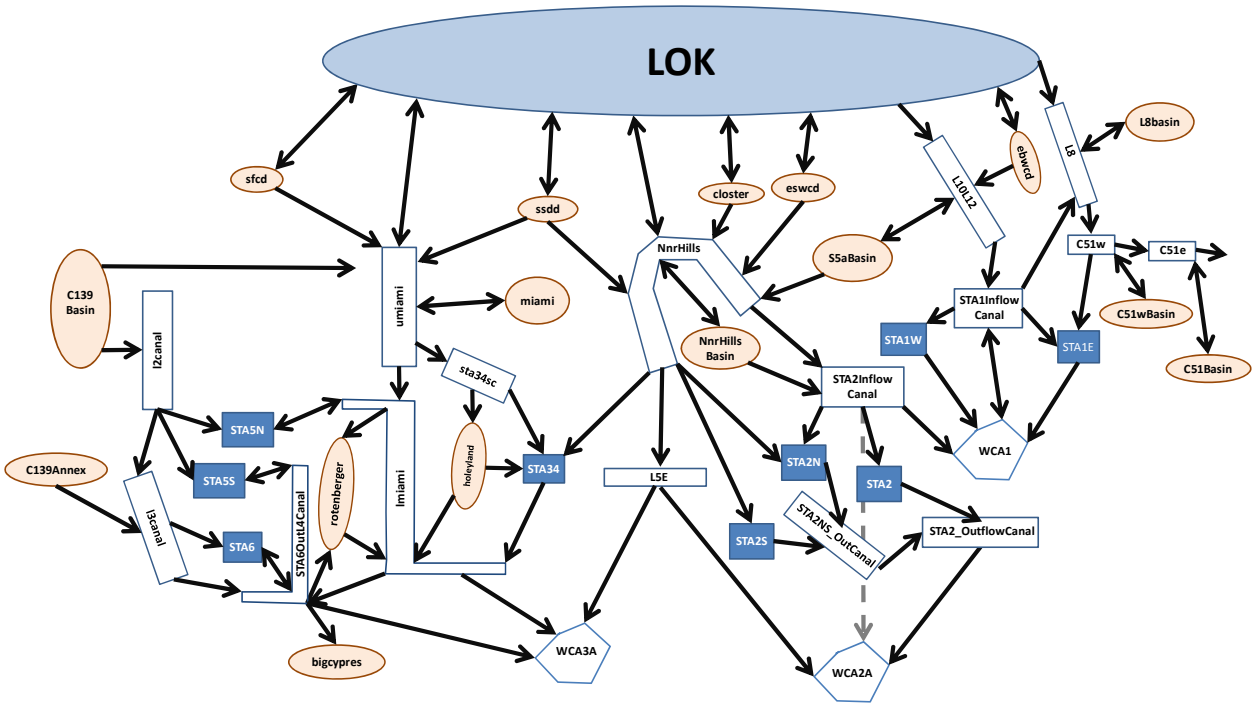


Fig. 2 RSMBSN Link-Node Routing Diagram: Future Without Project Baseline Simulation

Note:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the eastern and southern boundaries of the RSMBN model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Glades-LECSA Model (RSMGL). The SFWMM was the source of the eastern boundary groundwater/surface water flows, while the RSMGL was the source of the southern boundary structural flows.

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Basins (RSMBN)
2012 Existing Conditions (2012EC) Baseline
Table of Assumptions

Note: RSMBN CEPP 2012EC (2/28/13) is identical to the RSMBN CEPP ECB (12/13/12)

Feature	
Climate	• The climatic period of record is from 1965 to 2005 • Rainfall estimates have been revised and updated for 1965-2005 • Revised evapotranspiration methods have been used for 1965-2005
Topography	The Topography dataset for RSM was Updated in 2009 using the following datasets: • South Florida Digital Elevation Model, USACE, 2004 • High Accuracy Elevation Data , US Geological Survey 2007 • Loxahatchee River LiDAR Study, Dewberry and Davis, 2004 • St. Lucie North Fork LiDAR, Dewberry and Davis, 2007 • Palm Beach County LiDAR Survey, Dewberry and Davis, 2004 • Stormwater Treatment Area stage-storage-area relationships based on G. Goforth spreadsheets.
Land Use	• Lake Okeechobee Service Area (LOSA) Basins were updated using consumptive use permit information as of 2/21/12, as reflected in the LOSA Ledger produced by the Water Use Bureau • C-43 Groundwater irrigated basins – Permitted as of 2010, the dataset was updated using land use, aerial imagery and 2010 consumptive use permit information • Dominant land use in EAA is sugar cane other land uses consist of shrub land, wet land, ridge and slough, and sawgrass
LOSA Basins	• Lower Istokpoga, North Lake Shore and Northeast Lake Shore demands and runoff estimated using the AFSIRS model and assumed permitted land use (see land use assumptions row).

Lake Okeechobee	• Lake Okeechobee Regulation Schedule 2008 (LORS 2008)
	  ○ Includes Lake Okeechobee regulatory releases to tide via L8/C51 canals
	  ○ Lake Okeechobee regulatory releases limited to 1,550 cfs for Miami Canal and 1,350 cfs for North New River Canal based on studies performed by USACE.
	  ○ A regional hydrologic surrogate for the 2010 Adaptive Protocol operations utilized. This attempts to mimic desired timing of releases without estimating salinity criteria
	• Lake Okeechobee Water Shortage Management (LOWSM) Plan
	• Interim Action Plan (IAP) for Lake Okeechobee (under which backpumping to the lake at S-2 and S-3 is to be minimized)
	• "Temporary" forward pumps as follows:
	  ○ S354 – 400 cfs
	  ○ S351 – 600 cfs
	  ○ S352 – 400 cfs

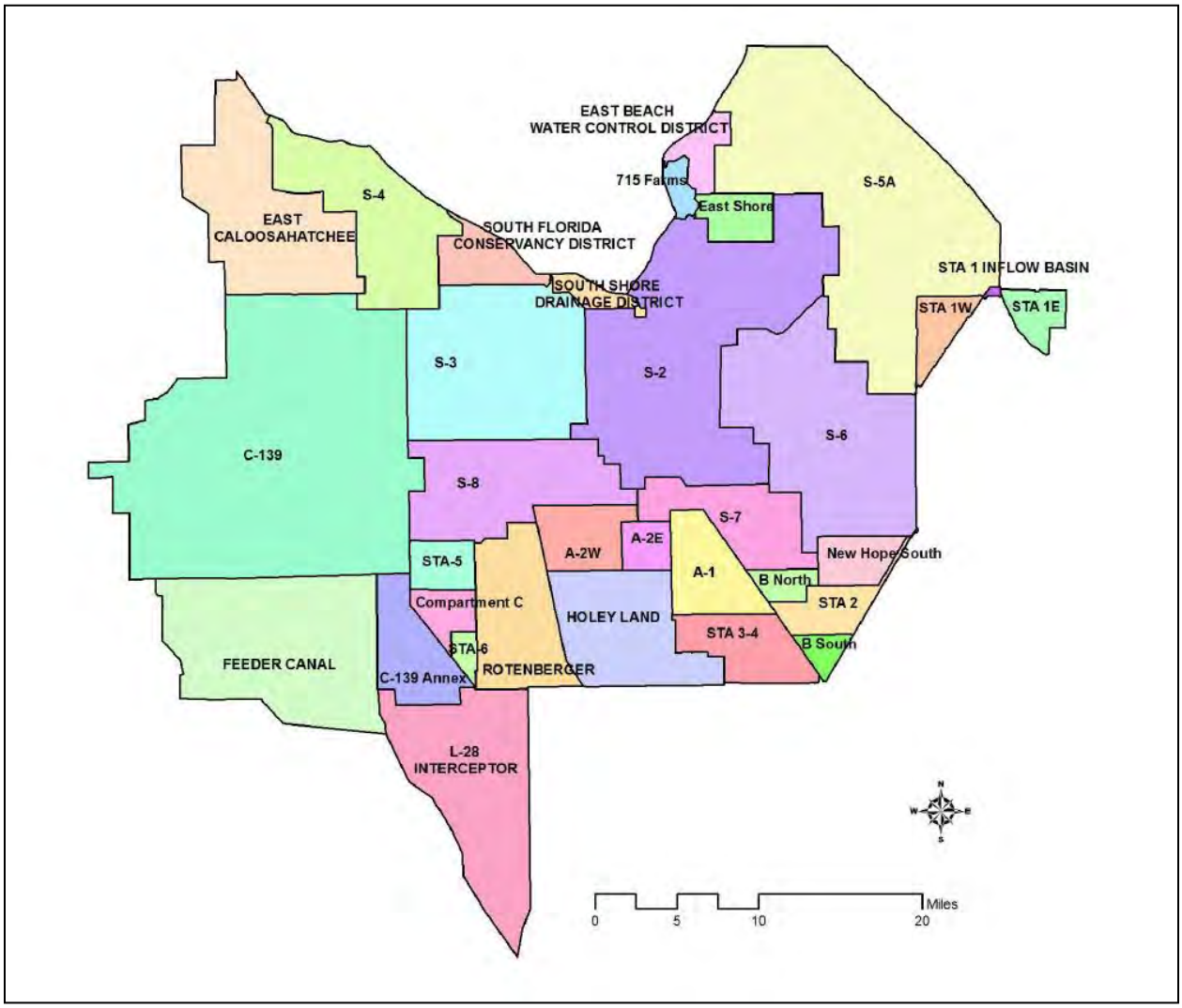
Feature	
	○ All pumps reduce to the above capacities when Lake Okeechobee stage falls below 10.2 ft and turn off when stages recover to greater than 11.2 ft. • No reduction in EAA runoff associated with the implementation of Best Management Practices (BMPs); No BMP makeup water deliveries to the WCAs • Operational intent is to treat LOK regulatory releases to the south through STA-3/4 • Backpumping of 298 Districts and 715 Farms into lake minimized
Northern Lake Okeechobee Watershed Inflows	• Kissimmee River inflows based on interim schedule for Kissimmee Chain of Lakes using the UKISS model • Restored reaches / pools of Kissimmee River as of 2010 • Fisheating Creek, Istokpoga & Taylor Creek / Nubbin Slough Basin Inflows calculated from historical runoff estimates.
Caloosahatchee River Basin	• Caloosahatchee River Basin irrigation demands and runoff estimated using the AFSIRS model and assumed permitted land use as of February 2012 (see land use assumptions row). • Public water supply daily intake from the river is included in the analysis.
St. Lucie Canal Basin	• St. Lucie Canal Basin demands estimated using the AFSIRS model and assumed permitted land use as of February 2012(see land use assumptions row). • Excess C-44 basin runoff is allowed to backflow into the Lake if the lake stage is 0.25 ft below the Zone D pulse release line. • Basin demands include the Florida Power & Light reservoir at Indiantown.
Seminole Brighton Reservation	• Brighton reservation demands were estimated using AFSIRS method based on existing planted acreage • The 2-in10 demand set forth in the Seminole Compact Work plan equals 2,262 MGM (million gallons per month). AFSIRS modeled 2-in-10 demands equaled 2,383 MGM • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per Table 7, Agreement 41-21 (Nov. 1992), tribal rights to these quantities are preserved • LOWSM applies to this agreement
Seminole Big Cypress Reservation	• Big Cypress Reservation irrigation demands and runoff were estimated using the AFSIRS method based on existing planted acreage • The 2-in-10 demand set forth in the Seminole Compact Work Plan equals 2,606 MGM • AFSIRS modeled 2-in-10 demands equaled 2,659 MGM • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per the District's Final Order and Tribe's Resolution establishing the Big Cypress Reservation entitlement, tribal rights to these quantities are preserved • LOWSM applies to this agreement

Feature	
Everglades Agricultural Area	• Model water-body components as shown in Figure 1 below. • Simulated runoff from the North New River – Hillsboro basin will be apportioned based on the relative size of contributing basins via S7 route vs. S6 route. • G-341 routes water from S-5A Basin to Hillsboro Basin • EAA runoff and irrigation demand compared to SFWMM (ECB) simulated runoff and demand from 1965-2005 for reasonability • Compartment C land in the Miami Canal Basin between STA-5 and STA-6 is not considered to be in production (shrub Land Use). Then, no irrigation demands are required in this area. • Compartment B (excluding cell 4) land in the North New River/Hillsboro is not considered to be in production (shrub Land Use). Then, no irrigation demands are required in this area.

Stormwater Treatment Areas	• STAs are simulated as single waterbodies
	• STA-1E: 6,546 acres total area
	• STA-1W: 7,488 acres total area
	• S-5A Basin runoff is to be treated in STA-1W first and when conveyance capacities are exceeded, rerouted to STA-1E
	• STA-2: includes first four cells: 9,910 acres total area
	• STA-3/4: 17,126 acres total area
	• STA-5: includes first 3 cells: 7,619 acres total area
	• STA-6: 2,486 acres total area
	• Assumed operations of STAs:
	  ○ 0.5 ft minimum depth below which supply from external sources is triggered
	  ○ 4 ft maximum depth above which inflows are discontinued
	• STA-3/4 receives Lake Okeechobee regulatory releases approximately at 60,000 acre-feet annual average for the entire period of record.

Holey Land Wildlife Management Area	• G-372HL is the only inflow structure for Holey Land used for environmental purposes only • Operations are similar to the existing condition as in the 1995 base simulation for the Lower East Coast Regional Water Supply Plan (LECRWSP, May 2000), as per the memorandum of agreement between the FWC and the SFWMD
Rotenberger Wildlife Management Area	• Operational Schedule as defined in the Operation Plan for Rotenberger WMA (SFWMD, March 2010)
Public Water Supply and Irrigation	• Regional water supply demands to maintain Lower East Coast canals as simulated from RSMGL ECB.
Western Basins	• C139 RSM basin is being modeled. Period is 1965-2005. • C139 basin runoff is modeled as follows: G136 flows is routed to Miami Canal; G342A-D flows routed to STA5; G406 flows routed to STA6 • C139 basin demand is met primarily by local groundwater

Feature	
Water Shortage Rules	• Reflects the existing water shortage policies as in South Florida Water Management District Chapters 40E-21 and 40E-22, FAC, including Lake Okeechobee Water Shortage Management (LOWSM) Plan.



Water-Body Components:

Miami Water-Body = S3 + S8 + A-2W

NNR/HILLS Water-Body = S2 + S6 + S7 + A-2E + B North
+ B South + New Hope South

WPB Water-Body = S-5A

Fig. 1 RSMBSN Basin Definition within the EAA: 2012 Existing Conditions Simulation

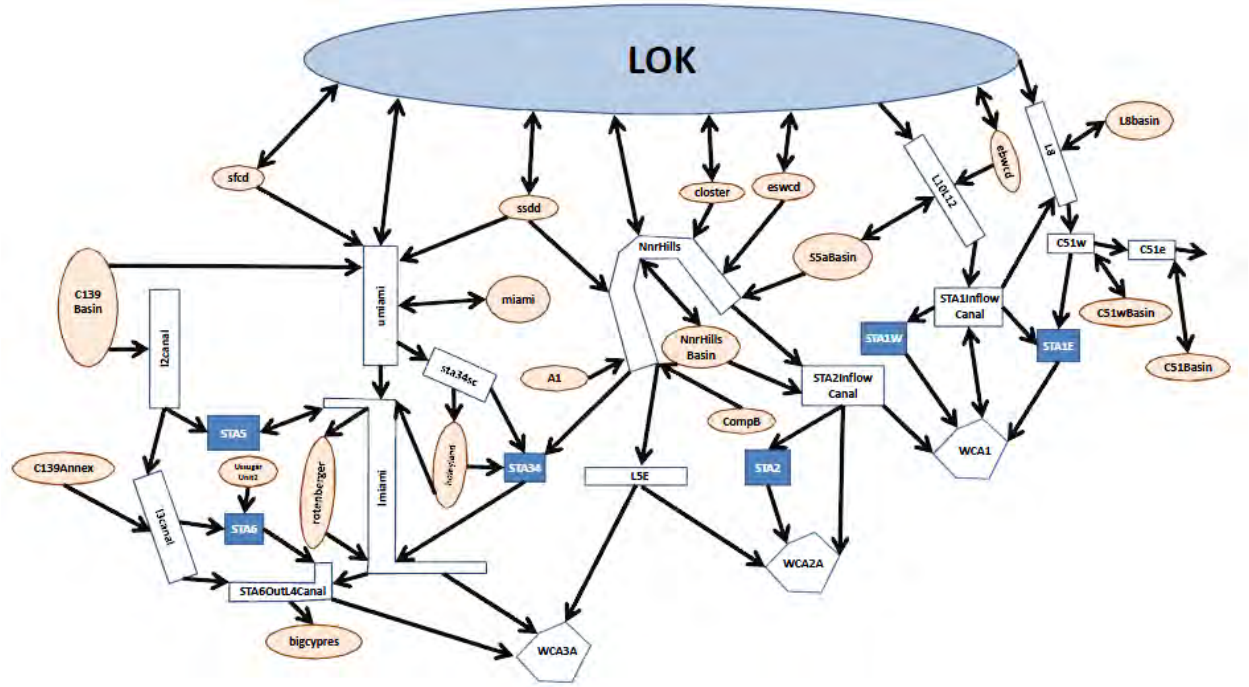


Fig. 2 RSMBSN Link-Node Routing Diagram: 2012 Existing Conditions Simulation

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the eastern and southern boundaries of the RSMBN model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Glades-LECSA Model (RSMGL). The SFWMM was the source of the eastern boundary groundwater/surface water flows, while the RSMGL was the source of the southern boundary structural flows.
- 2012EC assumptions were updated from the CEPP 12/13/2012 ECB scenario at the time that the CEPP tentatively selected plan was identified.

`Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Basins (RSMBN)
Initial Operating Regime Baseline 1 (IORBL1)
Table of Assumptions

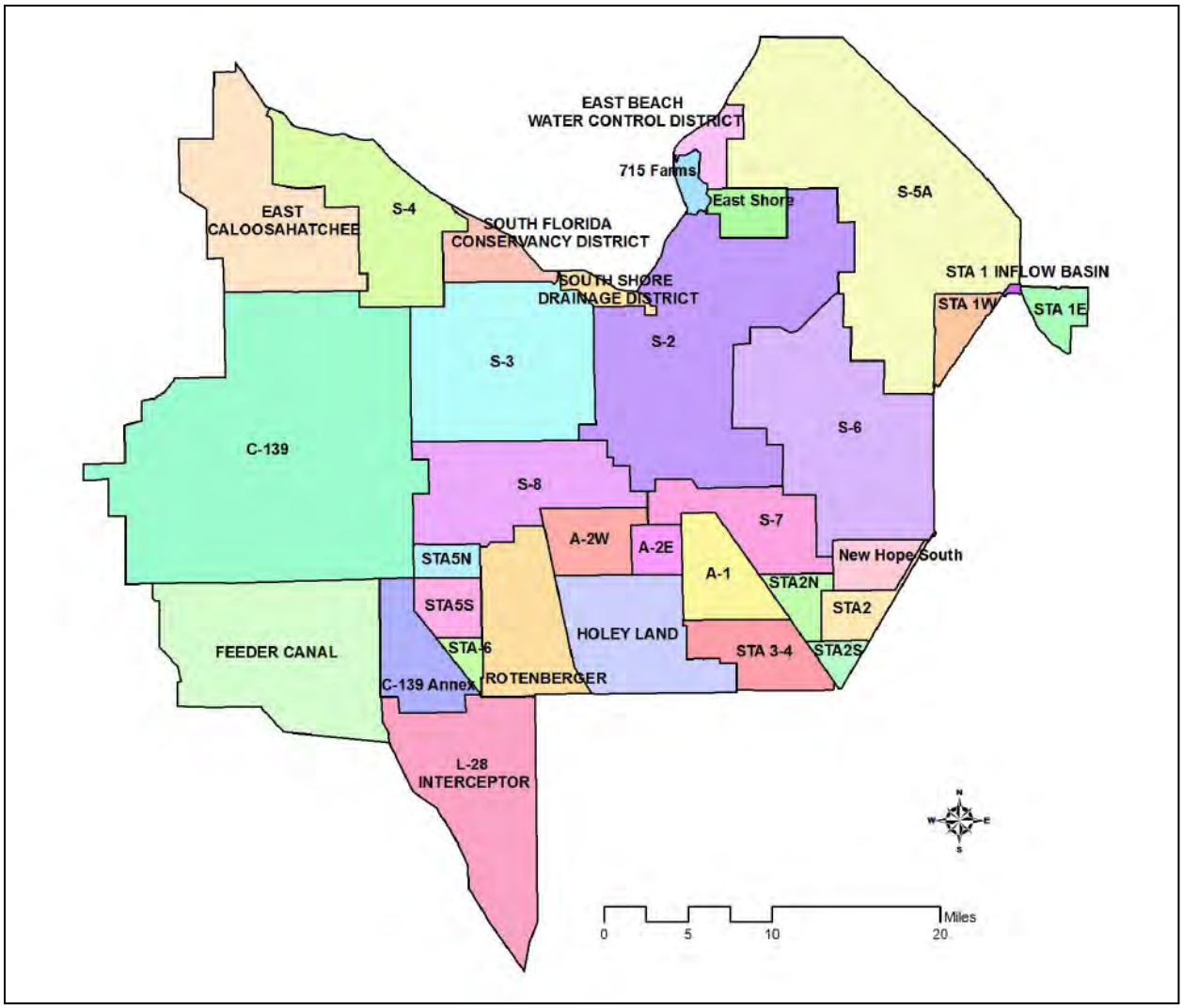
Feature	
Climate	• The climatic period of record is from 1965 to 2005 • Rainfall estimates have been revised and updated for 1965-2005 • Revised evapotranspiration methods have been used for 1965-2005
Topography	The topography dataset for RSM was updated in 2009 using the following datasets: • South Florida Digital Elevation Model, USACE, 2004 • High Accuracy Elevation Data , US Geological Survey 2007 • Loxahatchee River LiDAR Study, Dewberry and Davis, 2004 • St. Lucie North Fork LiDAR, Dewberry and Davis, 2007 • Palm Beach County LiDAR Survey, Dewberry and Davis, 2004 • Stormwater Treatment Area stage-storage-area relationships based on G. Goforth spreadsheets.
Land Use	• Lake Okeechobee Service Area (LOSA) Basins were updated using consumptive use permit information as of 2/21/2012, as reflected in the LOSA Ledger produced by the Water Use Bureau. • C-43 Groundwater irrigated basins – Permitted as of 2010, the dataset was updated using land use, aerial imagery and 2010 consumptive use permit information • Dominant land use in EAA is sugar cane other land uses consist of shrub land, wet land, ridge and slough, and sawgrass
LOSA Basins	• Lower Istokpoga, North Lake Shore and Northeast Lake Shore demands and runoff estimated using the AFSIRS model and assumed permitted land use (see land use assumptions row).

Lake Okeechobee	• Lake Okeechobee Regulation Schedule 2008 (LORS 2008)
	  o Includes Lake Okeechobee regulatory releases to tide via L8/C51 canals
	  o Lake Okeechobee regulatory releases limited to 1,550 cfs for Miami Canal and 1,350 cfs for North New River Canal based on studies performed by USACE.
	  o Releases via S-77 can be diverted into C43 Reservoir
	• No Lake Okeechobee environmental releases.
	• Lake Okeechobee Water Shortage Management (LOWSM) Plan
	• Interim Action Plan (IAP) for Lake Okeechobee (under which backpumping to the lake at S-2 and S-3 is to be minimized)
	• "Temporary" forward pumps as follows:
	  o S354 – 400 cfs
	  o S351 – 600 cfs
	  o S352 – 400 cfs

Feature	
	o All pumps reduce to the above capacities when Lake Okeechobee stage falls below 10.2 ft and turn off when stages recover to greater than 11.2 ft. • No reduction in EAA runoff associated with the implementation of Best Management Practices (BMPs); No BMP makeup water deliveries to the WCAs • Operational intent is to treat LOK regulatory releases to the south through STA-3/4 • Backpumping of 298 Districts and 715 Farms into lake minimized
Northern Lake Okeechobee Watershed Inflows	• Headwaters Revitalization schedule for Kissimmee Chain of Lakes using the UKISS model • Kissimmee River Restoration complete. • Fisheating Creek, Istokpoga & Taylor Creek / Nubbin Slough Basin Inflows calculated from historical runoff estimates.
Caloosahatchee River Basin	• Caloosahatchee River Basin irrigation demands and runoff estimated using the AFSIRS model and assumed permitted land use as of February 2012. (see land use assumptions row) • Public water supply daily intake from the river is included in the analysis. • Maximum reservoir height of 41.7 ft NGVD with a 9,379-acre footprint in Western C43 basin with a 175,800 acre-feet effective storage. • Proposed reservoir meets estuary demands while C-43 basin supplemental demands for surface water irrigation are met by Lake Okeechobee.
St. Lucie Canal Basin	• St. Lucie Canal Basin demands estimated using the AFSIRS model and assumed permitted land use as of February 2012(see land use assumptions row). • Excess C-44 basin runoff is allowed to backflow into the Lake if lake stage is 0.25 ft. below the Zone D pulse release line before being pumped into the C-44 reservoir. • Basin demands include the Florida Power & Light reservoir at Indiantown. • Indian River Lagoon South Project features o Ten-mile Creek Reservoir and STA: 7,078 acre-feet storage capacity at 10.79 maximum depth on 820 acre footprint; receives excess water from North Folk Basin o C-44 reservoir: 50,246 acre-feet storage capacity at 5.18 feet maximum depth on 12,125 acre footprint o C-23/C-24 reservoir: 92,094 acre-feet storage capacity at 13.27 maximum depth on 8,675 acre footprint o C-23/C-24 STA: 3,852 acre-feet storage capacity at 1.5 maximum depth on 2,568 acre footprint o All proposed reservoirs meet estuary demands o IRL operations assumed are consistent with the March 2010 St. Lucie River Water Reservation Rule update. o Excess C23 basin water not needed to meet estuary demands can be diverted to the C44 reservoir if capacity exists.
Seminole Brighton	• Brighton reservation demands were estimated using AFSIRS method based on existing planted acreage.

Feature	
Reservation	• The 2-in-10 demand set forth in the Seminole Compact Work plan equals 2,262 MGM (million gallons per month). AFSIRS modeled 2-in-10 demands equaled 2,383 MGM • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per Table 7, Agreement 41-21 (Nov. 1992), tribal rights to these quantities are preserved • LOWSM applies to this agreement
Seminole Big Cypress Reservation	• Big Cypress Reservation irrigation demands and runoff were estimated using the AFSIRS method based on existing planted acreage • The 2-in-10 demand set forth in the Seminole Compact Work Plan equals 2,606 MGM • AFSIRS modeled 2-in-10 demands equaled 2,659 MGM • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per the District's Final Order and Tribe's Resolution establishing the Big Cypress Reservation entitlement, tribal rights to these quantities are preserved • LOWSM applies to this agreement
Everglades Agricultural Area	• Model water-body components as shown in Figure 1. • Simulated runoff from the North New River – Hillsboro basin apportioned based on the relative size of contributing basins via S7 route vs. S6 route. • G-341 routes water from S-5A Basin to Hillsboro Basin. • RSMBN ECB EAA runoff and irrigation demand compared to SFWMM ECB simulated runoff and demand from 1965-2005 for reasonability.
Everglades Construction Project Stormwater Treatment Areas	• STAs are simulated as single waterbodies • STA-1E: 6,546 acres total area • STA-1W: 7,488 acres total area • S-5A Basin runoff is to be treated in STA-1W first and when conveyance capacities are exceeded, rerouted to STA-1E • STA-2: cells 1,2 & 3: 7,681 acres total area • STA-2N: cells 4,5 & 6; refers to Comp B-North; 6,531 acres total area • STA-2S: cells 7 & 8; refers to Comp B-South; 3,570 acres total area • STA-3/4: 17,126 acres total area • STA-5N: includes cells 1 & 2: 5,081 acres total area • STA-5S: includes cells 3, 4 & 5; uses footprint of Compartment C: 8,469 acres total area • STA-6: expanded with phase 2: 3,054 acres total area • Assumed operations of STAs: o 0.5 ft minimum depth below which supply from external sources is triggered

Feature	
	o 4 ft maximum depth above which inflows are discontinued o Inflow targets established for STA-3/4, STA-2N and STA-2S based on DMSTA simulation; met from local basin runoff, LOK regulatory discharge and available A1FEB storage. o STA-3/4 receives Lake Okeechobee regulation target releases approximately at 60,000 acre-feet annual average for the entire period of record. • A 15,853-acre Flow Equalization Basin (FEB) located north of STA-3/4 with assumed operations as follows: o FEB inflows are from excess EAA basin runoff above the established inflow targets at STA-3/4, STA-2N, and STA-2S, and from LOK flood releases south. o FEB outflows are used to help meet established inflow targets (as estimated using the Dynamic Model for Stormwater Treatment Areas) at STA-3/4, STA-2N, and STA-2S if EAA basin runoff and LOK regulatory discharge are not sufficient. o 0.5 ft minimum depth below which no releases are allowed o 3.8 ft maximum depth above which inflows are discontinued o Assumed inlet pump from STA-3/4 supply canal with capacity equal to combined capacity of G-372 and G-370 structures. o Outflow weirs, with similar discharge characteristics as STA-3/4 outlet structure, discharging into lower North New River canal. o Structure capacities and water quality operating rules are consistent with modeling assumptions assumed during the A-1 FEB EIS application process.
Holey Land Wildlife Management Area	• G-372HL is the only inflow structure for Holey Land used for environmental purposes only • Operations are similar to the existing condition as in the 1995 base simulation for the Lower East Coast Regional Water Supply Plan (LECRWSP, May 2000), as per the memorandum of agreement between the FWC and the SFWMD
Rotenberger Wildlife Management Area	• Operational Schedule as defined in the Operation Plan for Rotenberger WMA (SFWMD, March 2010)
Public Water Supply and Irrigation	• Regional water supply demands to maintain Lower East Coast canals as simulated from RSMGL.
Western Basins	• C139 RSM basin is being modeled. Period is 1965-2005. • C139 basin runoff is modeled as follows: G136 flows is routed to Miami Canal; G342A-D flows routed to STA5N; G508 flows routed to STA5S; G406 flows routed to STA6C139 basin demand is met primarily by local groundwater
Water Shortage Rules	• Reflects the existing water shortage policies as in South Florida Water Management District Chapters 40E-21 and 40E-22, FAC, including Lake Okeechobee Water Shortage Management (LOWSM) Plan



Water-Body Components:
Miami Water-Body = S3 + S8 + A-2W
NNR/HILLS Water-Body = S2 + S6 + S7 + A-2E + New Hope South
WPB Water-Body = S-5A
A1FEB = A-1

Fig. 1 RSMBSN Basin Definition within the EAA: Initial Operating Regime Baseline Simulation

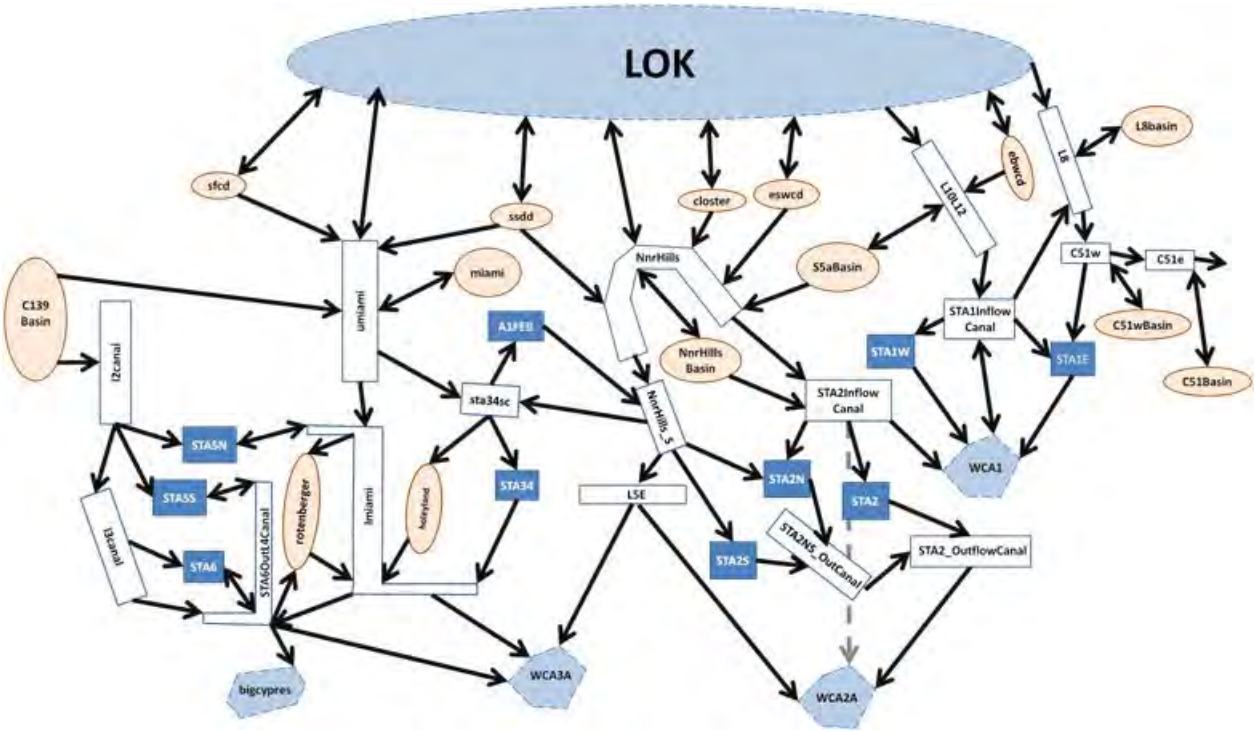


Fig. 2 RSMBSN Link-Node Routing Diagram: Initial Operating Regime Baseline Simulation

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the eastern and southern boundaries of the RSMBN model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Glades-LECSA Model (RSMGL). The SFWMM was the source of the eastern boundary groundwater/surface water flows, while the RSMGL was the source of the southern boundary structural flows.
- IORBL assumptions were updated from the CEPP 12/13/2012 FWO scenario at the time that the CEPP tentatively selected plan was identified and then adjusted for the IRL project to produce the IORBL1.

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Glades-LECSA (RSMGL)
2010 / 2011 Existing Conditions Baseline (ECB)
Table of Assumptions

Feature	
Meteorological Data	• Rainfall file used: rain_v3.0_beta_tin_14_05.bin • Reference Evapotranspiration (RET) file used: RET_48_05_MULTIQUAD_v1.0.bin (ARCADIS, 2008)
Topography	• Same as calibration topographic data set except where reservoirs are introduced (STA1-E, C4 Impoundment and C-111 reservoirs). • United States Geological Survey (USGS) High-Accuracy Elevation Data Collection (HAEDC) for the Water Conservation Areas (1, 2A, 2B, 3A, and 3B), the Big Cypress National Preserve and Everglades National Park.
Tidal Data	• Tidal data from two primary (Naples and Virginia Key) and five secondary NOAA stations (Flamingo, Everglades, Palm Beach, Delray Beach and Hollywood Beach) were used to generate a historic record to be used as sea level boundary conditions for the entire simulation period.
Land Use and Land Cover	• Land Use and Land Cover Classification for the Lower East Coast urban areas (east of the Lower East Coast Flood Protection Levee) use 2008-2009 Land Use coverage as prepared by the SFWMD, consumptive use permits as of 2011 were used to update the land use in areas where it did not reflect the permit information. • Land Use and Land Cover Classification for the natural areas (west of the Lower East Coast Flood Protection Levee) is the same as the Calibration Land Use and Land Cover Classification for that area. • Modified at locations where reservoirs are introduced (STA1-E, C4 Impoundment, Lakebelt Lakes and C-111 Reservoirs).
Water Control Districts (WCDs)	• Water Control Districts in Palm Beach and Broward Counties and in the Western Basins assumed.
Lake Belt Lakes	• Based on 2005 Lake Belt Lake coverage obtained from USACE.
Water Conservation Area 1 (Arthur R. Marshall Loxahatchee National Wildlife Refuge)	• Current C&SF Regulation Schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 14 ft. The bottom floor of the schedule (Zone C) is the area below 14 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow. • Structure S10E connecting LNWR to the northeastern portion of WCA-2A is no longer considered part of the simulated regional System

Feature	
Water Conservation Area 2A & 2B	• Current C&SF regulation schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels in WCA-2A are less than minimum operating criteria of 10.5 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Water Conservation Area 3A & 3B	• Current C&SF regulation schedule for WCA-3A, as per Water Control Plan –Interim Operational Plan (IOP) for protection of the Cape Sable seaside sparrow- C&SF Project for Flood Control and other Purposes (USACE, June 2006) • Includes regulatory releases to tide through LEC canals. Documented in Water Control Plan (USACE, June 2006) • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 7.5 ft in WCA-3A. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Everglades Construction Project Stormwater Treatment Areas	• STA-1E: 5,132 acres total treatment area. • A uniform bottom elevation equal to the spatial average over the extent of STA-1E is assumed.
Everglades National Park	• Water deliveries to Everglades National Park are based upon the Interim Operational Plan (IOP) • L-29 stage constraint for operation of S-333 assumed to be 7.5 ft, NGVD. • G-3273 constraint for operation of S-333 assumed to be 6.8 ft, NGVD. • Tamiami Trail culverts east of the L67 Extension are simulated. • 5.5 miles remain of the L-67 Extension Levee. • S-355A & S-355B are operated. • S-356 is not operated. • Partial construction of C-111 project reservoirs consistent with the 2009 as-built information from USACE (does not include contract 8 or contract 9). A uniform bottom elevation equal to the spatial average over the extent of each reservoir is assumed. • S-332DX1 is not operated. • 8.5 SMA project feature as per federally authorized Alternative 6D of the MWD/8.5 SMA Project (USACE, 2000 GRR); operations per 2011 Interim Operating Criteria (USACE, June 2011) including S-331 trigger shifted from Angel's well to LPG-2.
Other Natural Areas	• Flows to Biscayne Bay are simulated through Snake Creek, North Bay, the Miami River, Central Bay and South Bay

Feature	
Pumpage and Irrigation	• Public Water Supply pumpage for the Lower East Coast was updated using 2010 consumptive use permit information as documented in the C-51 Reservoir Feasibility Study; permits under 0.1 MGD were not included • Residential Self Supported (RSS) pumpage are based on 2030 projections from the SFWMD Water Supply Bureau. • Industrial pumpage are based on 2030 projections from the SFWMD Water Supply Bureau. • Irrigation demands for the six irrigation land-use types are calculated internally by the model. • Seminole Hollywood Reservation demands are set forth under VI. C of the Tribal Rights Compact. Tribal sources of water supply include various bulk sale agreements with municipal service suppliers.

Canal Operations	• C&SF system and operating rules in effect in 2010
	• Includes operations to meet control elevations in the primary coastal canals for the prevention of saltwater intrusion
	• Includes existing secondary drainage/water supply system
	• C-4 Flood Mitigation Project
	• Western C-4, S-380 structure retained open
	• C-11 Water Quality Treatment Critical Project (S-381 and S-9A)
	• S-25B and S-26 pumps are not modeled since they are used very rarely during high tide conditions and the model uses a long-term average daily tidal boundary
	• Northwest Dade Lake Belt area assumes that the conditions caused by currently permitted mining exist and that the effects of any future mining are fully mitigated by industry
	• ACME Basin A flood control discharges are sent to C-51, west of the S-155A structure, to be pumped into STA-1E. ACME Basin B flood control discharges are sent to STA-1E through the S-319 structure
	• Releases from WCA-3A to ENP and the South Dade Conveyance System (SDCS) will follow the Interim Operational Plan (IOP):
	  o Structures S-343A, S-343B, S-344 and S-12A are closed Nov. 1 to July 15
	  o Structure S-12B is closed Jan. 1 to July 15
	  o Structure S-12C is closed Feb. 1 to July 15
	• South Dade Conveyance System operations will follow IOP for protection of the Cape Sable seaside sparrow

Canal Configuration	• Canal configuration same as calibration except only 5.5 miles remain of the L-67 Extension Canal.
Lower East Coast Service Area Water Shortage Management	• Lower east coast water restriction zones and trigger cell locations are equivalent to SFWMM ECB implementation. An attempt was made to tie trigger cells with associated groundwater level gages to the extent possible. The Lower East Coast Subregional (LECsR) model is the source of this data. • Periods where the Lower East Coast is under water restriction due to low Lake Okeechobee stages were extracted from the corresponding RSMBN ECB simulation.

Notes

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the northern boundary of the RSMGL model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Basins Model (RSMBN). The SFWMM was the source of the northern boundary groundwater/surface water flows, while the RSMBN was the source of the northern boundary structural flows.

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Glades-LECSA (RSMGL)
2050 Future Without Project Baseline (FWO)
Table of Assumptions

Feature	
Meteorological Data	• Rainfall file used: rain_v3.0_beta_tin_14_05.bin • Reference Evapotranspiration (RET) file used: RET_48_05_MULTIQUAD_v1.0.bin (ARCADIS, 2008)
Topography	• Same as calibration topographic data set except where reservoirs are introduced (STA1-E, C4 Impoundment and C-111 reservoirs). • United States Geological Survey (USGS) High-Accuracy Elevation Data Collection (HAEDC) for the Water Conservation Areas (1, 2A, 2B, 3A, and 3B), the Big Cypress National Preserve and Everglades National Park.
Tidal Data	• Tidal data from two primary (Naples and Virginia Key) and five secondary NOAA stations (Flamingo, Everglades, Palm Beach, Delray Beach and Hollywood Beach) were used to generate a historic record to be used as sea level boundary conditions for the entire simulation period.
Land Use and Land Cover	• Land Use and Land Cover Classification for the Lower East Coast urban areas (east of the Lower East Coast Flood Protection Levee) use 2008-2009 Land Use coverage as prepared by the SFWMD, consumptive use permits as of 2011 were used to update the land use in areas where it did not reflect the permit information. • Land Use and Land Cover Classification for the natural areas (west of the Lower East Coast Flood Protection Levee) is the same as the Calibration Land Use and Land Cover Classification for that area. • Modified at locations where reservoirs are introduced (STA1-E, Site 1 Impoundment, Broward WPAs, C4 Impoundment, Lakebelt Lakes and C-111 Reservoirs).
Water Control Districts (WCDs)	• Water Control Districts in Palm Beach and Broward Counties and in the Western Basins assumed. • 8.5 SMA seepage canal is modeled as a WCD in ENP area.
Lake Belt Lakes	• Based on the permitted 2020 Lake Belt Lakes coverage obtained from USACE.
CERP Projects	• 1st Generation CERP – Site 1 Impoundment project is modeled as an above ground reservoir of area 1600 acres, with a maximum depth of 8 ft. • 2nd Generation CERP – Broward County Water Preserve Areas (WPAs) comprised of C-11 and C-9 impoundments were modeled as above ground reservoirs with areas 1221 and 1971 acres and maximum depths 4.3 and 4.0 ft. respectively.

Feature	
	• 2nd Generation CERP – C-111 Spreader Canal Project includes the Frog Pond Detention Area, which is modeled as an above ground impoundment with the S200 A, B and C pumps as inflow structures. In addition, the Aerojet canal is modeled with the inflow pumps S199 A, B and C. The S199 and S200 pumps are turned off based on the stage at the remote monitoring location EVER4 for the protection of the CSS Critical Habitat Unit 3. • 2nd Generation CERP – Biscayne Bay Coastal Wetlands project features were not modeled since these features along the coast in Miami-Dade County were not considered significant for CEPP. • Areal corrections were applied to the impoundment storages to account for the discrepancies of the areas in the model of the impoundments not matching the design areas.
Water Conservation Area 1 (Arthur R. Marshall Loxahatchee National Wildlife Refuge)	• Current C&SF Regulation Schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 14 ft. The bottom floor of the schedule (Zone C) is the area below 14 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow. • Structure S10E connecting LNWR to the northeastern portion of WCA-2A is no longer considered part of the simulated regional System
Water Conservation Area 2A & 2B	• Current C&SF regulation schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels in WCA-2A are less than minimum operating criteria of 10.5 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Water Conservation Area 3A & 3B	• Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 (USACE, 2012) • Includes regulatory releases to tide through LEC canals. Documented in Water Control Plan (USACE, June 2002) • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 7.5 ft in WCA-3A. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Everglades Construction Project Stormwater Treatment Areas	• STA-1E: 5,132 acres total treatment area. • A uniform bottom elevation equal to the spatial average over the extent of STA-1E is assumed.

Feature	
Everglades National Park	• Water deliveries to Everglades National Park are based upon Everglades Restoration Transition Plan (ERTP), with the WCA-3A Regulation Schedule including the lowered Zone A (compared to IOP) and extended Zones D and E1. • L-29 stage constraint for operation of S-333 assumed to be 7.5 ft, NGVD. • G-3273 constraint for operation of S-333 assumed to be 6.8 ft, NGVD. • The one mile Tamiami Trail Bridge as per the 2008 Tamiami Trail Limited Reevaluation Report is modeled as a one mile weir. Located east of the L67 extension and west of the S334 structure. • Tamiami Trail culverts east of the L67 Extension are simulated where the bridge is not located. • 5.5 miles remain of the L-67 Extension Levee. • S-355A & S-355B are operated. • S-356 is not operated. • Full construction of C-111 project reservoirs consistent with the as-built information from USACE plus addition of contract 8 and contract 9 features. A uniform bottom elevation equal to the spatial average over the extent of each reservoir is assumed. • 8.5 SMA project feature as per federally authorized Alternative 6D of the MWD/8.5 SMA Project (USACE, 2000 GRR); operations per 2011 Interim Operating Criteria (USACE, June 2011) including S-331 trigger shifted from Angel's well to LPG-2. Outflow assumed from 8.5 SMA detention cell to the C-111 North Detention Area.
Other Natural Areas	• Flows to Biscayne Bay are simulated through Snake Creek, North Bay, the Miami River, Central Bay and South Bay
Pumpage and Irrigation	• Public Water Supply pumpage for the Lower East Coast was updated using 2010 consumptive use permit information as documented in the C-51 Reservoir Feasibility Study; permits under 0.1 MGD were not included • Residential Self Supported (RSS) pumpage are based on 2010 projections of residential population from the SFWMD Water Supply Bureau. • Industrial pumpage is based on 2010 permits. • Irrigation demands for the six irrigation land-use types are calculated internally by the model. • Seminole Hollywood Reservation demands are set forth under VI. C of the Tribal Rights Compact. Tribal sources of water supply include various bulk sale agreements with municipal service suppliers.
Canal Operations	• C&SF system and operating rules in effect in 2010 • Includes operations to meet control elevations in the primary coastal canals for the prevention of saltwater intrusion • Includes existing secondary drainage/water supply system • C-4 Flood Mitigation Project • Western C-4, S-380 structure retained open

Feature	
	• C-11 Water Quality Treatment Critical Project (S-381 and S-9A) • S-25B and S-26 backflow pumps are not modeled since they are used very rarely during high tide conditions and the model uses a long-term average daily tidal boundary • Northwest Dade Lake Belt area assumes that the conditions caused by currently permitted mining exist and that the effects of any future mining are fully mitigated by industry • ACME Basin A flood control discharges are sent to C-51, west of the S-155A structure, to be pumped into STA-1E. ACME Basin B flood control discharges are sent to STA-1E through the S-319 structure • Releases from WCA-3A to ENP and the South Dade Conveyance System (SDCS) will follow the Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 o Structures S-343A, S-343B, S-344 and S-12A are closed Nov. 1 to July 15 o Structure S-12B is closed Jan. 1 to July 15
Canal Configuration	• Canal configuration same as calibration except only 5.5 miles remain of the L-67 Extension Canal and CERP project modifications.
Lower East Coast Service Area Water Shortage Management	• Lower east coast water restriction zones and trigger cell locations are equivalent to SFWMM ECB implementation. An attempt was made to tie trigger cells with associated groundwater level gages to the extent possible. The Lower East Coast Subregional (LECsR) model is the source of this data. • Periods where the Lower East Coast is under water restriction due to low Lake Okeechobee stages were extracted from the corresponding RSMBN FWO simulation.

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the northern boundary of the RSMGL model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Basins Model (RSMBN). The SFWMM was the source of the northern boundary groundwater/surface water flows, while the RSMBN was the source of the northern boundary structural flows.

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Glades-LECSA (RSMGL)
2012 Existing Conditions (2012EC)
Table of Assumptions

Feature	
Meteorological Data	• Rainfall file used: rain_v3.0_beta_tin_14_05.bin • Reference Evapotranspiration (RET) file used: RET_48_05_MULTIQUAD_v1.0.bin (ARCADIS, 2008)
Topography	• Same as calibration topographic data set except where reservoirs are introduced (STA1-E, C4 Impoundment and C-111 reservoirs). • United States Geological Survey (USGS) High-Accuracy Elevation Data Collection (HAEDC) for the Water Conservation Areas (1, 2A, 2B, 3A, and 3B), the Big Cypress National Preserve and Everglades National Park.
Tidal Data	• Tidal data from two primary (Naples and Virginia Key) and five secondary NOAA stations (Flamingo, Everglades, Palm Beach, Delray Beach and Hollywood Beach) were used to generate a historic record to be used as sea level boundary conditions for the entire simulation period.
Land Use and Land Cover	• Land Use and Land Cover Classification for the Lower East Coast urban areas (east of the Lower East Coast Flood Protection Levee) use 2008-2009 Land Use coverage as prepared by the SFWMD, consumptive use permits as of 2011 were used to update the land use in areas where it did not reflect the permit information. • Land Use and Land Cover Classification for the natural areas (west of the Lower East Coast Flood Protection Levee) is the same as the Calibration Land Use and Land Cover Classification for that area. • Modified at locations where reservoirs are introduced (STA1-E, C4 Impoundment, Lakebelt Lakes and C-111 Reservoirs).
Water Control Districts (WCDs)	• Water Control Districts in Palm Beach and Broward Counties and in the Western Basins assumed.
Lake Belt Lakes	• Based on 2005 Lake Belt Lake coverage obtained from USACE.
Water Conservation Area 1 (Arthur R. Marshall Loxahatchee National Wildlife Refuge)	• Current C&SF Regulation Schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 14 ft. The bottom floor of the schedule (Zone C) is the area below 14 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow. • Structure S10E connecting LNWR to the northeastern portion of WCA-2A is no longer considered part of the simulated regional System

Feature	
Water Conservation Area 2A & 2B	• Current C&SF regulation schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels in WCA-2A are less than minimum operating criteria of 10.5 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Water Conservation Area 3A & 3B	• Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 (USACE, 2012). • Includes regulatory releases to tide through LEC canals. Documented in Water Control Plan (USACE, June 2006) • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 7.5 ft in WCA-3A. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Everglades Construction Project Stormwater Treatment Areas	• STA-1E: 5,132 acres total treatment area. • A uniform bottom elevation equal to the spatial average over the extent of STA-1E is assumed.
Everglades National Park	• Water deliveries to Everglades National Park are based upon Everglades Restoration Transition Plan (ERTP), with the WCA-3A Regulation Schedule including the lowered Zone A (compared to IOP) and extended Zones D and E1. • L-29 stage constraint for operation of S-333 assumed to be 7.5 ft, NGVD. • G-3273 constraint for operation of S-333 assumed to be 6.8 ft, NGVD. • Tamiami Trail culverts east of the L67 Extension are simulated. • 5.5 miles remain of the L-67 Extension Levee. • S-355A & S-355B are operated. • S-356 is not operated. • Partial construction of C-111 project reservoirs consistent with the 2009 as-built information from USACE (does not include contract 8 or contract 9). A uniform bottom elevation equal to the spatial average over the extent of each reservoir is assumed. • S-332DX1 is not operated. • 8.5 SMA project feature as per federally authorized Alternative 6D of the MWD/8.5 SMA Project (USACE, 2000 GRR); operations per 2011 Interim Operating Criteria (USACE, June 2011) including S-331 trigger shifted from Angel's well to LPG-2.
Other Natural Areas	• Flows to Biscayne Bay are simulated through Snake Creek, North Bay, the Miami River, Central Bay and South Bay

Feature	
Pumpage and Irrigation	• Public Water Supply pumpage for the Lower East Coast was updated using 2010 consumptive use permit information as documented in the C-51 Reservoir Feasibility Study; permits under 0.1 MGD were not included • Residential Self Supported (RSS) pumpage are based on 2030 projections from the SFWMD Water Supply Bureau. • Industrial pumpage are based on 2030 projections from the SFWMD Water Supply Bureau. • Irrigation demands for the six irrigation land-use types are calculated internally by the model. • Seminole Hollywood Reservation demands are set forth under VI. C of the Tribal Rights Compact. Tribal sources of water supply include various bulk sale agreements with municipal service suppliers.

Canal Operations	• C&SF system and operating rules in effect in 2012
	• Includes operations to meet control elevations in the primary coastal canals for the prevention of saltwater intrusion
	• Includes existing secondary drainage/water supply system
	• C-4 Flood Mitigation Project
	• Western C-4, S-380 structure retained open
	• C-11 Water Quality Treatment Critical Project (S-381 and S-9A).
	  ○ S9/S9A operations modified for performance consistency with SFWMM ECB.
	• S-25B and S-26 pumps are not modeled since they are used very rarely during high tide conditions and the model uses a long-term average daily tidal boundary
	• Northwest Dade Lake Belt area assumes that the conditions caused by currently permitted mining exist and that the effects of any future mining are fully mitigated by industry
	• ACME Basin A flood control discharges are sent to C-51, west of the S-155A structure, to be pumped into STA-1E. ACME Basin B flood control discharges are sent to STA-1E through the S-319 structure
	• Releases from WCA-3A to ENP and the South Dade Conveyance System (SDCS) will follow the Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1
	  ○ Structures S-343A, S-343B, S-344 and S-12A are closed Nov. 1 to July 15
	  ○ Structure S-12B is closed Jan. 1 to July 15
	• South Dade Conveyance System operations will follow ERTP for protection of the Cape Sable seaside sparrow

Canal Configuration	• Canal configuration same as calibration except only 5.5 miles remain of the L-67 Extension Canal.
Lower East Coast Service Area Water Shortage Management	• Lower east coast water restriction zones and trigger cell locations are equivalent to SFWMM ECB implementation. An attempt was made to tie trigger cells with associated groundwater level gages to the extent possible. The Lower East Coast Subregional (LECsR) model is the source of this data.

Feature	
	• Periods where the Lower East Coast is under water restriction due to low Lake Okeechobee stages were extracted from the corresponding RSMBN ECB simulation.

Notes

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the northern boundary of the RSMGL model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Basins Model (RSMBN). The SFWMM was the source of the northern boundary groundwater/surface water flows, while the RSMBN was the source of the northern boundary structural flows.
- 2012EC assumptions were updated from the CEPP 12/13/2012 ECB scenario at the time that the CEPP tentatively selected plan was identified.

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Glades-LECSA (RSMGL)
Initial Operating Regime Baseline 1 (IORBL1)
Table of Assumptions

Feature	
Meteorological Data	• Rainfall file used: rain_v3.0_beta_tin_14_05.bin • Reference Evapotranspiration (RET) file used: RET_48_05_MULTIQUAD_v1.0.bin (ARCADIS, 2008)
Topography	• Same as calibration topographic data set except where reservoirs are introduced (STA1-E, C4 Impoundment and C-111 reservoirs). • United States Geological Survey (USGS) High-Accuracy Elevation Data Collection (HAEDC) for the Water Conservation Areas (1, 2A, 2B, 3A, and 3B), the Big Cypress National Preserve and Everglades National Park.
Tidal Data	• Tidal data from two primary (Naples and Virginia Key) and five secondary NOAA stations (Flamingo, Everglades, Palm Beach, Delray Beach and Hollywood Beach) were used to generate a historic record to be used as sea level boundary conditions for the entire simulation period.
Land Use and Land Cover	• Land Use and Land Cover Classification for the Lower East Coast urban areas (east of the Lower East Coast Flood Protection Levee) use 2008-2009 Land Use coverage as prepared by the SFWMD, consumptive use permits as of 2011 were used to update the land use in areas where it did not reflect the permit information. • Land Use and Land Cover Classification for the natural areas (west of the Lower East Coast Flood Protection Levee) is the same as the Calibration Land Use and Land Cover Classification for that area. Modified at locations where reservoirs are introduced (STA1-E, Site 1 Impoundment, Broward WPAs, C4 Impoundment, Lakebelt Lakes and C-111 Reservoirs).
Water Control Districts (WCDs)	• Water Control Districts in Palm Beach and Broward Counties and in the Western Basins assumed. • 8.5 SMA seepage canal is modeled as a WCD in ENP area.
Lake Belt Lakes	• Based on the permitted 2020 Lake Belt Lakes coverage obtained from USACE.
CERP Projects	• 1st Generation CERP – Site 1 Impoundment project is modeled as an above ground reservoir of area 1600 acres, with a maximum depth of 8 ft. • 2nd Generation CERP – Broward County Water Preserve Areas (WPAs) comprised of C-11 and C-9 impoundments were modeled as above ground reservoirs with areas 1221 and 1971 acres and maximum depths 4.3 and 4.0 ft. respectively. Operations refined in RSM model to closer represent project intent and outcomes.

Feature	
	• 2nd Generation CERP – C-111 Spreader Canal Project includes the Frog Pond Detention Area, which is modeled as an above ground impoundment with the S200 A, B and C pumps as inflow structures. In addition, the Aerojet canal is modeled with the inflow pumps S199 A, B and C. The S199 and S200 pumps are turned off based on the stage at the remote monitoring location EVER4 for the protection of the CSS Critical Habitat Unit 3. • 2nd Generation CERP – Biscayne Bay Coastal Wetlands project features were not modeled since these features along the coast in Miami-Dade County were not considered significant for CEPP. • Areal corrections were applied to the impoundment storages to account for the discrepancies of the areas in the model of the impoundments not matching the design areas.
Water Conservation Area 1 (Arthur R. Marshall Loxahatchee National Wildlife Refuge)	• Current C&SF Regulation Schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 14 ft. The bottom floor of the schedule (Zone C) is the area below 14 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow. • Structure S10E connecting LNWR to the northeastern portion of WCA-2A is no longer considered part of the simulated regional System
Water Conservation Area 2A & 2B	• Current C&SF regulation schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels in WCA-2A are less than minimum operating criteria of 10.5 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Water Conservation Area 3A & 3B	• Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 (USACE, 2012) • Includes regulatory releases to tide through LEC canals. Documented in Water Control Plan (USACE, June 2002) • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 7.5 ft in WCA-3A. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Everglades Construction Project Stormwater Treatment Areas	• STA-1E: 5,132 acres total treatment area. • A uniform bottom elevation equal to the spatial average over the extent of STA-1E is assumed.

Feature	
Everglades National Park	• Water deliveries to Everglades National Park are based upon Everglades Restoration Transition Plan (ERTP), with the WCA-3A Regulation Schedule including the lowered Zone A (compared to IOP) and extended Zones D and E1. • L-29 stage constraint for operation of S-333 assumed to be 7.5 ft, NGVD. • G-3273 constraint for operation of S-333 assumed to be 6.8 ft, NGVD. • The one mile Tamiami Trail Bridge as per the 2008 Tamiami Trail Limited Reevaluation Report is modeled as a one mile weir. Located east of the L67 extension and west of the S334 structure. • Western 2.6 mile Tamiami Trail Bridge, modeled as a 2.6 mile long weir, and is located east of Osceola Camp and west of Frog City. • Tamiami Trail culverts east of the L67 Extension are simulated where the bridge is not located. • 5.5 miles remain of the L-67 Extension Levee. • S-355A & S-355B are operated. • S-356 is not operated. • Full construction of C-111 project reservoirs consistent with the as-built information from USACE plus addition of contract 8 and contract 9 features. A uniform bottom elevation equal to the spatial average over the extent of each reservoir is assumed. • 8.5 SMA project feature as per federally authorized Alternative 6D of the MWD/8.5 SMA Project (USACE, 2000 GRR); operations per 2011 Interim Operating Criteria (USACE, June 2011) including S-331 trigger shifted from Angel's well to LPG-2. Outflow assumed from 8.5 SMA detention cell to the C-111 North Detention Area. o An additional length of seepage canal is assumed in the model to allow water to be collected for S357 operation.
Other Natural Areas	• Flows to Biscayne Bay are simulated through Snake Creek, North Bay, the Miami River, Central Bay and South Bay
Pumpage and Irrigation	• Public Water Supply pumpage for the Lower East Coast was updated using 2010 consumptive use permit information as documented in the C-51 Reservoir Feasibility Study; permits under 0.1 MGD were not included • Residential Self Supported (RSS) pumpage are based on 2030 projections of residential population from the SFWMD Water Supply Bureau. • Industrial pumpage is also based on 2030 projections of industrial use from the Water Supply Bureau. • Irrigation demands for the six irrigation land-use types are calculated internally by the model. • Seminole Hollywood Reservation demands are set forth under VI. C of the Tribal Rights Compact. Tribal sources of water supply include various bulk sale agreements with municipal service suppliers.

Feature	
Canal Operations	• C&SF system and operating rules in effect in 2012 • Includes operations to meet control elevations in the primary coastal canals for the prevention of saltwater intrusion • Includes existing secondary drainage/water supply system • C-4 Flood Mitigation Project • Western C-4, S-380 structure retained open • C-11 Water Quality Treatment Critical Project (S-381 and S-9A). o S9/S9A operations modified for performance consistency with SFWMM ECB. • S-25B and S-26 backflow pumps are not modeled since they are used very rarely during high tide conditions and the model uses a long-term average daily tidal boundary • Northwest Dade Lake Belt area assumes that the conditions caused by currently permitted mining exist and that the effects of any future mining are fully mitigated by industry • ACME Basin A flood control discharges are sent to C-51, west of the S-155A structure, to be pumped into STA-1E. ACME Basin B flood control discharges are sent to STA-1E through the S-319 structure • Releases from WCA-3A to ENP and the South Dade Conveyance System (SDCS) will follow the Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 o Structures S-343A, S-343B, S-344 and S-12A are closed Nov. 1 to July 15 o Structure S-12B is closed Jan. 1 to July 15
Canal Configuration	• Canal configuration same as calibration except only 5.5 miles remain of the L-67 Extension Canal and CERP project modifications.
Lower East Coast Service Area Water Shortage Management	• Lower east coast water restriction zones and trigger cell locations are equivalent to SFWMM ECB implementation. An attempt was made to tie trigger cells with associated groundwater level gages to the extent possible. The Lower East Coast Subregional (LECsR) model is the source of this data. • Periods where the Lower East Coast is under water restriction due to low Lake Okeechobee stages were extracted from the RSMBN FWO simulation.

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).

- The boundary conditions along the northern boundary of the RSMGL model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Basins Model (RSMBN). The SFWMM was the source of the northern boundary groundwater/surface water flows, while the RSMBN was the source of the northern boundary structural flows.
- IORBL assumptions were updated from the CEPP 12/13/2012 FWO scenario at the time that the CEPP tentatively selected plan was identified and then adjusted for the Broward County WPA project to produce the IORBL1.

Appendix B – LORS08 Operations Schedule

The LORS08 schedule is used for operation of Lake Okeechobee in all CEPP baselines. **Figure B-1** shows the LORS08 schedule. **Figures B-2 and B-3** show the pulse releases from Lake Okeechobee into the Caloosahatchee and St. Lucie Estuary, respectively.

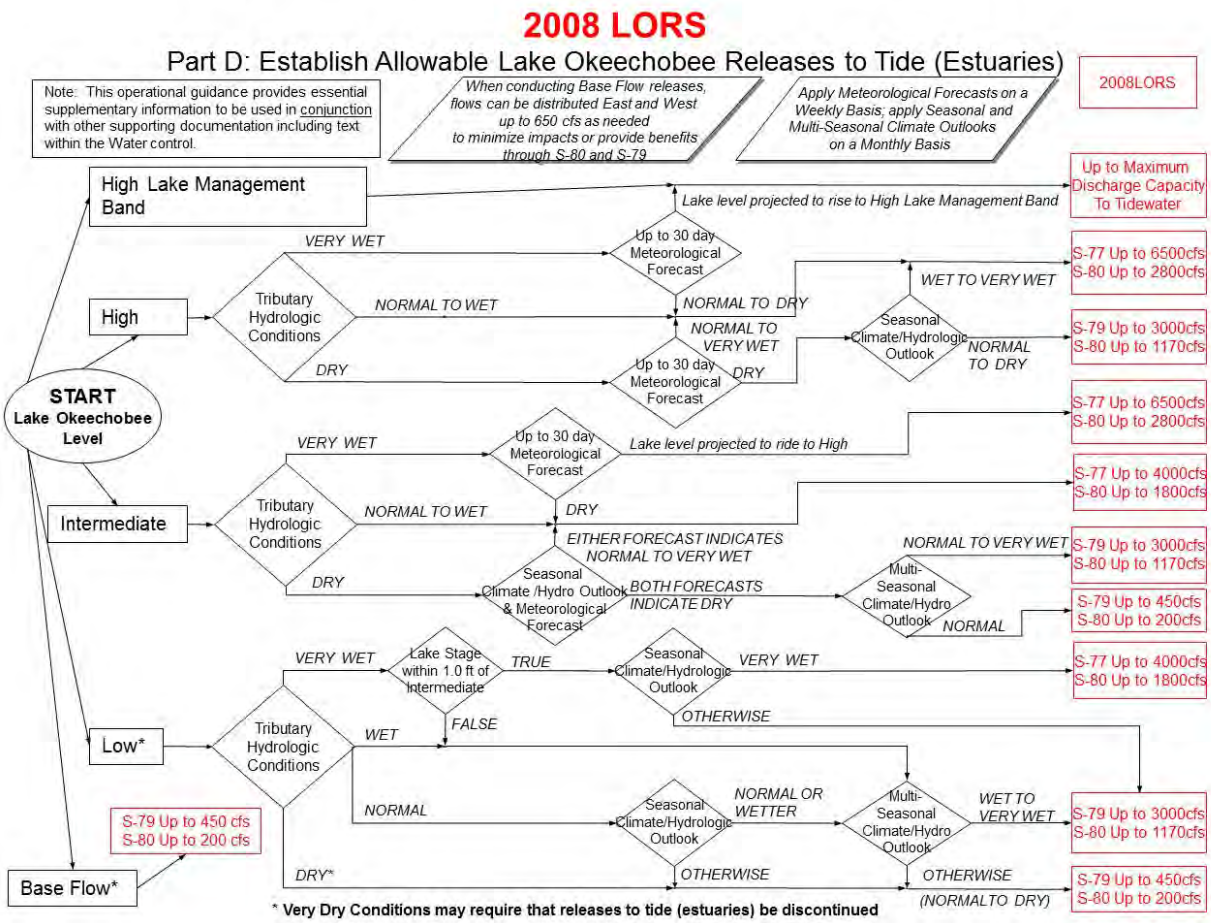


Figure B-1. LORS08 operations schedule.

	High		Intermediate		Low					
zone	A	A	B	B	D3	D3	D2	D2	D1	D1
	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling
Day of Pulse	P4cal	P400cal	P6cal	P600cal	P11cal	P1100cal	P5cal	P500cal	P12cal	P1200cal
1	500	125	840	504	125	125	850	850	504	504
2	1,375	343.75	1,920	1,152	344	344	2,200	2,200	1,152	1,152
3	1,625	406.25	2,220	1,332	406	406	2,600	2,600	1,332	1,332
4	1,250	312.50	1,680	1,008	313.50	313.50	2,000	2,000	1,008	1,008
5	1,000	250	1,440	864	250	250	1,600	1,600	864	864
6	750	187.50	1,140	684	188.50	188.50	1,200	1,200	684	684
7	500	125	960	576	125	125	850	850	576	576
8	250	62.50	720	432	62.50	62.50	500	500	432	432
9	125	31.25	540	324	31.25	31.25	350	350	324	324
10	125	31.25	540	324	31.25	31.25	350	350	324	324
Average Flow (cfs)	**750**	**187.5**	**1200**	**720**	**187.7**	**187.7**	**1250**	**1250**	**720**	**720**
Volume (ac-ft)	**14,873**	**3,718**	**23,796**	**14,278**	**3,722**	**3,722**	**24,788**	**24,788**	**14,278**	**14,278**
†equivalent depth (ft)	**0.03**	**0.01**	**0.05**	**0.03**	**0.01**	**0.01**	**0.05**	**0.05**	**0.03**	**0.03**

† : Volume to depth Conversion based on average Lake surface area of 467,000 acres.

Figure B-2. Pulse releases (as a function of lake level) from Lake Okeechobee into Caloosahatchee Estuary in cubic feet per second (cfs).

	High		Intermediate		Low					
zone	A	A	B	B	D3	D3	D2	D2	D1	D1
	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling
Day of Pulse	P4stl	P400stl	P6stl	P600stl	P11stl	P1100stl	P5stl	P500stl	P12stl	P1200stl
1	450	112.50	720	432	112.50	112.50	750	750	432	432
2	600	150	960	576	150	150	1,000	1,000	576	576
3	525	131.25	840	504	131.25	131.25	900	900	504	504
4	375	93.75	600	360	93.75	93.75	600	600	360	360
5	250	62.50	420	252	62.50	62.50	450	450	252	252
6	225	56.25	360	216	56.25	56.25	350	350	216	216
7	150	37.50	240	144	37.50	37.50	250	250	144	144
8	150	37.50	240	144	37.50	37.50	250	250	144	144
9	100	25	0	0	25	25	200	200	0	0
10	100	25	0	0	25	25	0	0	0	0
Average Flow (cfs)	292.5	73.1	438.0	262.8	73.1	73.1	475.0	475.0	262.8	262.8
Volume (ac-ft)	5,800	1,450	8,686	5,211	1,450	1,450	9,419	9,419	5,211	5,211
†equivalent depth (ft)	0.01	0.00	0.02	0.01	0.00	0.00	0.02	0.02	0.01	0.01
† : Volume to depth Conversion based on average Lake surface area of 467,000 acres.										

Figure B-3. Pulse releases (as a function of lake level) from Lake Okeechobee into St. Lucie Estuary in cubic feet per second (cfs).

Details of the model implementation of the schedule can be found in **Figures B-4, B-5 and B-6. Figure B-4** lists the range of values used to classify the tributary hydrologic conditions. **Figure B-5** lists the range of values used to classify the net inflow seasonal outlook. **Figure B-6** lists the range of values used to classify the net inflow multi-seasonal outlook.

LORS2008		
Classification of Lake Okeechobee Tributary Hydrologic Conditions		
Palmer Index Class Limits	2-wk Mean LO Inflow Class Limit	Tributary Hydrologic Classification*
> 3.0	>= 6000 cfs	Very Wet
1.5 to 2.99	2500 - 5999 cfs	Wet
-1.49 to 1.49	500 - 2499 cfs	Near Normal
-2.99 to -1.5	-5000 - 500 cfs	Dry
-3.0 or less	< -5000 cfs	Very Dry
*use the wettest of the two indicators		

Figure B-4. LORS08 Tributary Hydrologic Conditions Classifications

LORS2008		
Classification of Lake Okeechobee Net Inflow Seasonal Outlook**		
Lake Net Inflow Prediction (million acre-feet) (Does not include ET)	Equivalent Depth (feet)	Lake Okeechobee Net Inflow Seasonal Outlook
> 0.93	> 2.0	Very Wet
0.71 to 0.93	1.51 to 2.0	Wet
0.35 to 0.70	0.75 to 1.5	Normal
< 0.35	< 0.75	Dry
**volume-depth conversion based on average lake surface area of 467,000 acres.		

Figure B-5. LORS08 Seasonal Outlook Classifications

LORS2008		
Classification of Lake Okeechobee Net Inflow Multi-Seasonal Outlook**		
Lake Net Inflow Prediction (million acre-feet) (Does not include ET)	Equivalent Depth (feet)	Lake Okeechobee Net Inflow Multi-Seasonal Outlook
> 2.0	> 4.3	Very Wet
1.18 to 2.0	2.51 to 4.3	Wet
0.5 to 1.17	1.1 to 2.5	Normal
< 0.5	< 1.1	Dry
**volume-depth conversion based on average lake surface area of 467,000 acres.		

Figure B-6. LORS08 Multi-Seasonal Outlook Classifications

Appendix C – Structure Operations in South Miami-Dade County for CEPP Baseline Runs

In **Table C.1**, the list of structures is color-coded in three groupings:

green	Structures on the L-67, L-28, and L-29 canals. Structures included are S-345, S-349, S-344, S-343A-B, S-12A-D, S-333, S-334, S-355, and S-356
blue	Structures on the L-30 and part of the L-31 canals Structures included are S-337, S-151, S-335, S-338, G-211, S-173 & S-331P (COMBQ), S-176 and S-174
yellow	Structures on part of the L-31 canal and L-31W and C-111 canals Structures included are S-332A-D, S-357, S-332, S-175, S-200, S-199, S-177, S-18C, S-197 and S-332E

Table C.1 includes the four baselines (ECB 2010-11, 2050FWO, 2012EC, IORBL1).

Table C.1 Baselines (ECB 2010-11, 2050FWO, 2012EC, IORBL1)

Canal	Structure	ECB 2010-11 (RSMGL)	2050FWO (RSMGL)
		Recommended for ECB Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-67	S-345*	Non-existent	Non-existent
	S-349*	Non-existent	Non-existent
L-28	S-344*	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15 2)flood control only	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15 2)flood control only
	S-343A-B*	Special code 1) Closed Nov 1- Jul15 2) flood control only 3)S343A&B- Design Q= 200 cfs each	Special code 1) Closed Nov 1- Jul15 2) flood control only 3)S343A&B- Design Q= 200 cfs each
L-29	S-12A-D*	S12A closed Nov 1 to Jul 15; S12B closed Jan 1 to Jul 15; S12C closed Feb 1 to Jul 15; S12D no closure dates. Special code 1) S12s = 8000 cfs per structure. 2) Each structure modeled individually. 3) Each Structure is a spillway 4) Flood Control only	per ERTP S12A closed Nov 1 to Jul 31; S12B closed Jan 1 to Jul 31; S12C no closure dates. S12D no closure dates. Special code 1) S12s = 8000 cfs per structure. 2) Each structure modeled individually. 3) Each Structure is a spillway 4) Flood Control only
	S-333*	Special code 1) L-29 stage constraint of 7.5 Wet/Dry 2) Design Q=1350 cfs 3) G-3273 stage constraint of 6.8 4) Flood Control only	Special code 1) L-29 stage constraint of 7.5 Wet/Dry 2) Design Q=1350 cfs 3) G-3273 stage constraint of 6.8 4) Flood Control only
	S-334	Non-existent Special code 1) Flood Control 2) No open/close ops, structure flow is based on L31N stage 4) Design Q=1230 cfs	Non-existent Special code 1) Flood Control 2) No open/close ops, structure flow is based on L31N stage 4) Design Q=1230 cfs
	S-355*	Special code 1) S355 A and B Modeled Design Q = 1000 cfs each, 2) L-29 Max stage of 7.5' 3) Flood control only 4)G-3273 stage constraint of 6.8 5)L-29 stage constraint of 7.5	Special code 1) S355 A and B Modeled Design Q = 1000 cfs each, 2) L-29 Max stage of 7.5' 3) Flood control only 4)G-3273 stage constraint of 6.8 5)L-29 stage constraint of 7.5
	S-356*	Not operational	Not operational

Canal	Structure	2012EC (RSMGL)	IORBL1 (RSMGL)
		Recommended for ECB Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-67	S-345*	Non-existent	Non-existent
	S-349*	Non-existent	Non-existent
L-28	S-344*	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15 2)flood control only	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15 2)flood control only
	S-343A-B*	Special code 1) Closed Nov 1- Jul15 2) flood control only 3)S343A&B- Design Q= 200 cfs each	Special code 1) Closed Nov 1- Jul15 2) flood control only 3)S343A&B- Design Q= 200 cfs each
L-29	S-12A-D*	Per ERTP S12A closed Nov 1 to Jul 31; S12B closed Jan 1 to Jul 31; S12C no closure dates; S12D no closure dates. Special code 1) S12s = 8000 cfs per structure. 2) Each structure modeled individually. 3) Each Structure is a spillway 4) Flood Control only	per ERTP S12A closed Nov 1 to Jul 31; S12B closed Jan 1 to Jul 31; S12C no closure dates. S12D no closure dates. Special code 1) S12s = 8000 cfs per structure. 2) Each structure modeled individually. 3) Each Structure is a spillway 4) Flood Control only
	S-333*	Special code 1) L-29 stage constraint of 7.5 Wet/Dry 2) Design Q=1350 cfs 3) G-3273 stage constraint of 6.8 4) Flood Control only	Special code 1) L-29 stage constraint of 7.5 Wet/Dry 2) Design Q=1350 cfs 3) G-3273 stage constraint of 6.8 4) Flood Control only
	S-334	Non-existent Special code 1) Flood Control 2) No open/close ops, structure flow is based on L31N stage 4) Design Q=1230 cfs	Non-existent Special code 1) Flood Control 2) No open/close ops, structure flow is based on L31N stage 4) Design Q=1230 cfs
	S-355*	Special code 1) S355 A and B Modeled Design Q = 1000 cfs each, 2) L-29 Max stage of 7.5' 3) Flood control only 4)G-3273 stage constraint of 6.8	Special code 1) S355 A and B Modeled Design Q = 1000 cfs each, 2) L-29 Max stage of 7.5' 3) Flood control only 4)G-3273 stage constraint of 6.8
	S-356*	Not operational	Not operational

Canal	Structure	ECB 2010-11 (RSMGL)	2050FWO (RSMGL)
		Recommended for ECB Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-30	S337	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)
		mse_unit inlet L30; L30 localLevel=7.0 mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_ECB.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml	mse_unit inlet L30; L30 localLevel=7.0 mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_2050FWO.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml
	S-151*	Flow target based on WCA-3A regulation schedule 1) Water Supply / Flood Control 2) Design Q=1800 cfs (discharge coef. = 1154.48 in msestruc*.xml) mse_unit outlet for WCA-3A; "WCA3A local" localLevel = 7.5 mse_unit inlet C-304; C304 localLevel=99.0 Special Code for S151: S151_reg_max_zoneA=1000 (input variable Special_Assessors_ECB.so) S151_reg_max_zoneBC=500 (input variable Special_Assessors_ECB.so) S151_TWi & S151_HWi (input variable Special_Assessors_ECB.so) S151_FracGO & S151_FracGo_high & S151_FracGo_low variable output maxfracS12s xml	Flow target based on WCA-3A regulation schedule 1) Water Supply / Flood Control 2) Design Q=1800 cfs (discharge coef. = 1154.48 in msestruc*.xml) mse_unit outlet for WCA-3A; "WCA3A local" localLevel = 7.5 mse_unit inlet C-304; C304 localLevel=99.0 Special Code for S151: S151_reg_max_zoneA=1000 (input variable Special_Assessors_2050FWO.so) S151_reg_max_zoneBC=500 (input variable Special_Assessors_2050FWO.so) S151_TWi & S151_HWi (input variable Special_Assessors_2050FWO.so) S151_FracGO & S151_FracGo_high & S151_FracGo_low variable output maxfracS12s xml
	S-335	**7.5/ 7.2** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 localLevel=7.0 mse_unit inlet for L31NC; localLevel=99.0	**7.5/ 7.2** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 localLevel=7.0 mse_unit inlet for L31NC; localLevel=99.0

Canal	Structure	**2012EC (RSMGL)**	**IORBL1 (RSMGL)**
		Recommended for ECB Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-30	S337	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)
		mse_unit inlet L30; L30 localLevel=7.0 mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_ECB.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml	mse_unit inlet L30; L30 localLevel=7.0 mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_2050FWO.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml
	S-151*	Flow target based on WCA-3A regulation schedule 1) Water Supply / Flood Control 2) Design Q=1800 cfs (discharge coef. = 1154.48 in msestruc*.xml) mse_unit outlet for WCA-3A; "WCA3A local" localLevel = 7.5 mse_unit inlet C-304; C304 localLevel=99.0 Special Code for S151: S151_reg_max_zoneA=1000 (input variable Special_Assessors_ECB.so) S151_reg_max_zoneBC=500 (input variable Special_Assessors_ECB.so) S151_TWi & S151_HWi (input variable Special_Assessors_ECB.so) S151_FracGO & S151_FracGo_high & S151_FracGo_low variable output maxfracS12s xml	Flow target based on WCA-3A regulation schedule 1) Water Supply / Flood Control 2) Design Q=1800 cfs (discharge coef. = 1154.48 in msestruc*.xml) mse_unit outlet for WCA-3A; "WCA3A local" localLevel = 7.5 mse_unit inlet C-304; C304 localLevel=99.0 Special Code for S151: S151_reg_max_zoneA=1000 (input variable Special_Assessors_2050FWO.so) S151_reg_max_zoneBC=500 (input variable Special_Assessors_2050FWO.so) S151_TWi & S151_HWi (input variable Special_Assessors_2050FWO.so) S151_FracGO & S151_FracGo_high & S151_FracGo_low variable output maxfracS12s xml
	S-335	**7.5/ 7.2** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 localLevel=7.0 mse_unit inlet for L31NC; localLevel=99.0	**7.5/ 7.2** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 localLevel=7.0 mse_unit inlet for L31NC; localLevel=99.0

Canal	Structure	ECB 2010-11 (RSMGL)	2050FWO (RSMGL)
		Recommended for ECB Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N	S-338	**5.8 / 5.5** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0 mse_unit inlet for L31NC; localLevel=99.0	**5.8 / 5.5** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0 mse_unit inlet for L31NC; localLevel=99.0
	G-211	**6.0 / 5.5** open/closed wet & dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply / Flood Control 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N; L31N localLevel=99.0 no rulecurve	**6.0 / 5.5** open/closed wet & dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply / Flood Control 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N; L31N localLevel=99.0 no rulecurve
	S-173 & S-331P (COMBQ) *	1) Water Supply / Flood Control 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.	1) Water Supply / Flood Control 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.

Canal	Structure	**2012EC (RSMGL)**	**IORBL1 (RSMGL)**
		Recommended for ECB Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N	S-338	**5.8 / 5.5** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0	**5.8 / 5.5** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0
	G-211	**6.0 / 5.5** open/closed wet & dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply / Flood Control 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N; L31N localLevel=99.0 no rulecurve	**6.0 / 5.5** open/closed wet & dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply / Flood Control 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N; L31N localLevel=99.0 no rulecurve
	S-173 & S-331P (COMBQ) *	1) Water Supply / Flood Control 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.	1) Water Supply / Flood Control 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.

Canal	Structure	ECB 2010-11 (RSMGL)	2050FWO (RSMGL)
		Recommended for ECB Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N (cont)	S-173 & S-331P (COMBQ) * (cont)	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations
	S-176	**5.0 / 4.75** open/closed wet & dry season 1) Water Supply / Flood Control 2) desigh Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)	**5.0 / 4.75** open/closed wet & dry season 1) Water Supply / Flood Control 2) desigh Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)
	S-174*	S174 not in model; canal is blocked near structure	S174 not in model; canal is blocked near structure

Canal	Structure	2012EC (RSMGL)	IORBL1 (RSMGL)
		Recommended for ECB Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N (cont)	S-173 & S-331P (COMBQ) * (cont)	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations
	S-176	**5.0 / 4.75** open/closed wet & dry season 1) Water Supply / Flood Control 2) design Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)	**5.0 / 4.75** open/closed wet & dry season 1) Water Supply / Flood Control 2) design Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)
	S-174*	S174 not in model; canal is blocked near structure	S174 not in model; canal is blocked near structure

Canal	Structure	ECB 2010-11 (RSMGL)		2050FWO (RSMGL)	
		Recommended for ECB Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	
L-31N (cont)	S-332A, B,C,D (pumps)	S332A Non-Existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A Non-Existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A 5.0/4.7 S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A 5.0/4.7 S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65
		S332B =325 cfs S332BN =250cfs S332C = 575 cfs S332D = 500 cfs Jul16-Nov30, 325cfs Dec 1-Jan31, 165cfs Feb 1-Jul15 All Flood Control		S332A =300 cfs S332B =325 cfs S332BN =250cfs S332C = 575 cfs S332D = 500 cfs Jul16-Nov30, 325cfs Dec 1-Jan31, 165cfs Feb 1-Jul15 All Flood Control	
	S-357 (pump)	**6.2 / 5.7** open/closed wet & dry season 1) Flood Control Pump Q = 126 cfs		**6.2 / 5.7** open/closed wet & dry season 1) Flood Control Pump Q = 126 cfs	
L-31W	S-332 (pumps)*	Non-existent		Non-existent	
	S-175	Non-existent		Non-existent	
C-111	S-200	Structure not simulated		S-200A=75cfs; **3.8/3.6** S-200B=75cfs; **3.9/3.6** S-200C=75cfs; **4.0/3.6**	
	S-199	Structure not simulated		S-200A=75cfs; **3.8/3.6** S-200B=75cfs; **3.9/3.6** S-200C=75cfs; **4.0/3.6**	
	S-177	**4.2/3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.		**4.2/3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.	
	S-18C	**2.6 / 2.3** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.		**2.6 / 2.3** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.	
	S-197*	****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.		****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.	
	S-332E (pump)	Non-existent		Non-existent	

* SFWMM uses special code. Open/Close may or may not be used in operations.

**** S-197 Ops: Open 3 gates if S-177 full open & S-177>4.1 ft or S-18C> 2.8 ft
Open 7 gates if S-177 > 4.2 ft for 24 hrs or S-18C > 3.1 ft
Open 13 gates if S-177 > 4.3 ft or S-18C > 3.3 ft
Close when all the conditions below are met
1) S-176 < 5.2 ft and S-177 < 4.2 ft
2) Storm moved away from basin
3) After 1 and 2 are met, keep the number of S-197 culverts open necessary only to match residual flow through S-176

Canal	Structure	**2012EC (RSMGL)**		**IORBL1 (RSMGL)**	
		Recommended for ECB Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	
L-31N (cont)	S-332A, B,C,D (pumps)	S332A Non-Existent S332B 5.0/4.7 (4.8/4.5) using IOP dual ops. S332BN 5.0/4.7 (4.8/4.5) using IOP dual ops. S332C 5.0/4.7 (4.8/4.5) using IOP dual ops. S332D 4.85/4.65 (4.7/4.5) using IOP dual ops.	S332A Non-Existent S332B 5.0/4.7 (4.8/4.5) using IOP dual ops. S332BN 5.0/4.7 (4.8/4.5) using IOP dual ops. S332C 5.0/4.7 (4.8/4.5) using IOP dual ops. S332D 4.85/4.65 (4.7/4.5) using IOP dual ops.	S332A Non-Existent S332B 5.0/4.7 (4.8/4.5) using IOP dual ops. S332BN 5.0/4.7 (4.8/4.5) using IOP dual ops. S332C 5.0/4.7 (4.8/4.5) using IOP dual ops. S332D 4.85/4.65 (4.7/4.5) using IOP dual ops.	S332A Non-Existent S332B 5.0/4.7 (4.8/4.5) using IOP dual ops. S332BN 5.0/4.7 (4.8/4.5) using IOP dual ops. S332C 5.0/4.7 (4.8/4.5) using IOP dual ops. S332D 4.85/4.65 (4.7/4.5) using IOP dual ops.
		S332B =250 cfs S332BN =250cfs S332C = 500 cfs S332D = 500 cfs Jul15-Nov30, 325cfs Dec 1-Jan31, 165cfs Feb 1-Jul14 All Flood Control		S332B =250 cfs S332BN =250cfs S332C = 500 cfs S332D = 500 cfs Jul15-Nov30, 325cfs Dec 1-Jan31, 250cfs Feb 1-Jul14 All Flood Control	
	S-357 (pump)	**6.2 / 5.7** open/closed wet & dry season 1) Flood Control Pump Q = 126 cfs		**6.2 / 5.7** open/closed wet & dry season 1) Flood Control Pump Q = 126 cfs	
L-31W	S-332 (pumps)*	Non-existent		Non-existent	
	S-175	Non-existent		Non-existent	
C-111	S-200	Structure not simulated		S-200A=75cfs; **3.6/3.4** S-200B=75cfs; **3.7/3.4** S-200C=75cfs; **3.8/3.4**	
	S-199	Structure not simulated		S-200A=75cfs; **3.8/3.6** S-200B=75cfs; **3.9/3.6** S-200C=75cfs; **4.0/3.6**	
	S-177	**4.2/3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.		**4.2/3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.	
	S-18C	**2.6 / 2.3 (2.25/2.0) using IOP dual ops** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.		**2.6 / 2.3 (2.25/2.0) using IOP dual ops** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.	
	S-197*	****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.		****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.	
	S-332E (pump)	Non-existent		Non-existent	

* SFWMM uses special code. Open/Close may or may not be used in operations.

**** S-197 Ops: Open 3 gates if S-177 full open & S-177>4.1 ft or S-18C> 2.8 ft
Open 7 gates if S-177 > 4.2 ft for 24 hrs or S-18C > 3.1 ft
Open 13 gates if S-177 > 4.3 ft or S-18C > 3.3 ft
Close when all the conditions below are met

1) S-176 < 5.2 ft and S-177 < 4.2 ft
2) Storm moved away from basin
3) After 1 and 2 are met, keep the number of S-197 culverts open necessary only to match residual flow through S-176

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Central Everglades Planning Project (CEPP) Final Array of Alternatives Model Documentation Report

IMC MSR 368 **February 14, 2014**

1.0 Overview

Identification

The Central Everglades Planning Project (CEPP) is an expedited planning effort undertaken as part of the overall Comprehensive Everglades Restoration Plan (CERP), a program led by the United States Army Corps of Engineers (USACE) with the South Florida Water Management District (SFWMD) as local sponsor. The project worked throughout 2012 and 2013 to develop a Project Implementation Report (PIR; **USACE, 2013b**) that combines planning and design activities for three primary areas of interest in the south Florida system as follows: 1) Storage & water treatment facilities in the Everglades Agricultural Area, 2) Decompartmentalization of levees within the Everglades Protection Area (EPA) and 3) Levee seepage management features along the Everglades / urban boundary in southeastern Florida. Modeling support to the CEPP effort was provided by a team comprised of modelers from the Hydrologic & Environmental Systems Modeling Section of the SFWMD and the Interagency Modeling Center (IMC), with direct support also provided by the USACE and Everglades National Park of the Department of the Interior (DOI). Modeling workflow and coordination were performed in a manner consistent with the procedures outlined in IMC Modeling Services Request (MSR) 368 and the CEPP Modeling Strategy (**SFWMD, 2012a**).

Scope and Objectives

Modeling support for CEPP focused on working with the larger project planning team and other interested parties to formulate and test project features leading to the ultimate identification and refinement of a tentatively selected plan (TSP). Modeling products were developed at the appropriate level of detail to support feature screening and detailed representation of project features and to provide information to all necessary evaluations required for plan development and documentation in the PIR. The project plan formulation framework is shown in **Figure 1.1** and illustrates a spatially determined workflow (moving north to south through the south Florida system) utilizing initial screening followed by detailed evaluation to identify final project planning alternatives and ultimately a TSP for the effort.

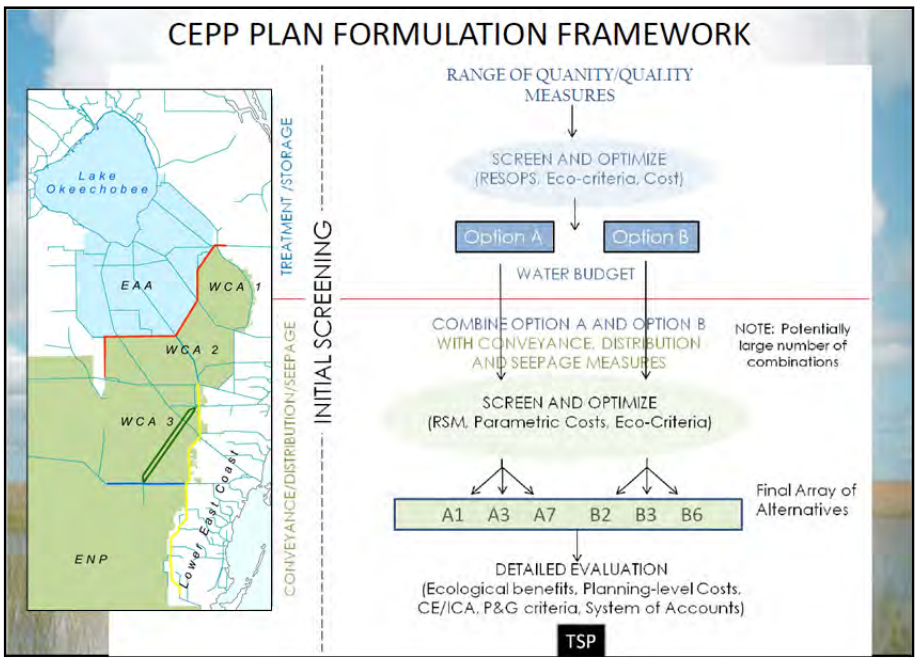


Figure 1.1. Central Everglades Planning Project Plan Formulation Framework

The CEPP Modeling Strategy document (**SFWMD, 2012a**) describes the modeling process and tools utilized, the associated rationale of the selection process and the means by which the tools could expediently support the project workflow. The primary model support tools utilized in CEPP are as follows:

Screening Tools:

- REservoir Sizing and OPerations Screening (RESOPS)
- Lake Okeechobee OPerations Screening (LOOPS)
- C-43 Spreadsheet Model
- iModel©

Detailed Planning Models:

- Regional Simulation Model Basins (RSMBN)
- Regional Simulation Model Glades-LECSA (RSMGL)
- Dynamic Model for Stormwater Treatment Areas (DMSTA)

From a modeling deliverable perspective, the entirety of the CEPP modeling support can be summarized by reviewing the following four Model Documentation Reports (MDRs):

1. CEPP Baseline Runs – Reviews the various non-CEPP model representations (e.g., current and future without project conditions) used in various aspects of the project planning (**SFWMD & IMC, 2014a**).
2. CEPP Final Array of Alternatives – Reviews four proposed with-CEPP project model representations examined during plan formation (this document)
3. CEPP Tentatively Selected Plan – Reviews the model representation of the CEPP TSP and subsequent refinements during final plan formulation and project assurance planning (**SFWMD & IMC, 2014c**).
4. CEPP Model Supported Screening Efforts – Reviews the various model-supported feature screening efforts undertaken at various points in the planning process (**SFWMD & IMC, 2014d**).

This Final Array of Alternatives MDR describes the assumptions, model implementation steps and observed outcomes associated with modeling representations of various future with-CEPP project features model scenarios. These model runs were predominantly used to identify the final CEPP project features carried forward into the CEPP TSP in support of plan formulation. This document will focus on the modeling details of these scenarios; information on the use and rationale for the definition of these conditions is contained in the CEPP PIR (**USACE, 2013b**).

2.0 Basis

Project Assumptions

This Final Array of Alternatives MDR describes the assumptions, model implementation steps and observed outcomes associated with modeling the following scenarios:

CEPP Final Array of Alternatives - released 12/20/2012

- Alternatives 1, 2, 3 and 4 (ALT1, ALT2, ALT3, and ALT4)

The CEPP project team identified a series of infrastructure changes for each alternative as shown in **Figure 2.1**. More detailed figures describing each alternative are included in **Appendix A.**

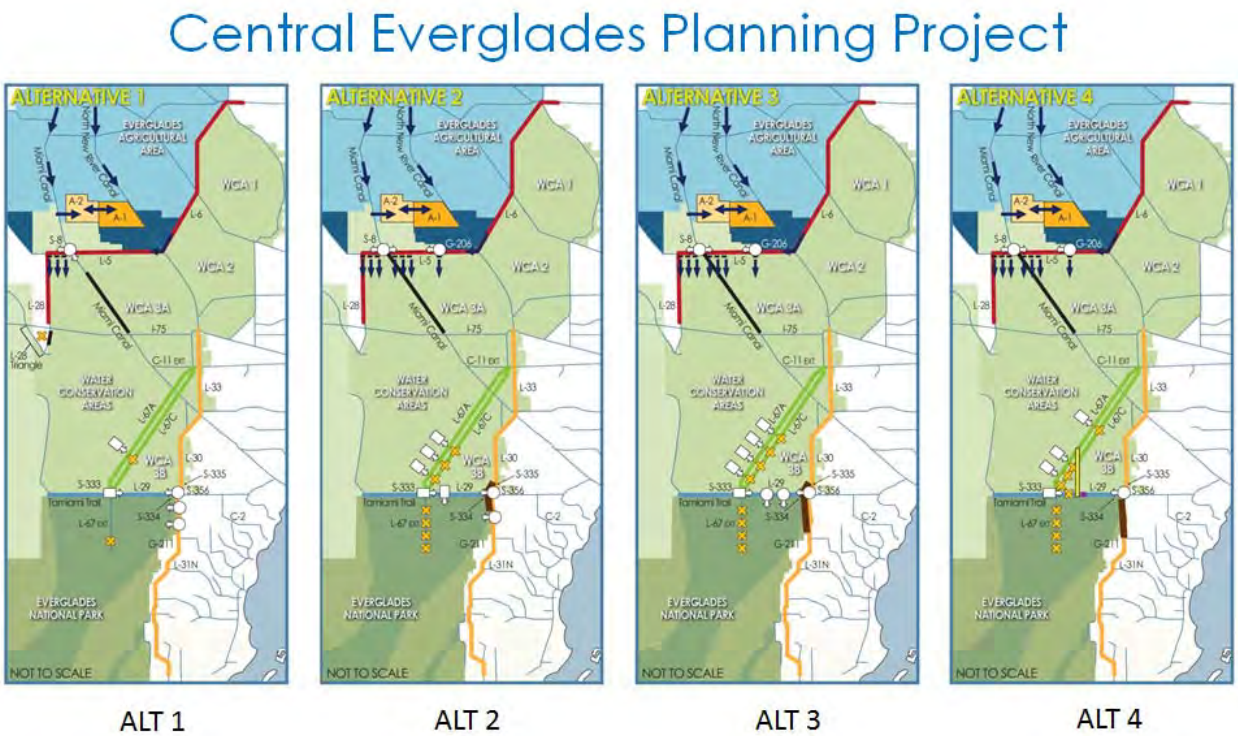


Figure 2.1. Generalized view of infrastructure changes modeled for alternatives ALT1, ALT2, ALT3, and ALT4.

In addition to the infrastructure changes identified in **Figure 2.1**, the project team also identified a series of performance objectives to help guide operational decision-making as follows:

- Maintain the weighted average of Lake Okeechobee Standard Score performance measures near baseline levels.
- Keep percent of time that Lake stages are greater than 15.0 ft, NGVD less than 25% for the period of simulation; reduce frequency and magnitude of Lake Okeechobee-triggered high discharge events to the Northern Estuaries.
- Maintain level of low flow performance for the Caloosahatchee Estuary consistent with C43 Reservoir Project; reduce the frequency, duration and severity of Lake Okeechobee triggered water shortage events.
- Improve cutback percentages relative to the baseline conditions for the "8 worst years" of drought conditions, with emphasis on the most severe drought years.
- Strive to achieve approximately 200 kac-ft average annual additional water delivery to the Everglades system, promoting significant additional dry season deliveries
- Maintain a hydrologic regime in the FEB and STAs consistent with water quality objectives
- Utilize operational protocols for the CEPP Greenline screening exercise (including L6 Diversions and Everglades Rainfall Driven Operations) to improve hydrologic indicators in the Greater Everglades.
- Promote additional flow through WCA3A and into ENP while maintaining performance for identified species and flood protection criteria.
- To the extent possible with assumed infrastructure, minimize changes in Lower East Coast performance relative to the CEPP project baselines (ECB and FWO).

The modeling team in implementing the RSM scenarios relied heavily on the outcomes of the screening and optimization steps summarized in the CEPP Model Supported Screening Efforts MDR. Completion of these scenarios within the expedited project schedule would not have been possible without extensive use of iModel©, LOOPs and other tools to inform operational guidance prior to detailed modeling.

Detailed project assumption tables were not developed for ALTs 1 to 4, but other than the specific with-CEPP project details identified in Section 3 and the Appendices, the assumptions are all consistent with those of the FWO baseline scenario.

Model Limitations and Intended Use of Results

The primary modeling products of CEPP were evaluated based on outputs from the Regional Simulation Model (RSM; **SFWMD, 2005a** and **2005b**). The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g., use available input-driven options to represent more complex project operations).

The RSMBN, RSMGL (**SFWMD, 2010** and **2011**), and DMSTA (**Walker & Kadlec, 2005**; **Wang, 2012**) models were reviewed through the USACE validation process for engineering software, as part of the CEPP project. The RSM and DMSTA models were classified as "allowed for use" for south Florida applications in August 2012 and January

2013, respectively. Additionally, the RESOPS (**SFWMD, 2009**), LOOPS (**Neidrauer et al, 2006**), and C-43 spreadsheet model (**Starnes & Marlowe, 2007**) tools and the iModel© optimization tool (**Ali, 2009**) used in CEPP underwent USACE Agency Technical Review (ATR). Approval of these modeling tools for CEPP application was completed in November, 2012.

3.0 Simulation

Modeling Tools Used

RSM version 2.3.5 was used to run both the RSMBN and RSMGL models.
Release date 12/6/2012, SVN Version #4730.

Model Set Up

The CEPP final array of alternative was developed using the RSMBN and RSMGL models. Collectively, these two models cover the spatial extent of the project planning area as shown in **Figure 3.1**. The RSMBN modeling for the final array was built upon the CEPP FWO baseline representation and since only one configuration was proposed by the project team for the area north of the redline, one RSMBN scenario (ALTS) is representative and used for all defined Alternatives. The RSMGL modeling for the final array was built upon the CEPP FWO baseline representation. The period of simulation for both models utilizes a climate record from 1965 to 2005. Details about project rationale for defining these scenarios can be found in the CEPP PIR.

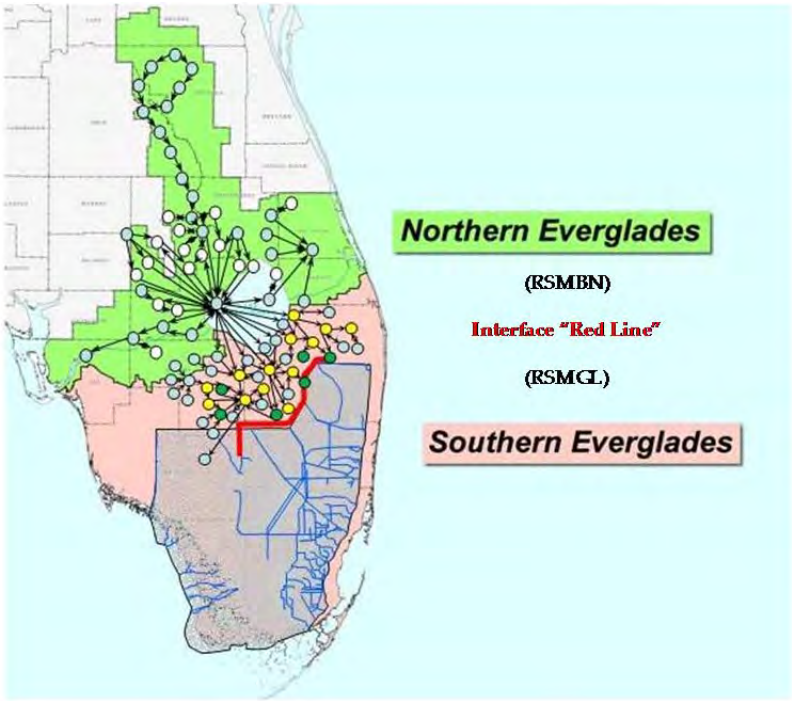


Figure 3.1. Decoupled CEPP Modeling Approach

This section will focus on the project plan formation alternative and assumed model implementation changes relative to the CEPP FWO project baseline (**SFWMD, 2014a**). The RSMBN modeling review will only describe the one representative scenario (ALTS)

that is applicable to all four defined CEPP alternatives while the RSMGL modeling review will describe the changes specific to each alternative.

RSMBN ALTS Scenario

The CEPP project alternatives all share a common configuration north of the Redline which is an integrated A1/A2 Flow Equalization Basin (FEB) as shown in **Figure 3.2,** operated to allow for the additional treatment and discharge of Lake Okeechobee water into the Everglades.

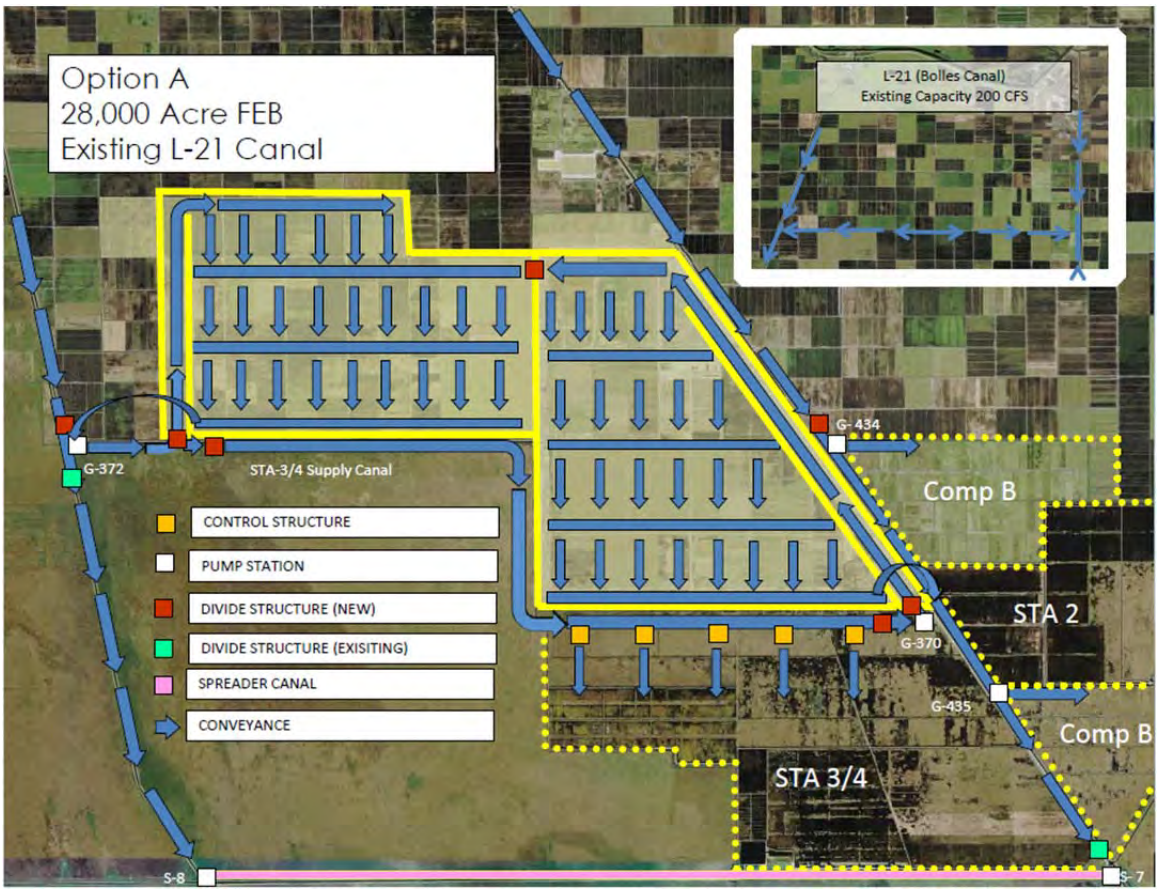


Figure 3.2. A1/A2 FEB Schematic Diagram Provided by CEPP Project Team

In RSMBN, this feature is modeled as a single element (see **Figure 3.3** for component locations). The ALTS scenario assumes the following:
A-1/A-2 FEB Assumptions

- Assumed Flowage Equalization Basin Effective Footprint = 28,467 acres
- FEB operating limits:
  - EAA runoff accepted when FEB stage < 3.8 ft.
  - Lake Okeechobee water accepted when FEB stage < 2.0 ft.
  - Discharges discontinued when depths < 0.5 ft.
  - No supplemental water supply provided to FEB.
  - FEB outflows are used to help meet established inflow targets, as estimated using the Dynamic Model for Stormwater Treatment Areas (**Wang, 2012**) at STA-3/4, STA-2N, and STA-2S

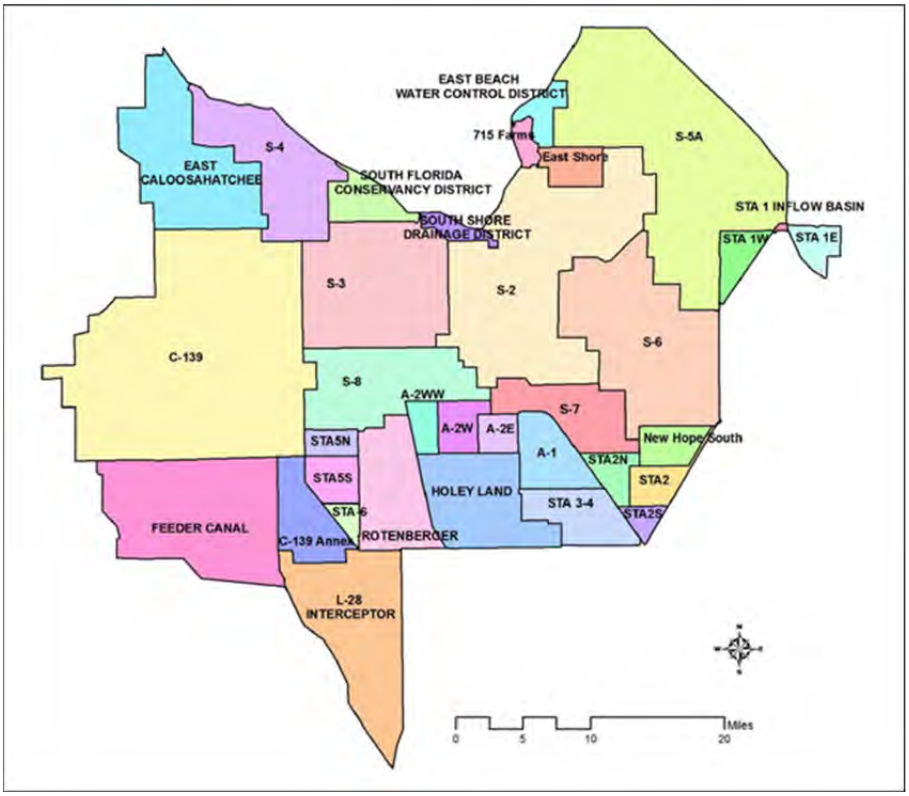


Figure 3.3. Location of CEPP FEB (A-2W + A-2E + A-1) in RSMBN.

The operations of the ALTS FEB are integrated with the regional objectives by including operational modifications to the Lake Okeechobee regulation schedule as follows:

- Lake Okeechobee regulatory releases to the south are made when the Lake is in or above the baseflow zone of the LORS08 schedule and when criteria as identified in **Figure 3.4** are satisfied.
- In order to promote opportunity for Lake discharges to the south, release criteria from the Northern Estuaries are also modified to result in lower overall discharges. Specific changes can be found in **Appendix B.**

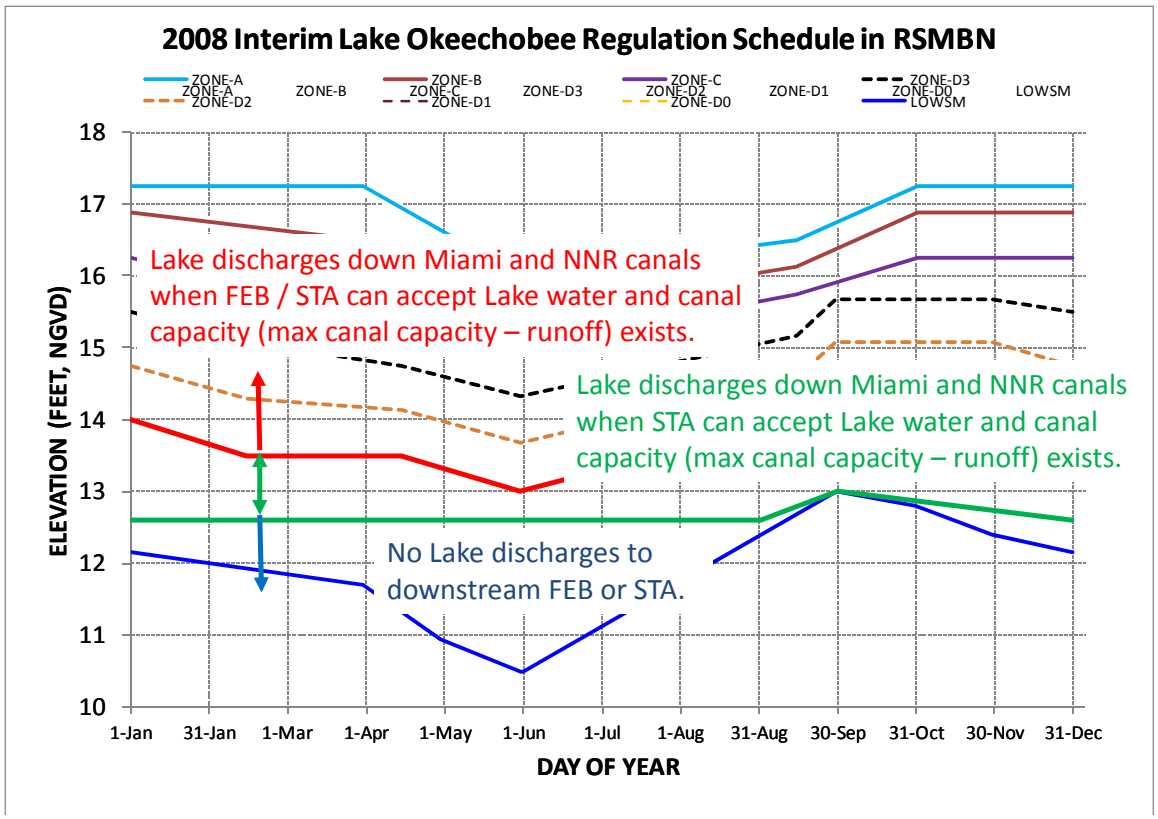


Figure 3.4. Lake Okeechobee Operational Criteria for Determining Discharges South to FEB and STA Facilities.

RSMGL ALT1 Scenario

For ALT1, modifications to system infrastructure relative to the FWO baseline are shown in **Figure 3.5**. Specific modeling details related to these elements are listed below. Notes on operational intent as applied for the RSMGL scenarios may be found in a consolidated discussion at the end of this section. Specific operational criteria may also be referenced in **Appendix C** for the South Dade area or the baseline assumption table / previous model documentation for other regions (**SFWMD, 2014a**).

- Western Hydropattern Restoration Feature (HRF) not modeled as a canal within the model domain but with boundary inflows into the three edge cells west of S8
- Miami Canal removed from Alligator Alley to 1.5 mi south of S8 structure
- Breaches across L28 levee modeled as weirs connecting two pairs of mesh cells between the L28 triangle south of Alligator Alley and WCA3A (9000 ft total length)
- One canal segment in L28 canal reach disabled to represent backfill of a portion of the L28 canal within the L28 triangle area
- Single S345 structure (S345E) with a design discharge of 750 cfs at 1.5 ft differential head (flow is jumped directly into the nearest mesh cell within WCA3B east of the L67C levee) located ~13 mi south of S151
- L-67ext partial levee removal ~3.9 mi remaining
- Two L31N pumps stations (L31PA and L31PB) at 250 cfs each – L29A pump ~1.5 mi south of the L29 canal and L29B pump ~3.6 mi south of the L29 canal
- S333 design capacity increased from 1350 cfs to 3000 cfs (discharge coefficient increased proportionally from 2548 to 5662)
- Western Tamiami Trail Bridge modeled as weirs connecting the L29 canal and the mesh cells intersecting the bridge location (~2.6 mi total length)

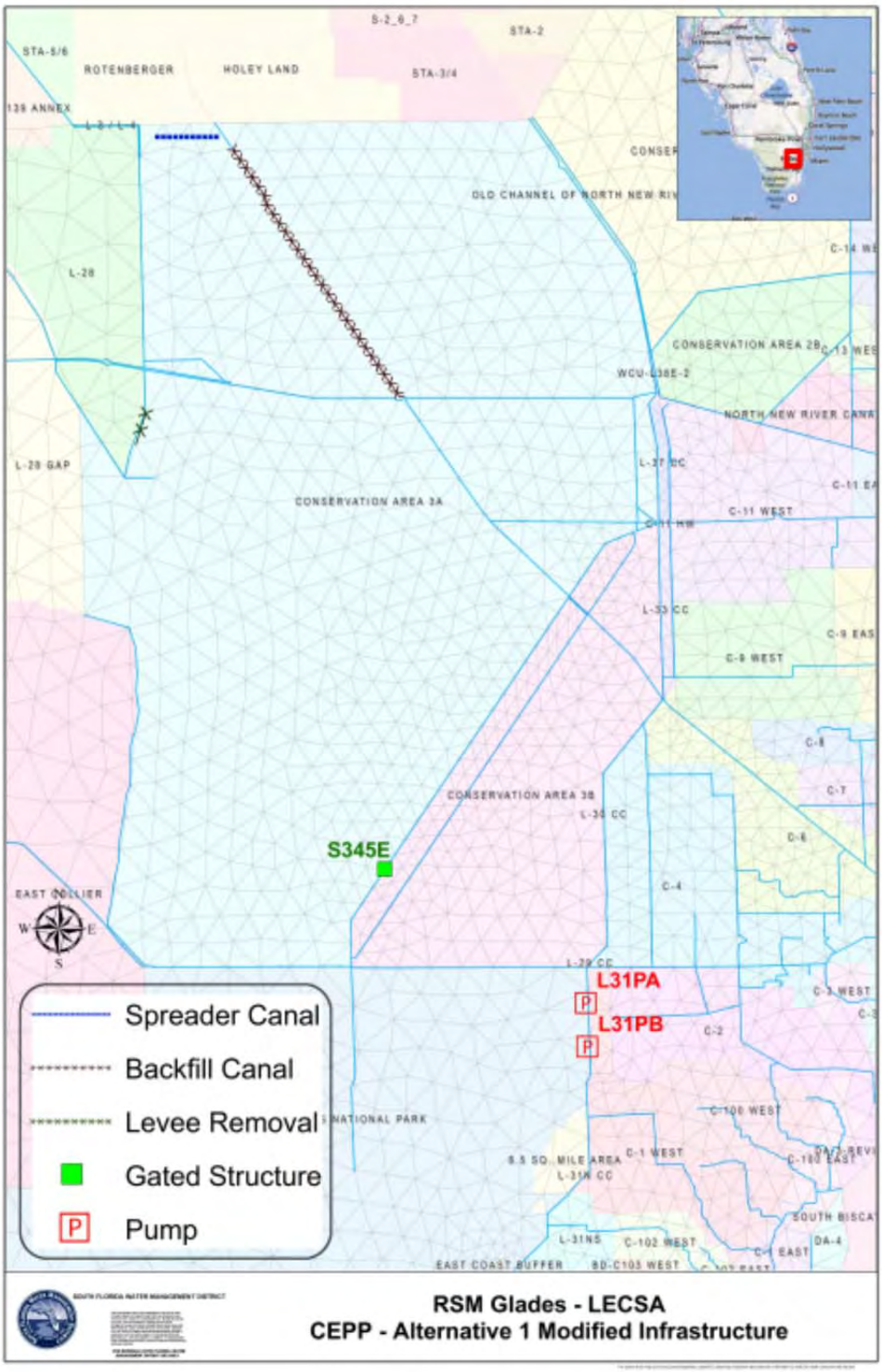


Figure 3.5. Alternative 1 Modified Infrastructure Relative to FWO Baseline

RSMGL ALT2 Scenario

For ALT2, modifications to system infrastructure relative to the FWO baseline are shown in **Figure 3.6**. Specific modeling detail related to these elements are listed below. Notes on operational intent as applied for the RSMGL scenarios may be found in a consolidated discussion at the end of this section. Specific operational criteria may also be referenced in **Appendix C** for the South Dade area or the baseline assumption table / previous model documentation for other regions.

- Western HRF not modeled as a canal within the model domain but with boundary inflows into the three edge cells west of S8
- Eastern HRF not modeled as a canal within the model domain but with boundary inflows into the three cells west of G206
- Central HRF modeled as a canal within the model domain just south of the L5 levee and east of the S8 structure (~3 mi total length) - S8 structure discharges into westernmost segment of canal
- Miami Canal removed from Alligator Alley to S8 structure
- Three S345 structures (S345D, S345E, S345F) where S345E has a design discharge of 750 cfs at 1.5 ft differential head and S345D and S345F have a design discharge of 500 cfs at 1.5 ft differential head (flow is jumped directly into the nearest respective mesh cell within WCA3B east of the L67C levee). S345E is located ~13 mi south of S151 (as in ALT1), S345D is located ~3.3 mi north of S345E, and S345F is located ~4.9 mi south of S345E.
- Full L-67ext levee removal
- Single L31N pump station (L31PB) at 250 cfs is located ~3.6 mi south of the L29 canal
- S333 design capacity increased from 1350 cfs to 3000 cfs (discharge coefficient increased proportionally from 2548 to 5662)
- Western Tamiami Trail Bridge modeled as weirs connecting the L29 canal and the mesh cells intersecting the bridge location (~2.6 mi total length)
- Single L29 gravity structure (L29SA) with a discharge coefficient of 750 is located ~1.7 mi east of S333 and discharges into the L29 canal upstream of the Tamiami Trail Bridge
- Full L31N seepage curtain wall from L29 canal north to S335
- Partial L31N seepage curtain wall from L29 canal south ~3.1 mi

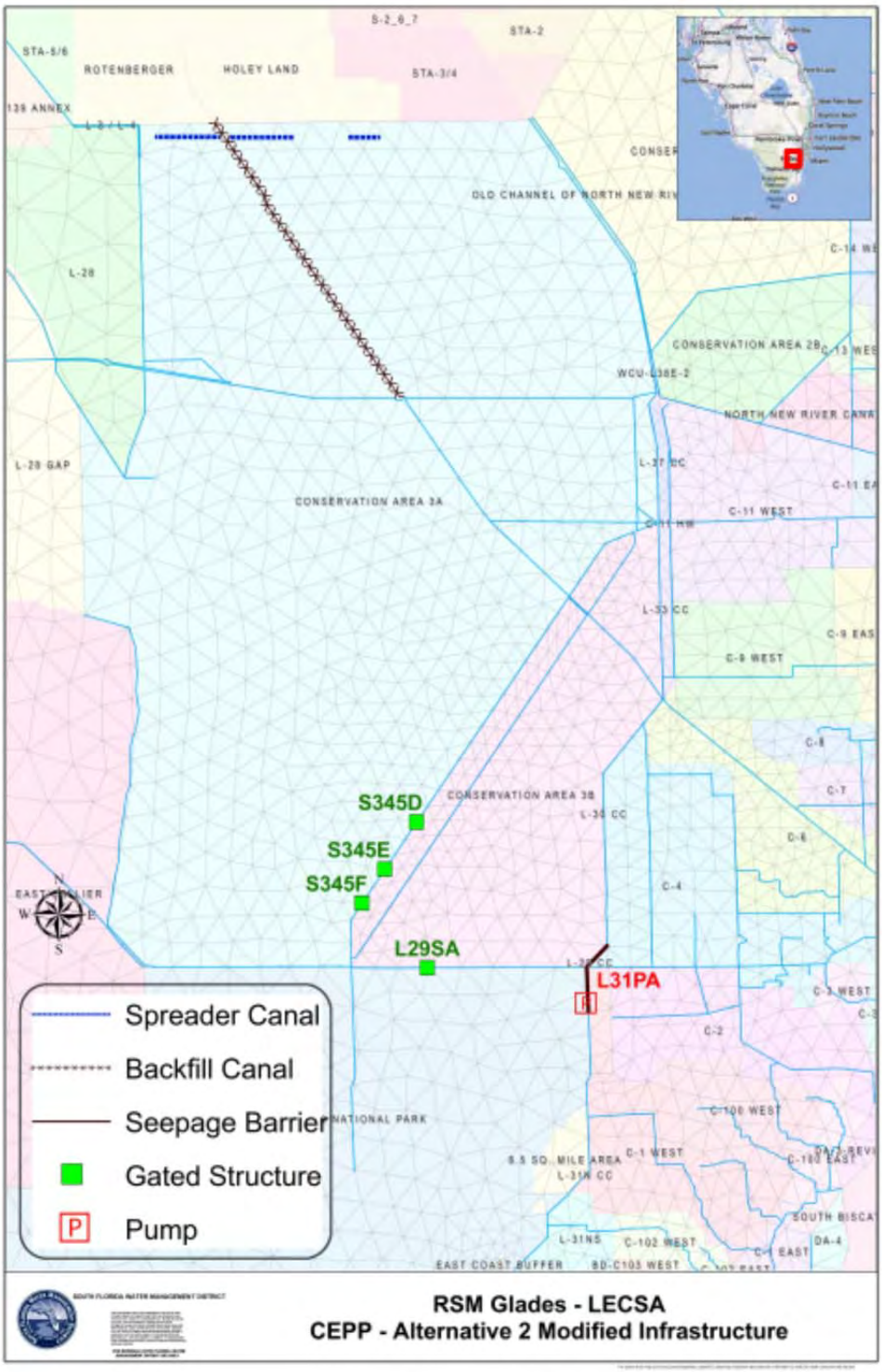


Figure 3.6. Alternative 2 Modified Infrastructure Relative to FWO Baseline

RSMGL ALT3 Scenario

For ALT3, modifications to system infrastructure relative to the FWO baseline are shown in **Figure 3.7**. Specific modeling detail related to these elements are listed below. Notes on operational intent as applied for the RSMGL scenarios may be found in a consolidated discussion at the end of this section. Specific operational criteria may also be referenced in **Appendix C** for the South Dade area or the baseline assumption table / previous model documentation for other regions.

- Western HRF not modeled as a canal within the model domain but with boundary inflows into the three edge cells west of S8
- Eastern HRF not modeled as a canal within the model domain but with boundary inflows into the three cells west of G206
- Central HRF modeled as a canal within the model domain just south of the L5 levee and east of the S8 structure (~3 mi total length) - S8 structure discharges into westernmost segment of canal
- Miami Canal removed from Alligator Alley to S8 structure
- Four S345 structures (S345C, S345D, S345E, S345F), each with a design discharge of 500 cfs at 1.5 ft differential head (flow is jumped directly into the nearest respective mesh cell within WCA3B east of the L67C levee). S345E is located ~13 mi south of S151 (as in ALT1), S345D is located ~3.3 mi north of S345E, S345C is located ~2.5 mi north of S345D, and S345F is located ~4.9 mi south of S345E.
- Full L-67ext levee removal
- S333 design capacity increased from 1350 cfs to 3000 cfs (discharge coefficient increased proportionally from 2548 to 5662)
- Western Tamiami Trail Bridge modeled as weirs connecting the L29 canal and the mesh cells intersecting the bridge location (~2.6 mi total length)
- Two L29 pumps stations (L29PA and L29PB) at 500 cfs each located at the south end of the two westernmost remnant agricultural canals dug in WCA3B (~3 mi and ~7mi east of S333). Modeling included the effects of improving the existing remnant canals for efficient drainage in the southern end of WCA3B.
- Full L31N seepage curtain wall from L29 canal north to S335
- Partial L31N seepage curtain wall from L29 canal south to ~0.6 mi north of C1W canal junction

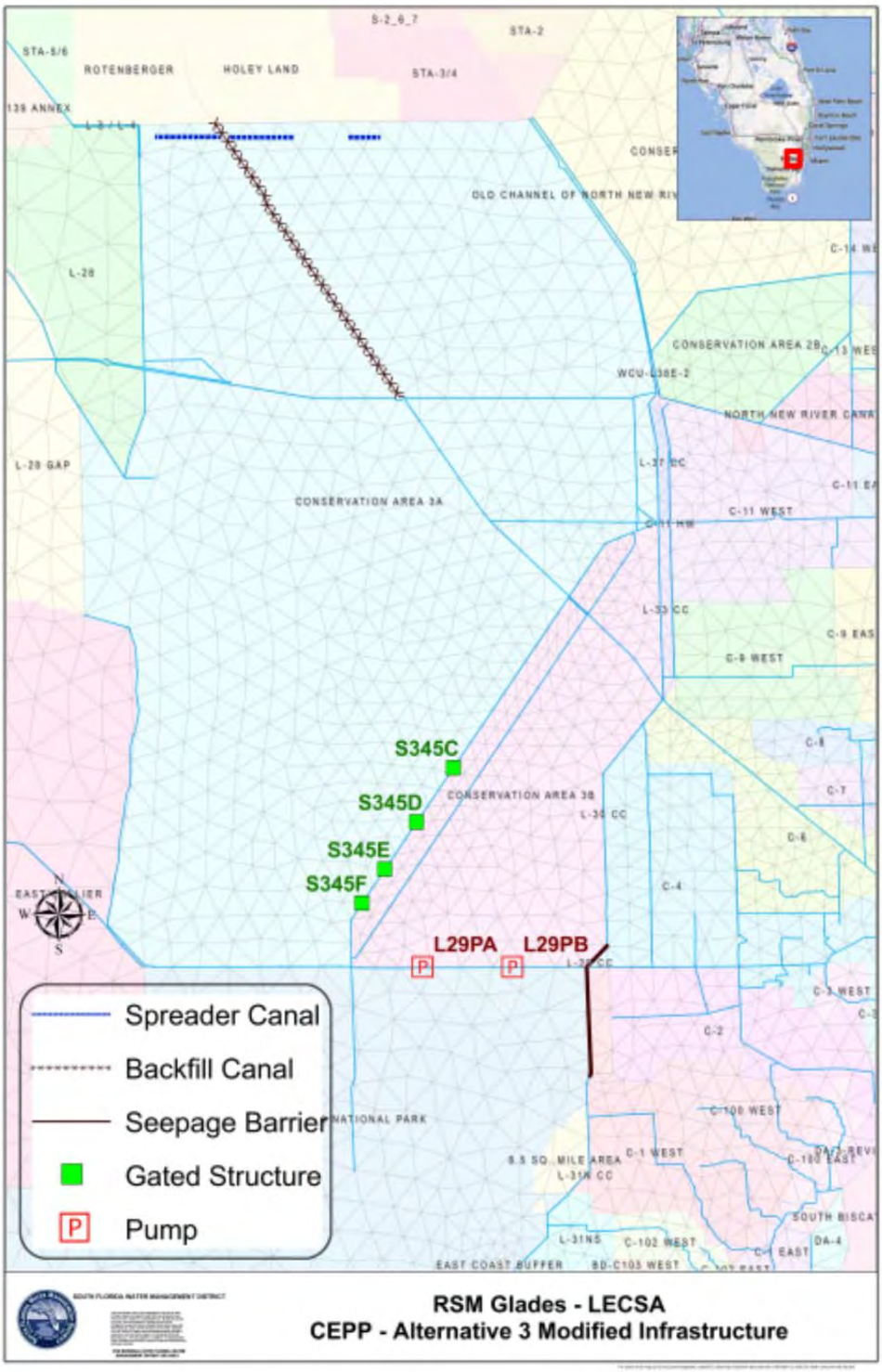


Figure 3.7. Alternative 3 Modified Infrastructure Relative to FWO Baseline

RSMGL ALT4 Scenario

For ALT4, modifications to system infrastructure relative to the FWO baseline are shown in **Figure 3.8**. Specific modeling details related to these elements are listed below. Notes on operational intent as applied for the RSMGL scenarios may be found in a consolidated discussion at the end of this section. Specific operational criteria may also be referenced in **Appendix C** for the South Dade area or the baseline assumption table / previous model documentation for other regions.

- Western HRF not modeled as a canal within the model domain but with boundary inflows into the three edge cells west of S8
- Eastern HRF not modeled as a canal within the model domain but with boundary inflows into the three cells west of G206
- Central HRF modeled as a canal within the model domain just south of the L5 levee and east of the S8 structure (~3 mi total length) - S8 structure discharges into westernmost segment of canal
- Miami Canal removed from Alligator Alley to S8 structure
- S356 design capacity changed from 500 cfs to 1000 cfs
- Three S345 structures (S345D, S345G, S345F), each with a design discharge of 500 cfs at 1.5 ft differential head (flow is jumped directly into the nearest respective mesh cell within WCA3B east of the L67C levee). S345D is located ~9.7 mi south of S151, S345G is located ~16.4 mi south of S151, and S345F is located ~17.9 mi south of S151 along L67-A
- S333 design capacity increased from 1350 cfs to 3000 cfs (discharge coefficient increased proportionally from 2548 to 5662)
- Western Tamiami Trail Bridge modeled as weirs connecting the L29 canal and the mesh cells intersecting the bridge location (~2.6 mi total length)
- Degraded sections of L-29 levee (between S333 and divide structure) as a part of Blue Shanty flowway.
- Divide structure (no flow junction block) east of Blue Shanty Flowway close to western bridge.
- Partial L31N seepage curtain wall from L29 canal south to ~0.6 mi north of C1W canal junction
- Entire section of L-67 extension levee degraded

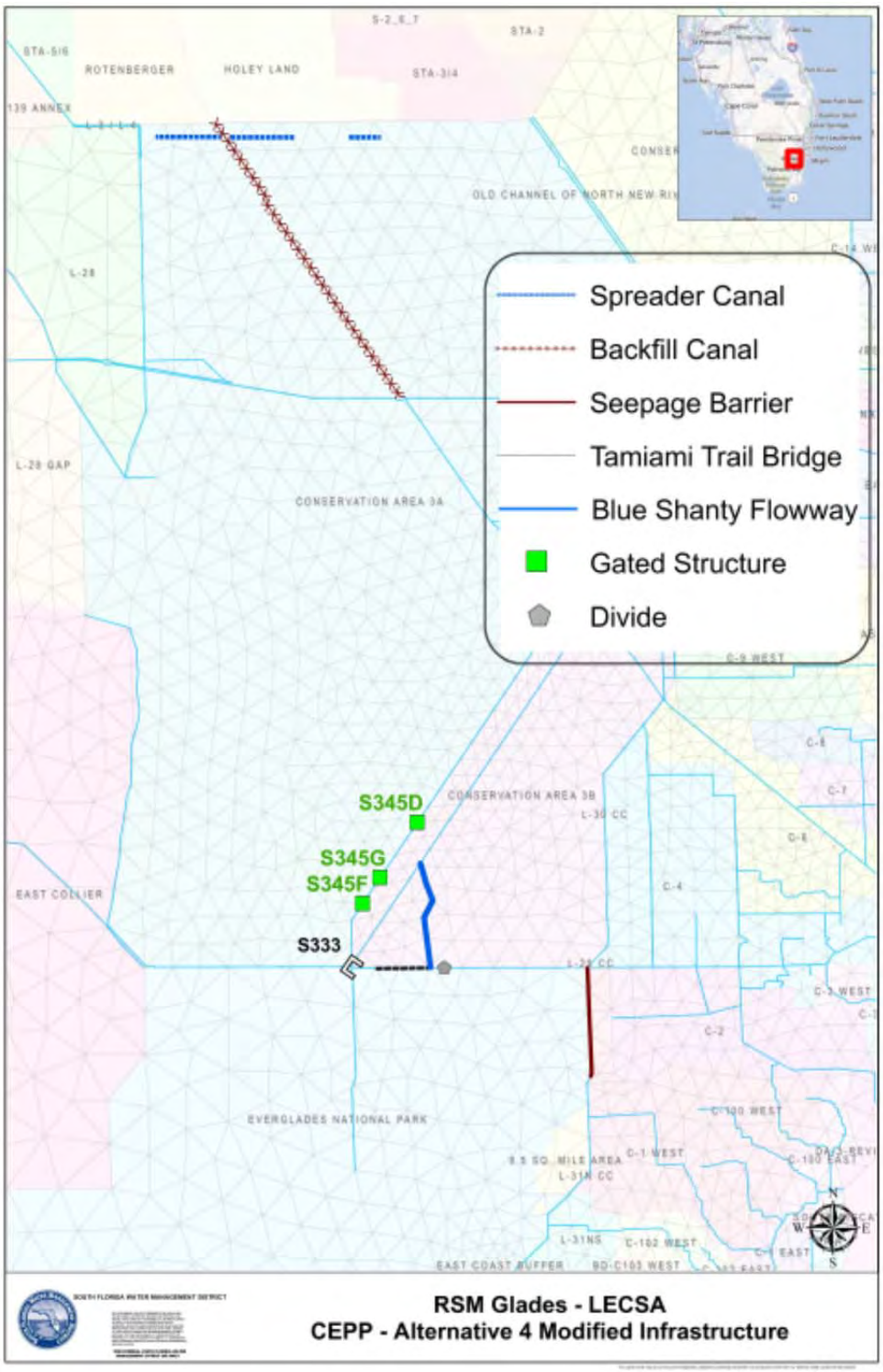


Figure 3.8. Alternative 4 Modified Infrastructure Relative to FWO Baseline

Operational Criteria in RSMGL

Operational criteria in RSMGL for the CEPP alternatives were implemented to mimic the results of the Greenline target and operations screening work (**SFWMD, 2014d**). Using the iModel©, a system-wide simulation and optimization tool that is based on artificial neural network and numerical optimization, WCA3A inflow and outflow structures are managed under a Rainfall Driven Operation (RDO) scheme. Unlike regulation schedule based operations, the RDO estimates inflow releases and outflow delivery to WCA3B and the Everglades National Park (ENP), in response to weekly rainfall and potential evapotranspiration (PET). Goals of the operations consider the following:

- Weekly stage at system-wide locations (3ANW, 3A11, 3ASW, W2, 3A4, 3AS, 3ANE, 3A28, E4, 3A3, 3B-71, Shanty, NESRS2, NP205, NP46 and P33) approach the corresponding weekly restoration targets as agreed upon during Greenline screening. The locations were identified by the CEPP project team. Results of optimization are unique for each alternative and summarized in the CEPP Draft PIR/EIS (**USACE, 2013b**).
- Aims to improved WCA3A recession rates in three range categories: excellent (0.03 to 0.06), acceptable (0 to 0.03 and 0.06 to 0.1) and unacceptable (> 0.1). The recession rate is calculated as the difference between current stage and last week's stage (averaged over 3A4, 3A28 and 3A3 locations).
- Reduce frequency when stage may exceed above Zone "A" of the ERTP regulation schedule.

In addition to those operations predicated on RDO, the following operational changes were made to the CEPP alternatives:

- Tamiami Trail releases (S333 and S12s) use the same operating logic as today's ERTP schedule, namely the Rainfall Plan. CEPP alternatives replace the calculation of the rainfall-driven component (i.e., environmental target) with RDO estimates. Spatially, CEPP alternatives also attempt to deliver 100% of both the environmental and regulatory calculation through S333 subject to capacity and hydraulic constraints (this is different than the current ratio used in ERTP).
    - It is important to note that the model still assumes that the S12s will attempt to discharge regulatory releases once WCA3A stages are in Zone A of the regulation schedule independent of the Rainfall Plan calculation (this assumption is unchanged from the project baseline scenarios).
    - In the final array alternatives, any assumed 345 structures are operated solely based upon RDO environmental targets and are independent of operational considerations at Tamiami Trail.
- L29 canal can receive inflow up to 9.7 ft (applies to western segment only in ALT4, i.e., S333, but not S356); G3273 constraint = 9.5 ft
- Seepage infrastructure and associated LEC canal structures were operated as shown in the detailed table in **Appendix C**.
- L6 diversion operational criteria (common to all alternatives) were assumed as follows:
    - Divert up to 500 cfs (southern L6 canal conveyance without overtopping into southern WCA2A), subject to WCA2A considerations
    - Limit total L5 flow to 3000 cfs (e.g. if STA 3+4 outflows =2800 cfs, only 200 cfs will be diverted), subject to WCA2A considerations
    - When below the WCA2A CEPP diversion line (**Table 3.1**), first 2500 cfs discharge to WCA2A and then 20% toward WCA3A, subject to conveyance

- When above the CEPP diversion line (**Table 3.1**), 67% toward WCA3A, subject to conveyance

Table 3.1. Water Conservation Area 2A Inflow Operational Consideration

			CEPP Diversion Line	2A Schedule
1	1-Jan	1	11.492	11.484
2	31-Jan	2	11.250	11.000
3	30-Jun	3	11.250	11.000
4	30-Sep	4	13.000	13.000
5	310Dec	5	11.500	11.500

4.0 Results

Final CEPP modeling products have been uploaded to the CERP Model Management System (MMS), a geographic information system (GIS) based application that includes model input data, select model output data, source code/executable files and documentation. This system can be accessed at http://www.evergladesplan.org/pm/progr_mms.aspx. CEPP modeling products in MMS can be accessed directly at the project page:

http://cerpmap1.cerpzone.org/arcgisapps/CERPMMS/CerpReport/ProjectReport.aspx?projectID=687

Due to the large size of many of the CEPP modeling files, the majority of the modeling output has been archived in the Data Access Storage and Retrieval (DASR) application of CERPzone at www.cerpzone.org. CEPP modeling products in DASR can be accessed within the project modeling folder:

P:\IMC_Final_Modeling_Results\PROJ 51 - Central Everglades Planning

While the modeling products have been archived in the above systems, the table below lists more specific information including model version, inputs used and detailed DASR archival location. Version numbers and "svnroot" paths refer to a model version control system found on the SFWMD network that is not generally accessible, but inputs, model executables and source code have been copied into the MMS system for ease of access.

Version information and model file locations

RSMBN ALTS 12202012	**RSM_v4728 and xml_v8948**
Input: …svnroot/trunk/CentEver/rsmbn/FinalArray/12202012/run3 Output (DASR): .../2PlanFormulation/4FinalArray/Final_Output_122012/rsmbn_model_output/ALTS	
RSMGL ALT1 12202012	**RSM_REL_2.3.5 and xml_v8965**
Input: ……svnroot/trunk/CentEver/rsmgl/Final_Array/ALT1 Output (DASR): .../2PlanFormulation/4FinalArray/Final_Output_122012/rsmgl_model_output/ALT1	
RSMGL ALT2 12202012	**RSM_REL_2.3.5 and xml_v8965**
Input: … svnroot/trunk/CentEver/rsmgl/Final_Array/ALT2 Output (DASR):../2PlanFormulation/4FinalArray/Final_Output_122012/rsmgl_model_output/ALT2	
RSMGL ALT3 12202012	**RSM_REL_2.3.5 and xml_v8965**
Input: … svnroot/trunk/CentEver/rsmgl/Final_Array/ALT3 Output (DASR): .../2PlanFormulation/4FinalArray/Final_Output_122012/rsmgl_model_output/ALT3	
RSMGL ALT4 12202012	**RSM_REL_2.3.5 and xml_v8965**
Input: … svnroot/trunk/CentEver/rsmgl/Final_Array/ALT4 Output (DASR): .../2PlanFormulation/4FinalArray/Final_Output_122012/rsmgl_model_output/ALT4	

Review of Local and Regional-Level Results

The RSMBN and RSMGL baseline modeling scenarios were reviewed from the perspective of ensuring that localized effects of project implementations were observed as expected and that regional performance was considered reasonable. Specific checks on RSM outputs included the following:

- The ALTS scenario generally maintains Lake Okeechobee performance relative to ECB as shown in **Figure 4.1 and Table 4.1**. CEPP ALTS is > 15.0 ft for approximately 23.1% of the time, meeting the desired criteria.
- ALTS reduces the number of high discharge events to northern estuaries relative to the baselines as shown in **Figure 4.2 (a) and (b)**. It can also be observed that maintain low flow event frequency is maintained in the Caloosahatchee Estuary, but increased in the St. Lucie Estuary
- The ALTS scenario generally maintains LOSA and Tribal water supply performance relative to FWO as shown in **Figure 4.3 to 4.6.**
- Compared to FWO, ALTS provides approximately 200 kac-ft additional flow to Everglades as shown in **Table 4.2**.
- Performance of the CEPP FEB is deemed to be reasonable since the depth regime observed in the ALTS run is similar to the "design" criteria utilized for the A1 FEB (based on an emergent vegetation flowway). Flow regimes were checked in DMSTA (**Wang 2012**) to verify compliance with applicable planning standards.
- In RSMGL, CEPP ALT1, ALT2, ALT3 and ALT4 have varying performance.
- In WCA 2A & WCA2B, performance in all alternatives is affected by CEPP L-6 Diversion operations. CEPP runs are similar to ECB (lower highs) in WCA2A (**Figure 4.7**), but lower WCA2B and adjacent LEC areas relative to FWO and ECB (**Figure 4.8**).
- Distribution of northern WCA3A inflows varies between CEPP ALT1 and ALTs 2-4 as illustrated by an example in **Figure 4.9**. All CEPP alternatives increase stages and hydroperiods in northern WCA3A relative to FWO (an example in **Figure 4.10**). In all CEPP alternatives, performance in northeastern WCA3A are similar to defined sawgrass targets
- CEPP alternatives are all similar to FWO (lower highs) in central & southern WCA3A (**Figure 4.11**). In general, more flow is moving through WCA3A system in CEPP relative to FWO (**Figure 4.12**). While stage performance is similar, WCA3A outflow distribution is different across the CEPP ALTs as shown in **Table 4.3**. "Eastern" releases to ENP via S333 have higher priority than S12 discharges, which only make flood control releases as determined by WCA3A regulation schedule.
- High variability is observed across the CEPP alternatives for performance in WCA3B (**Figures 4.13 to 4.14**). All alternatives raise WCA3B stages and increase hydroperiods relative to FWO. Pennsuco & LEC trends are heavily influenced by and related to WCA3B stage conditions. In the alternatives, WCA3B overland flow directionality generally shows poor alignment with landscape patterning.
- CEPP alternatives all significantly increase stages and hydroperiods in Shark River Slough. All alternatives show large flow increases into eastern ENP at Tamiami Trail and subsequently down Shark River Slough (**Figure 4.15**). The

majority of Marl areas do not show increased hydroperiods, but immediately adjacent to Shark River Slough, wetter conditions do exist (**Figure 4.16**). Higher stage conditions could improve conditions in Florida Bay.

- In the Lower East Coast, the alternatives all show differing degrees of seepage management (**Table 4.4**) as could be expected from the diverse assumptions in infrastructure. While extreme canal / groundwater conditions are somewhat mitigated by additional CEPP infrastructure, more moderate and dry conditions (**Figure 4.17**) may show undesirable trends.
- Potential exists in CEPP to reduce surface water discharges throughout LEC east of ENP and toward Biscayne Bay as shown in **Table 4.5**.

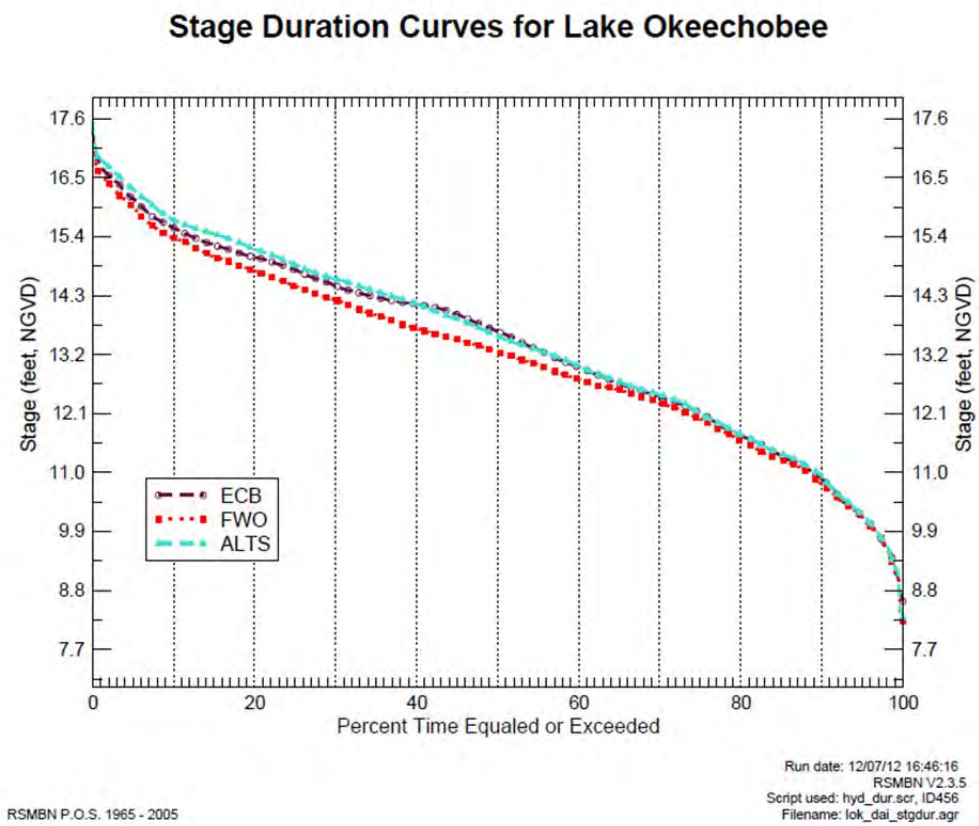


Figure 4.1. Lake Okeechobee performance for ALTS relative to the baselines.

Table 4.1. Lake Okeechobee Standard Score Performance Measure

	ECB	FWO	ALTS
Low Lake (LO1)	86.99	86.02	87.48
High Lake (LO2	99.11	99.11	97.78
Score Below Env (LO3)	40.32	34.29	42.41
Score Above Env (LO3)	75.74	82.50	73.48
Weighted Average:	86.70	86.86	86.02

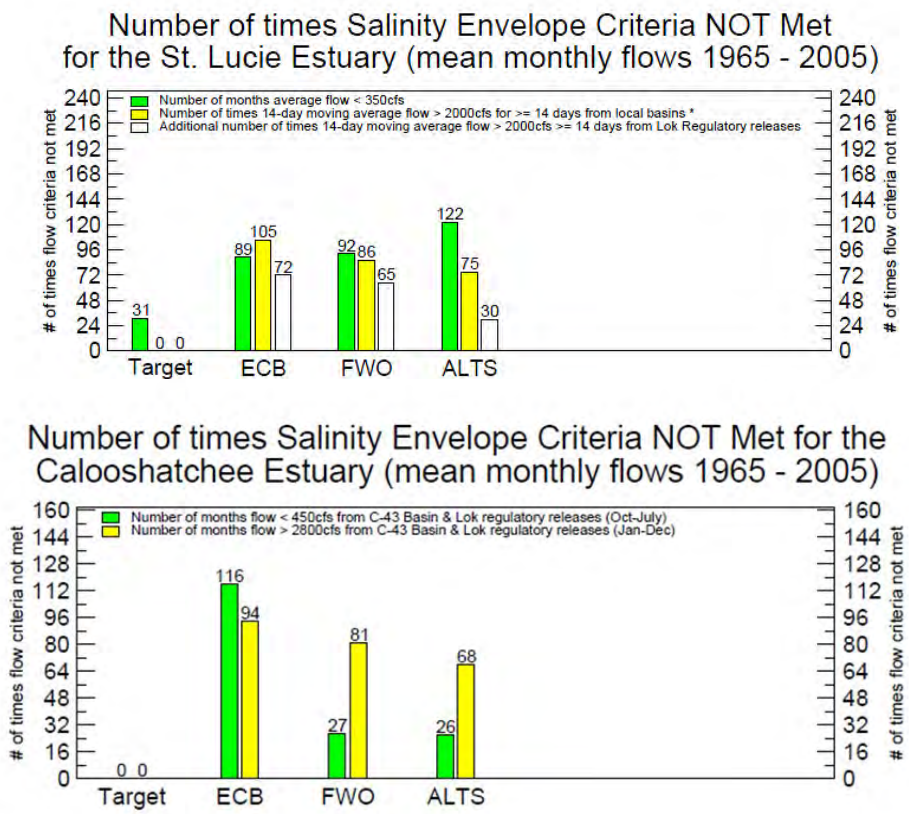


Figure 4.2. High discharge events to northern estuaries (a) St. Lucie Estuary and (b) Caloosahatchee Estuary relative to the baselines for the ALTS alternative.

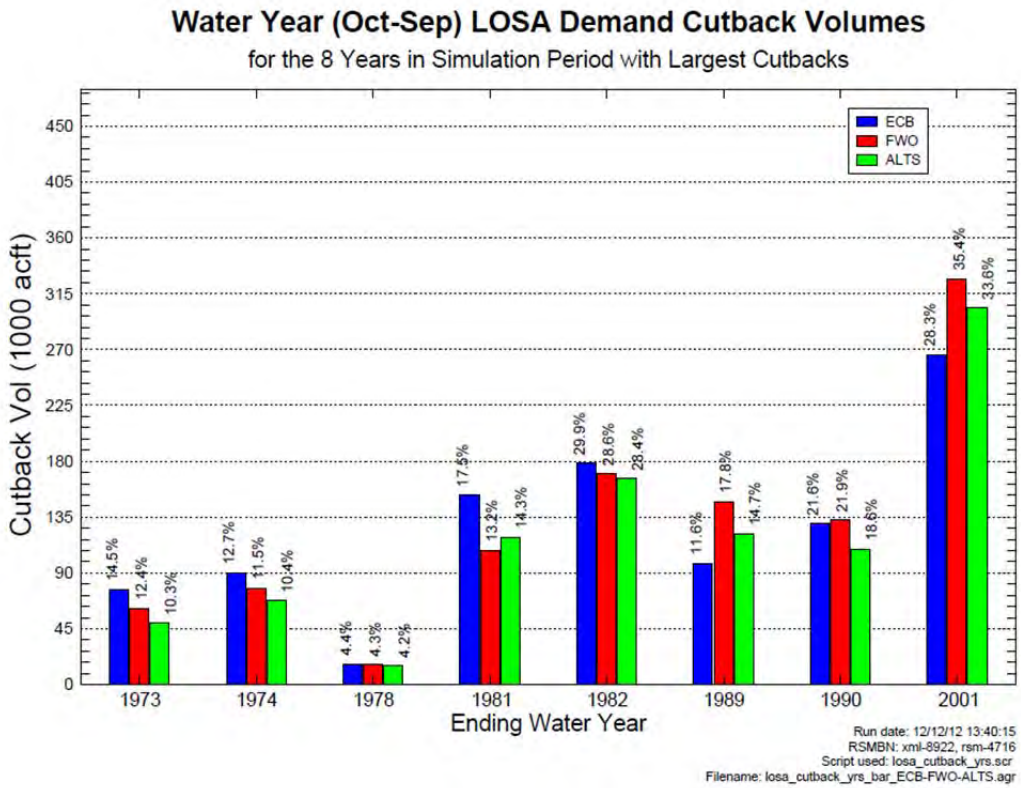


Figure 4.3. Water shortage cutbacks for water years with large cutback volumes

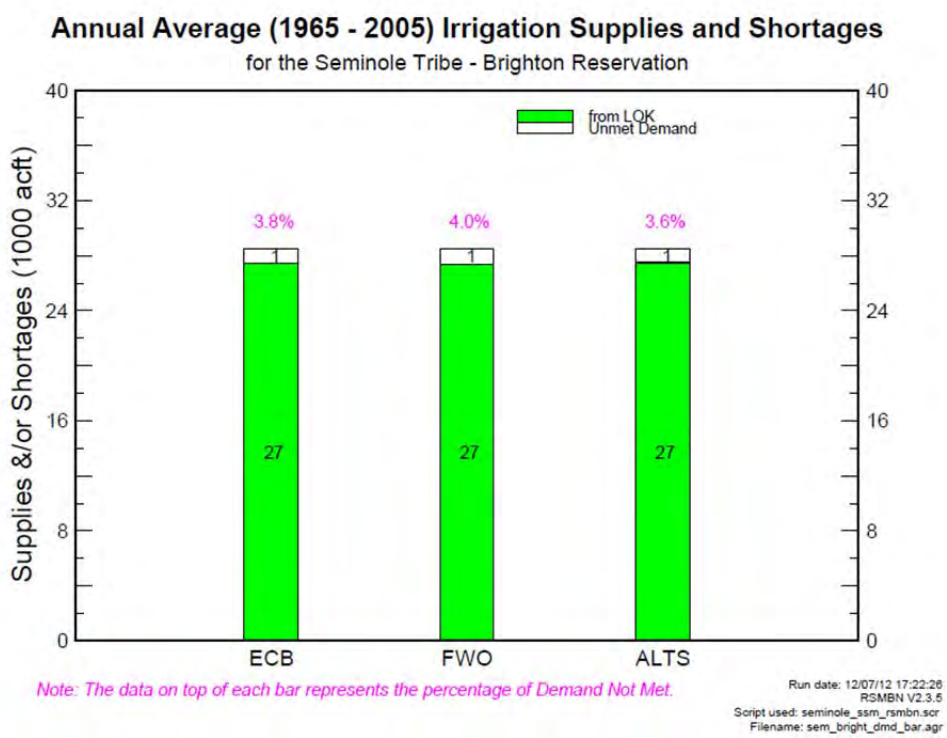


Figure 4.4. Average annual water shortage cutbacks for the Seminole Brighton Reservation

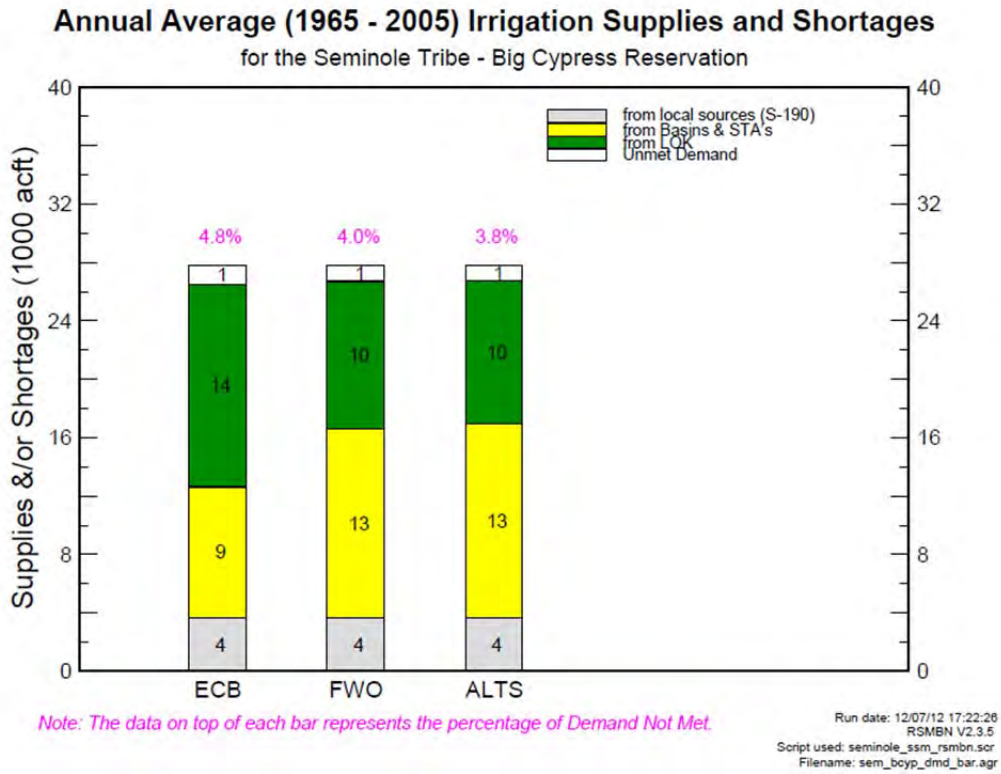


Figure 4.5. Average annual water shortage cutbacks for the Seminole Big Cypress Reservation

Table 4.2. Average annual Discharges (kac-ft) from STA2 and STA34 toward the Greater Everglades

	ECB	FWO	ALTS	Diff (ALTS-FWO)
STA2	234.5	381.0	374.2	(-6.8)
STA34	538.5	382.2	595.9	(213.7)
Total Additional Water =				+206.9

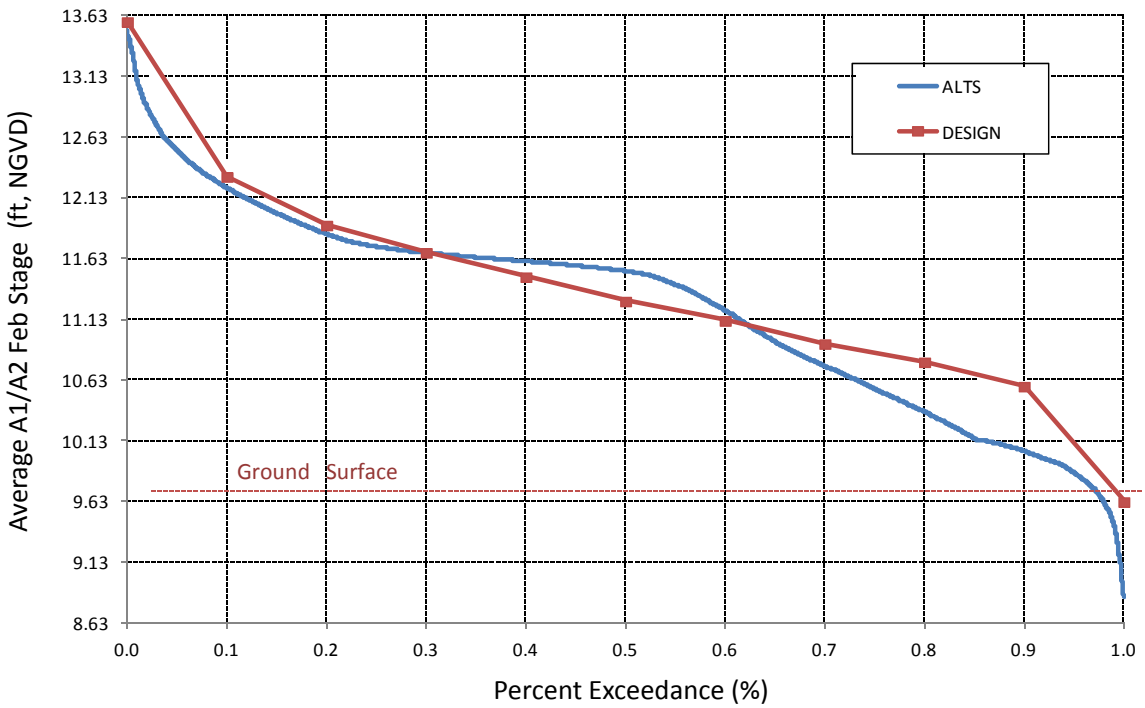


Figure 4.6. A1/A2 FEB stages as modeled relative to "Design" target for an emergent vegetation flowway

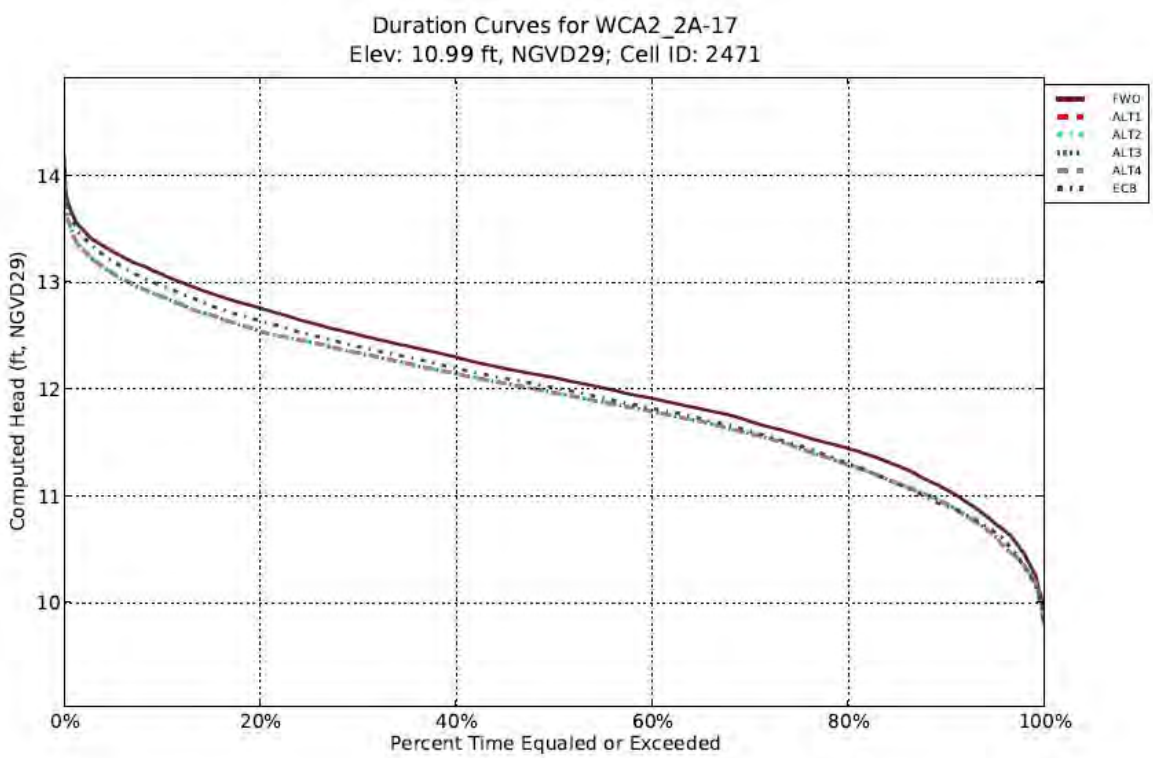


Figure 4.7. Stage duration curve for Gauge 2A-17 in Water Conservation Area 2A

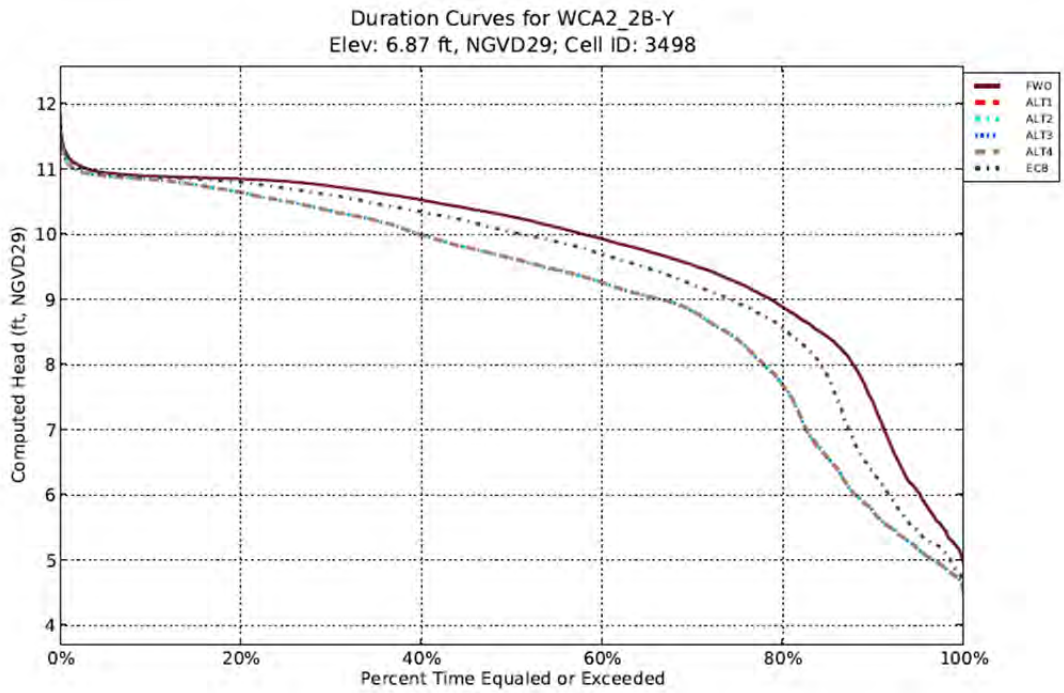


Figure 4.8. Stage duration curve for Gauge 2B-Y in Water Conservation Area 2B

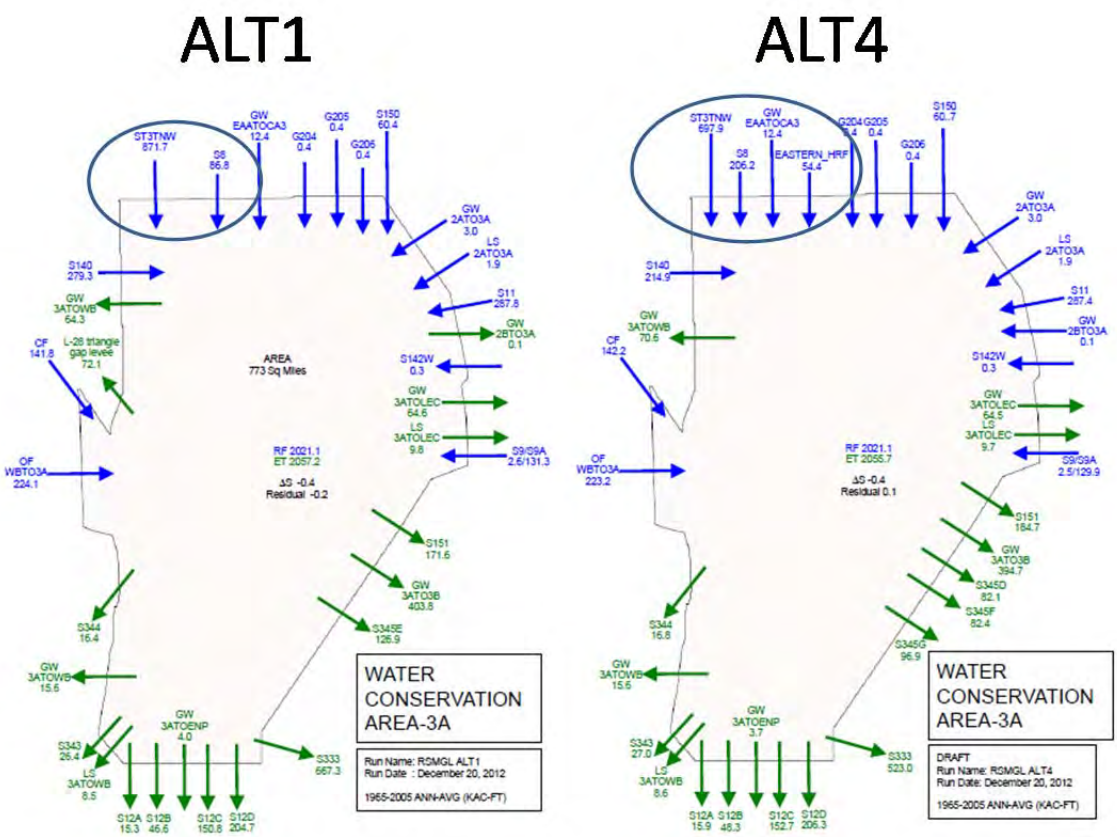


Figure 4.9. Average annual water budget flows (kac-ft) for WCA3A between ALT1 (left) and ALT4 (right)

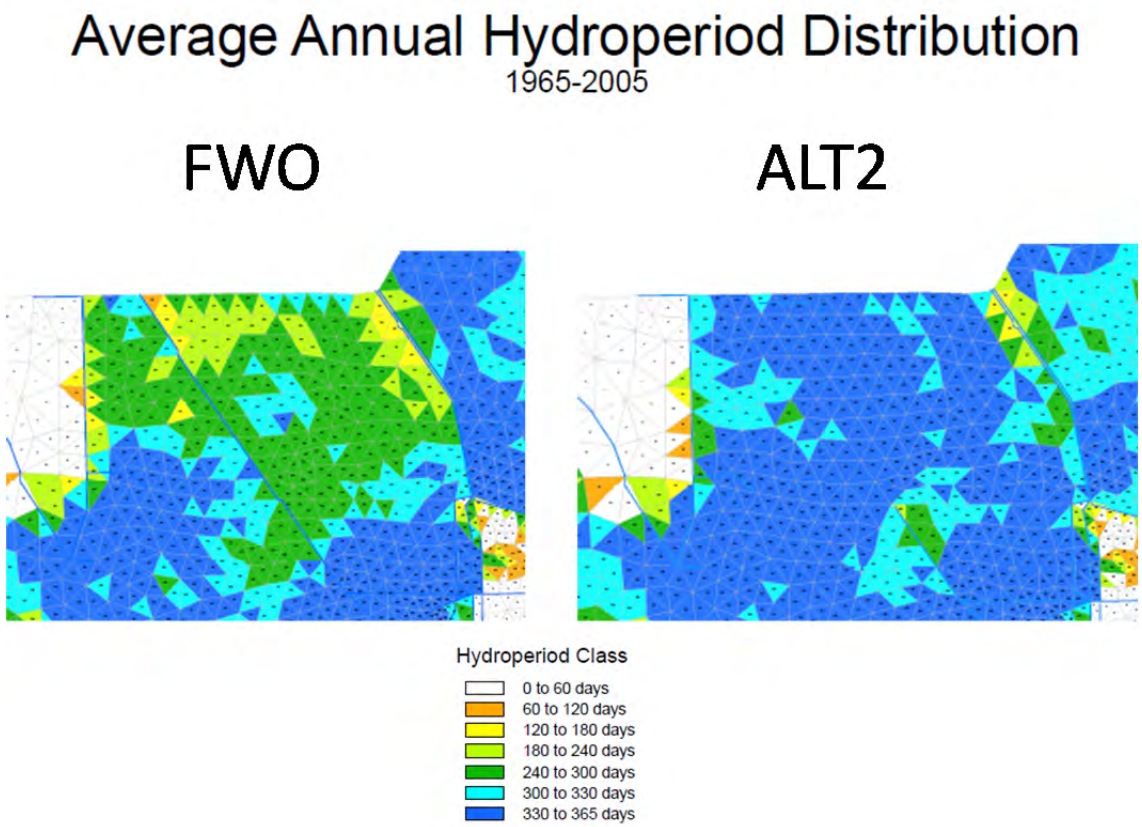


Figure 4.10. Average annual hydroperiod difference in northern WCA3A between FWO (left) and ALT2 (right)

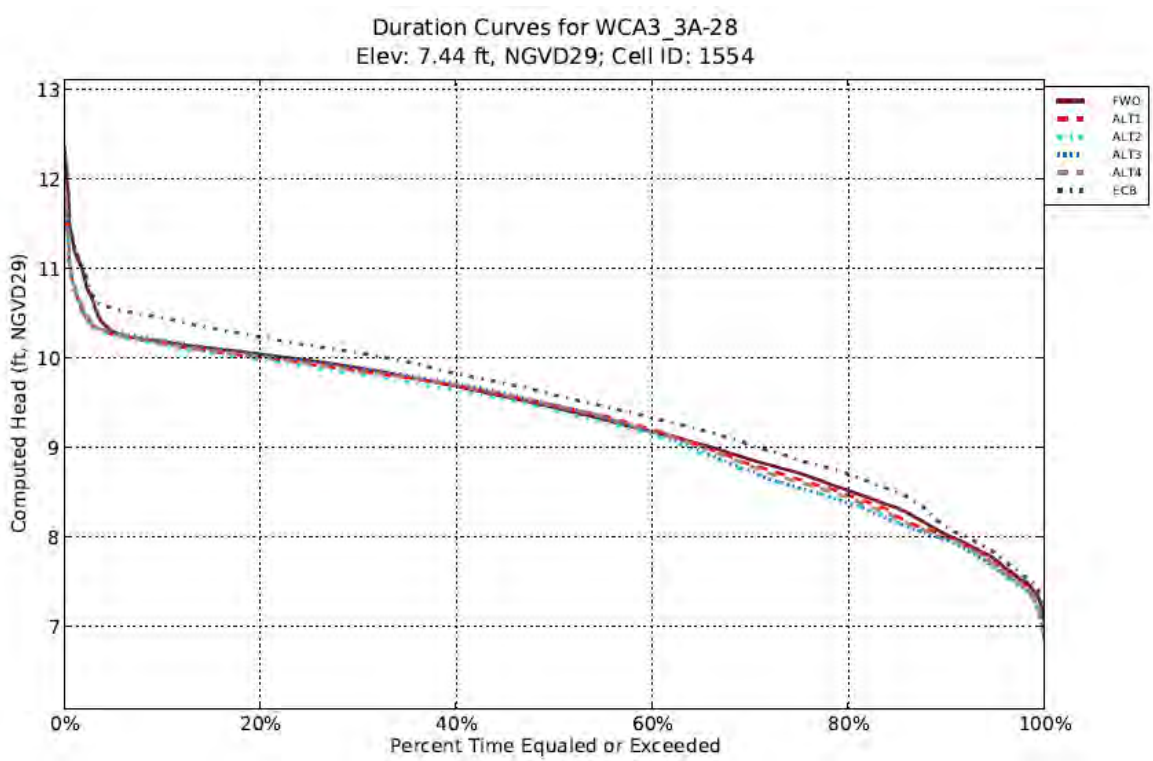


Figure 4.11. Stage duration curve for Gauge 3A-28 in Water Conservation Area 3A

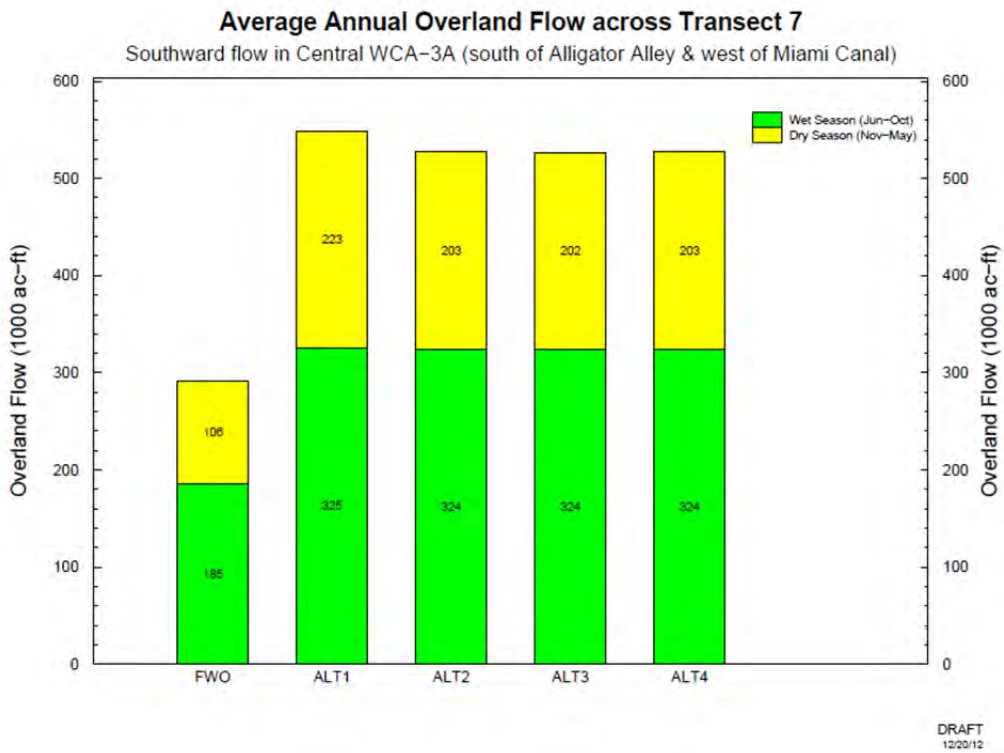


Figure 4.12. Flow differences between FWO and Alternatives in central WCA3A

Table 4.3. WCA3A Tamiami Trail Structural Outflow Distribution (kac-ft)

	ECB	FWO	ALT1	ALT2	ALT3	ALT4
S333	129.72	137.15	667.28	626.32	354.42	522.95
S12A	37.33	29.76	15.25	14.54	16.76	15.87
S12B	98.56	92.16	46.57	44.90	51.06	48.26
S12C	172.91	242.85	150.81	143.93	157.56	152.74
S12D	384.87	320.39	204.73	194.48	211.93	206.29
	693.67	685.16	417.36	397.85	437.31	423.16

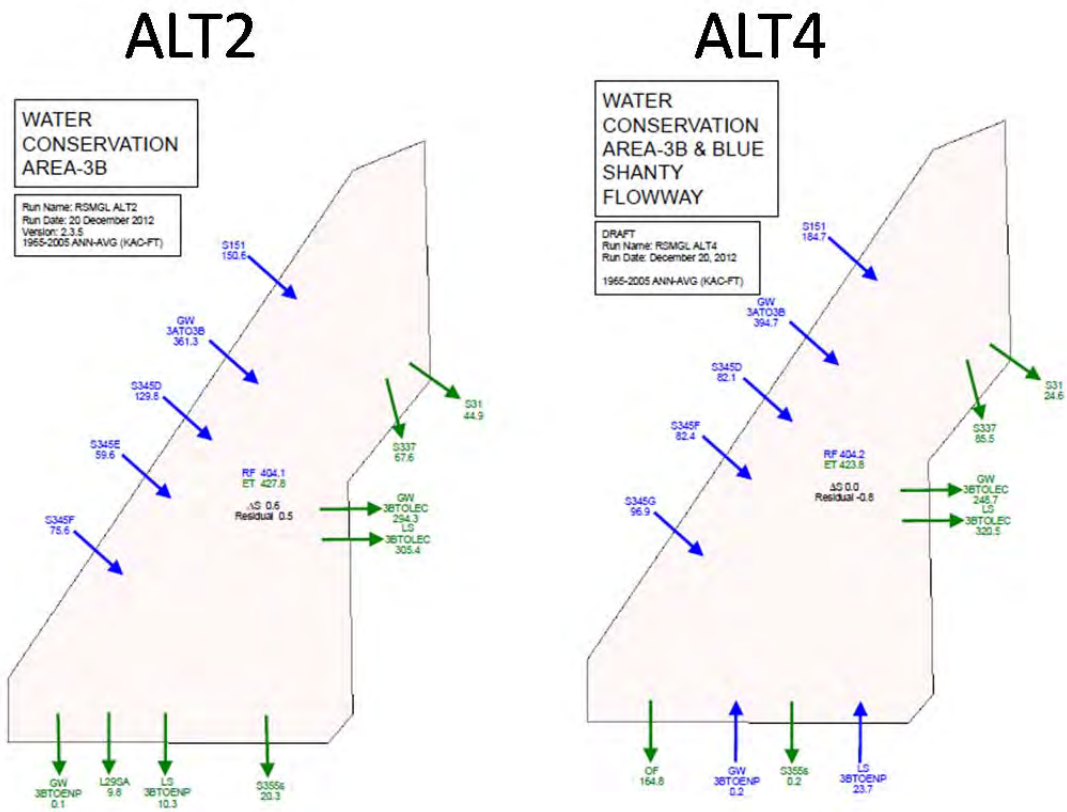


Figure 4.13. Average annual water budget flows (kac-ft) for WCA3B between ALT2 (left) and ALT4 (right)

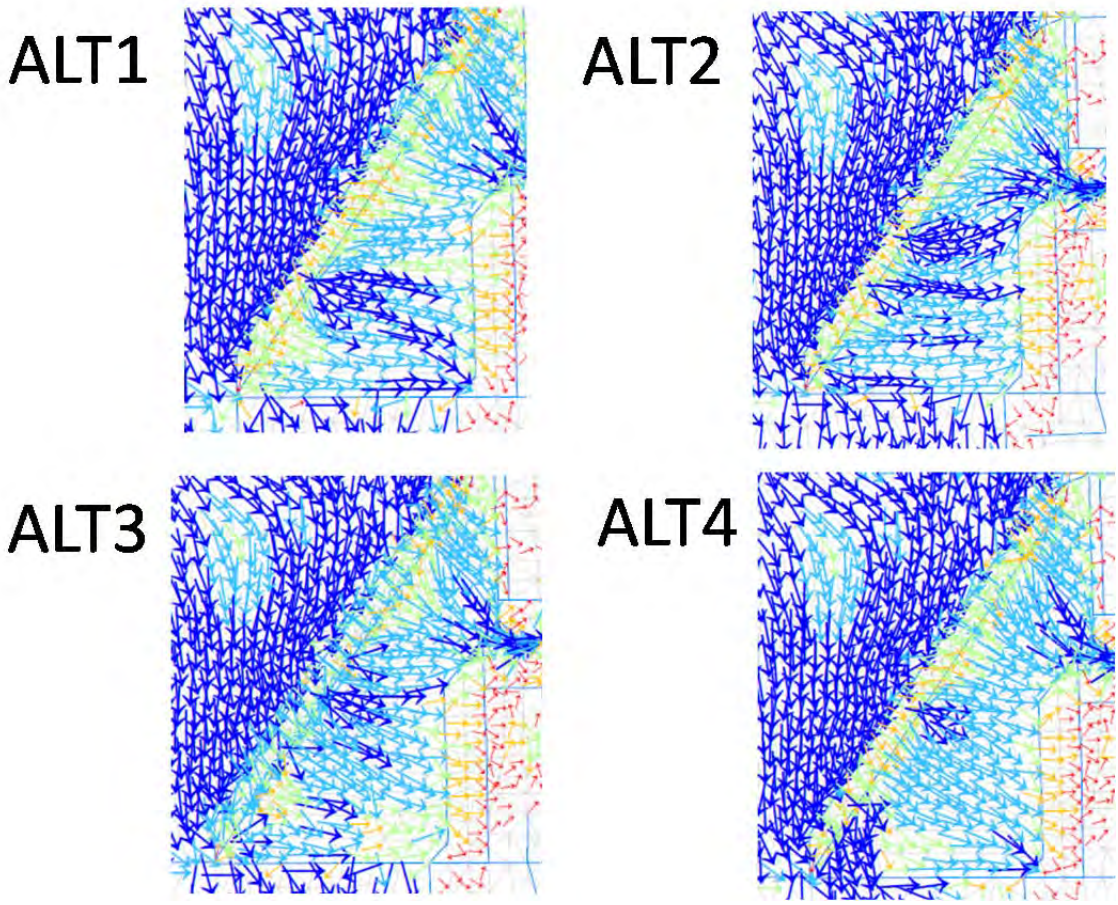


Figure 4.14. Average annual overland flow vectors (showing flow directionality) in WCA3B for ALT1, ALT2, ALT3 and ALT4.

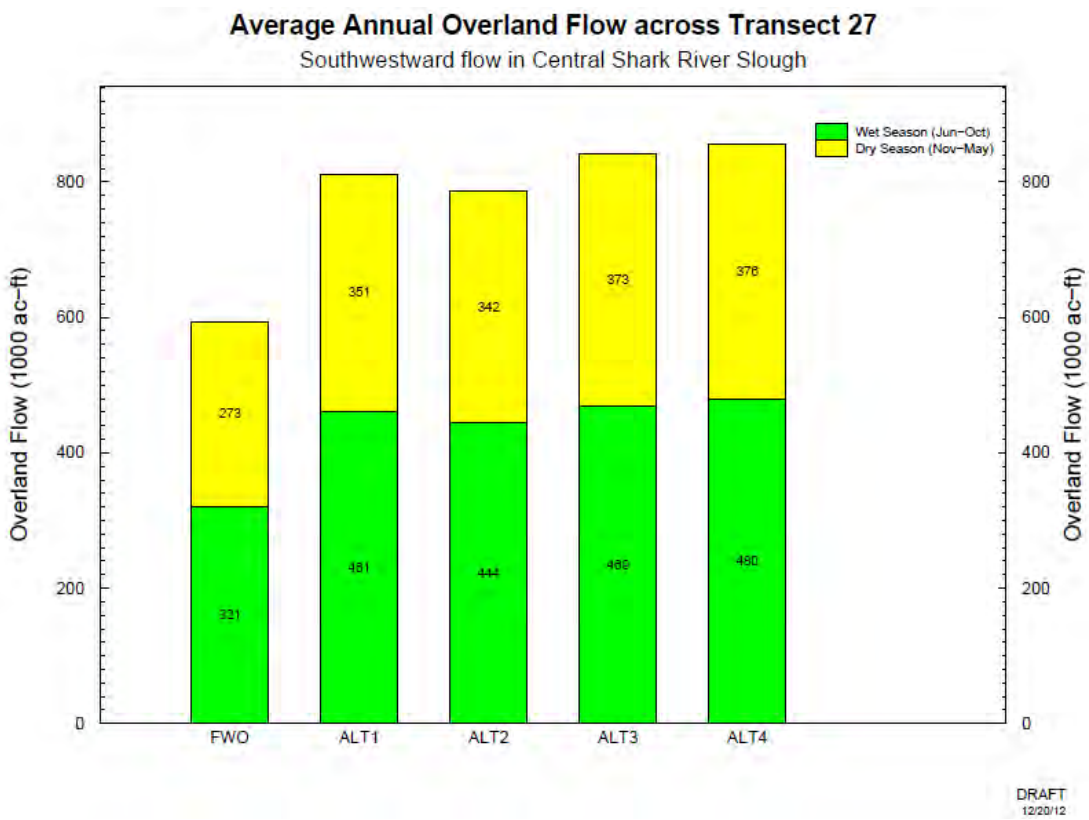


Figure 4.15. Flow differences between FWO and Alternatives in central Shark River Slough

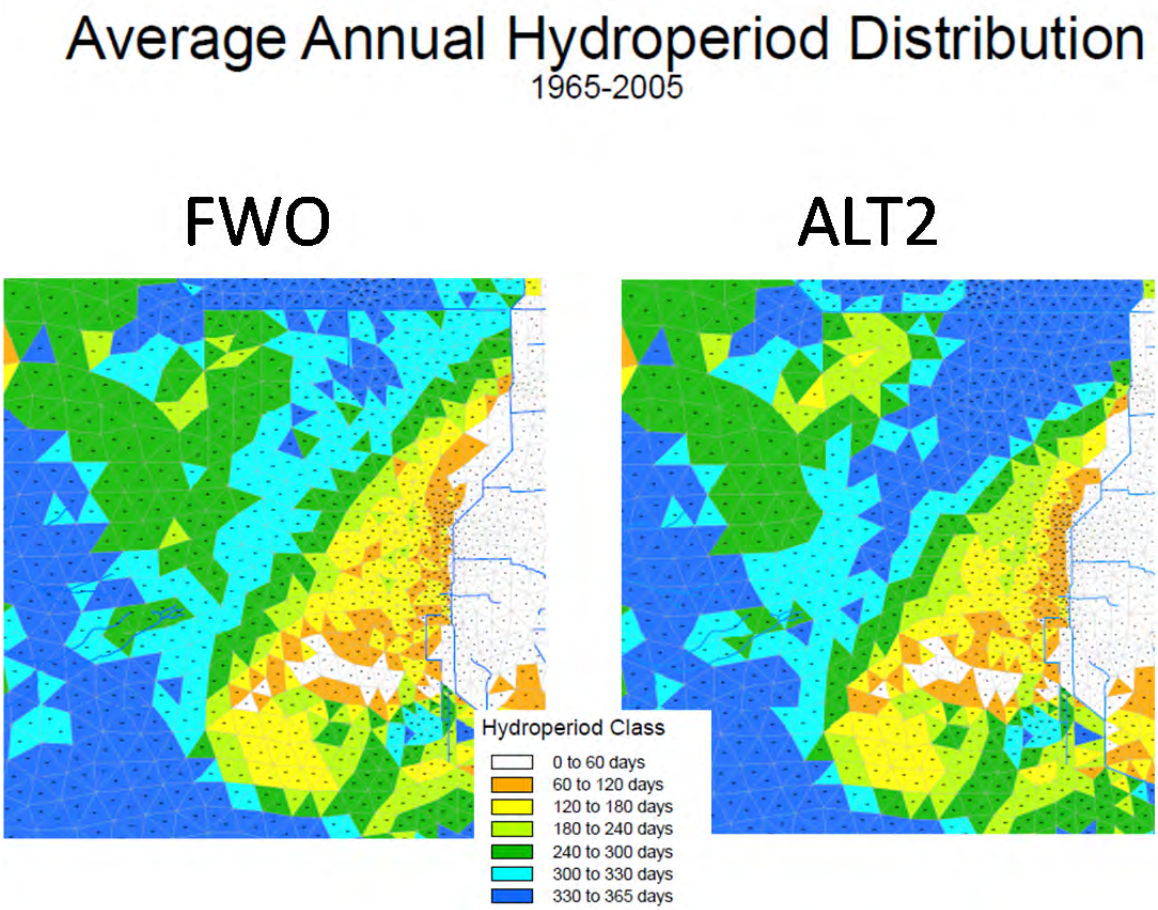


Figure 4.16. Average annual hydroperiod difference in northern Everglades National Park between FWO (left) and ALT2 (right)

Table 4.4. Levee seepage from marsh cell to adjacent canal (Avg. Annual, kac-ft)

	ECB	FWO	ALT1	ALT2	ALT3	ALT4
C-111 from S-176 to S-177	98	188	190	188	190	184
C-111 from S-177 to S-18C	29	43	42	42	43	44
L-30 between S-335 and the bridge	111	107	151	225	162	133
L-30 north of the bridge	218	214	205	236	201	203
L-30 south of S-335	92	82	107	0	0	102
L-31N from G-211 to S-331	29	29	32	31	33	32
L-31N from S-331 to S-176	209	236	286	249	259	286
L-31N north of G-211	149	164	390	31	159	64

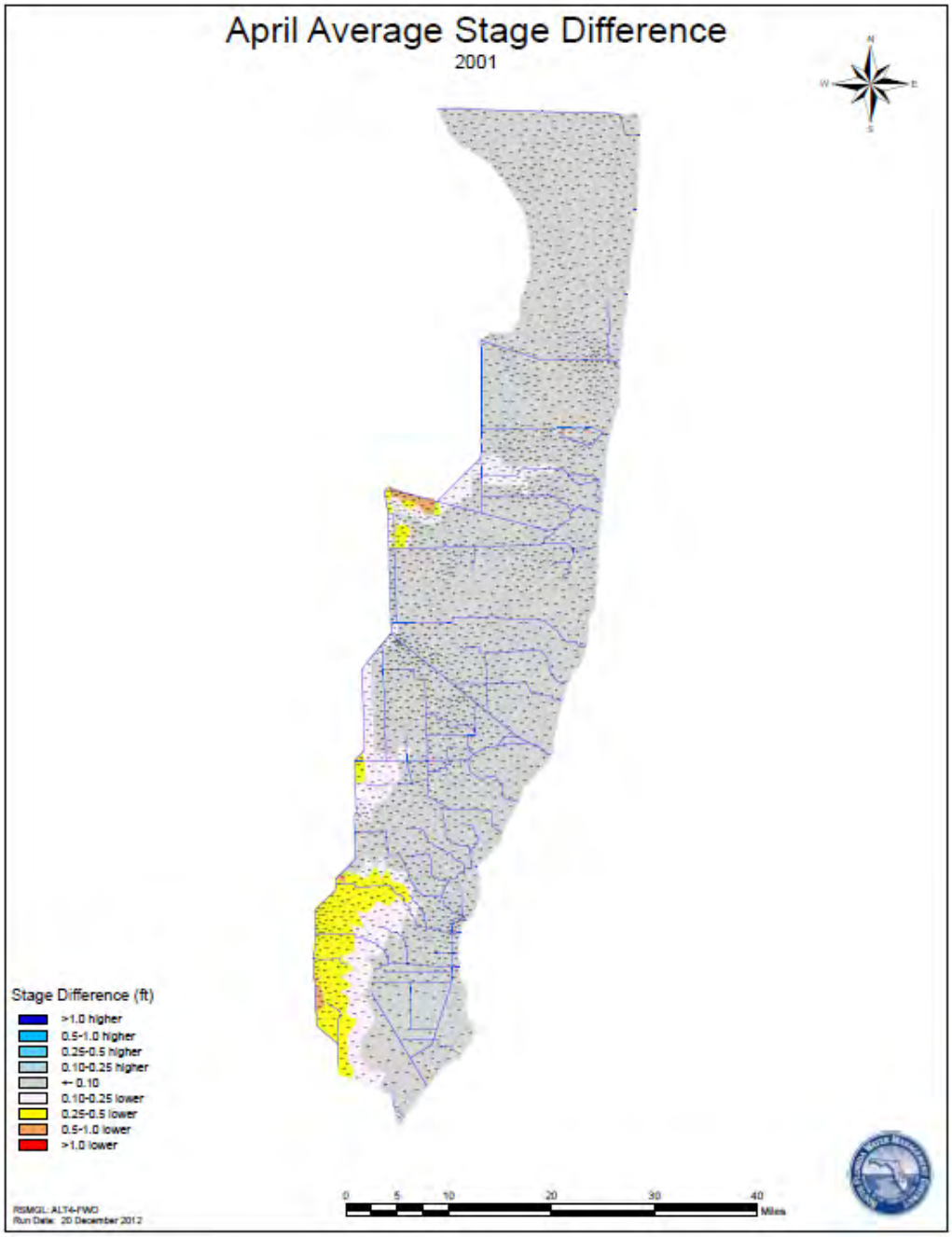


Figure 4.17. Difference between ALT4 and FWO stages for an April 2001 condition in the Lower East Coast

Table 4.5. Surface water flows east of ENP and toward Biscayne Bay.

South Dade	ECB	FWO	ALT1	ALT2	ALT3	ALT4
G211FC	110.17	110.78	2.90	0.66	0.08	6.83
G211WS	60.48	62.41	57.51	60.24	58.58	58.09
S336	5.93	5.71	4.04	4.21	5.73	6.35
S338	58.89	57.13	51.17	53.19	29.02	32.97
S357	2.66	3.27	47.20	45.18	48.22	47.31
S331FC	164.10	164.94	87.39	80.43	80.38	86.29
S331WS	61.41	62.58	53.02	57.35	54.70	54.35
S194	20.98	25.82	15.89	15.63	16.86	18.53
S196	8.99	13.72	6.59	6.09	6.08	7.14
S176	50.25	42.98	42.28	43.04	43.06	42.03
S177	124.33	69.78	73.25	71.96	72.80	71.31
S18C	182.80	144.98	144.38	143.52	145.08	144.56
S197	16.49	6.66	7.91	7.85	8.12	8.25

In summary, the four delivered alternative runs provided to the CEPP project team are deemed to adequately represent the intended planning conditions and when utilized in conjunction with proposed with-CEPP project baselines, provide a reasonable basis of comparison for the necessary evaluations required to draft the PIR.

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Appendix A – Details of Alternatives

Figure A.1 shows spatial perspective of the different modeling zones of the Central Everglades Planning Project. Details of Alternatives ALT1, ALT2, ALT3, and ALT4 are shown in **Figures A.2, A.3, A.4 and A.5**, respectively.

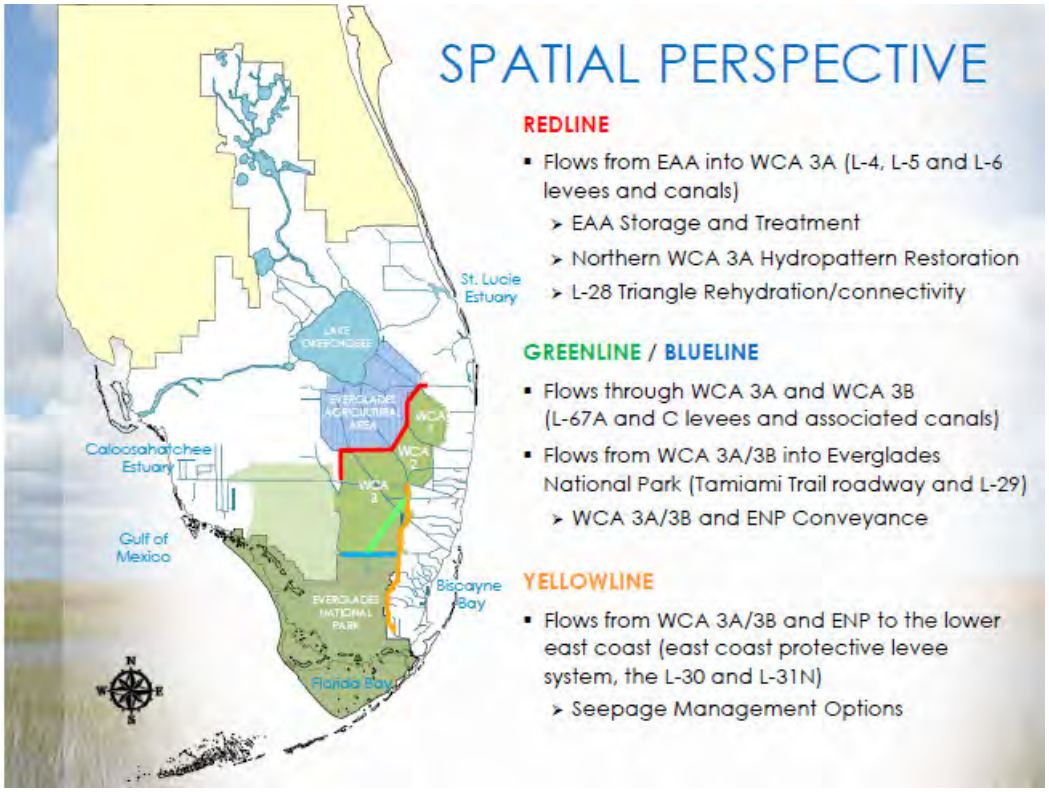

Figure A.1. Spatial perspective of the four modeling zones of the Central Everglades Planning Project.

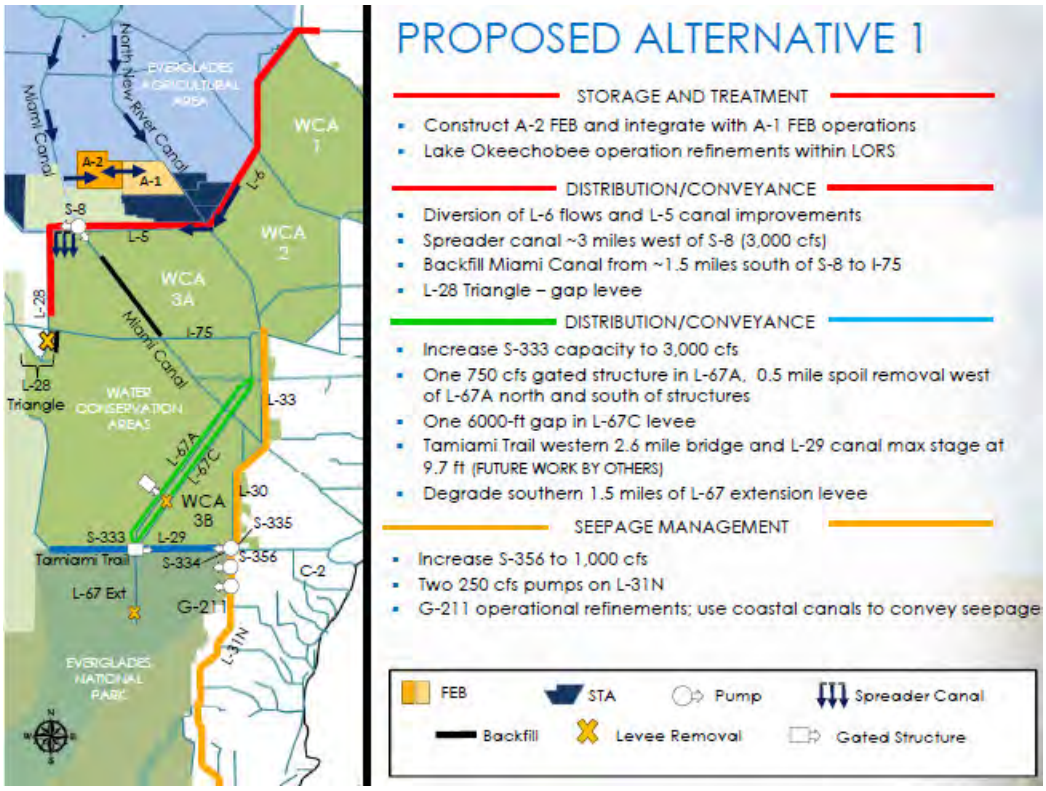

Figure A.2. Proposed alternative ALT1

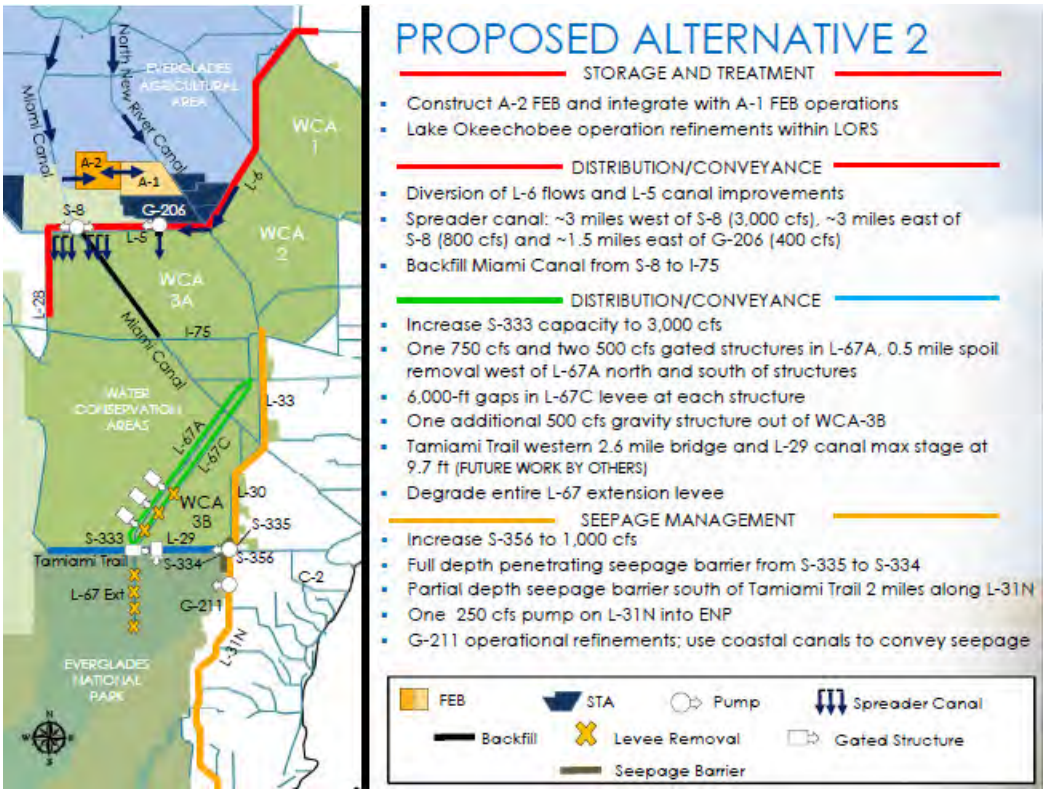

Figure A.3. Proposed alternative ALT2

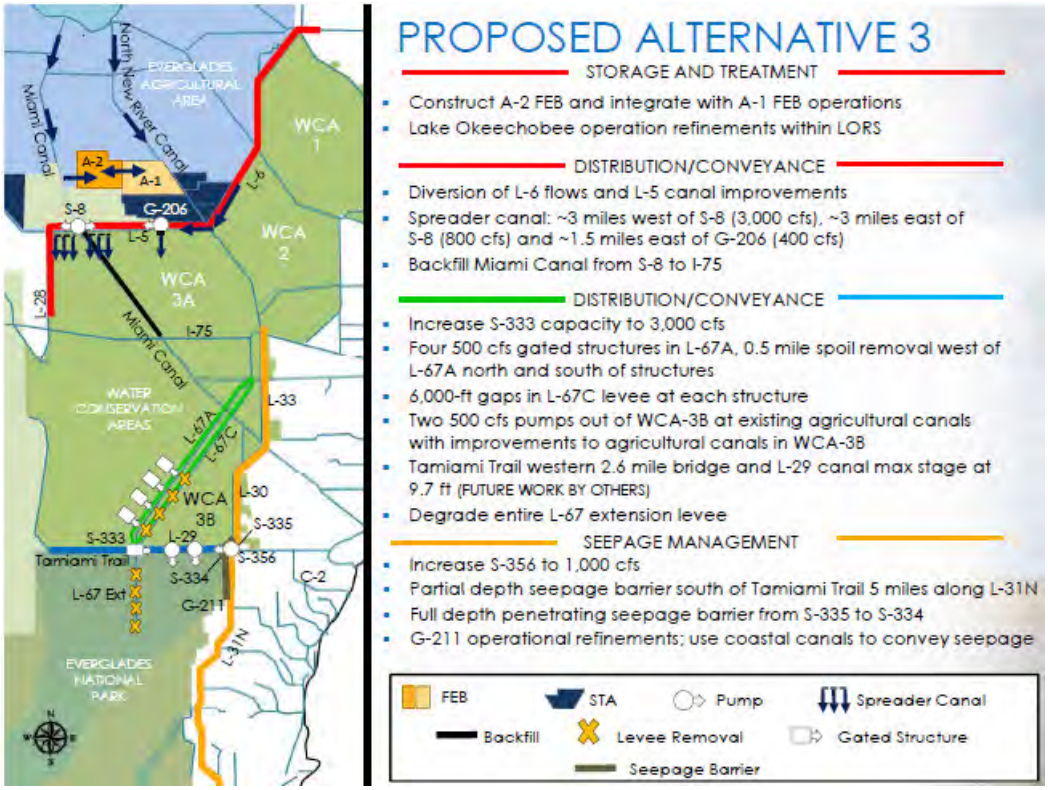

Figure A.4. Proposed alternative ALT3

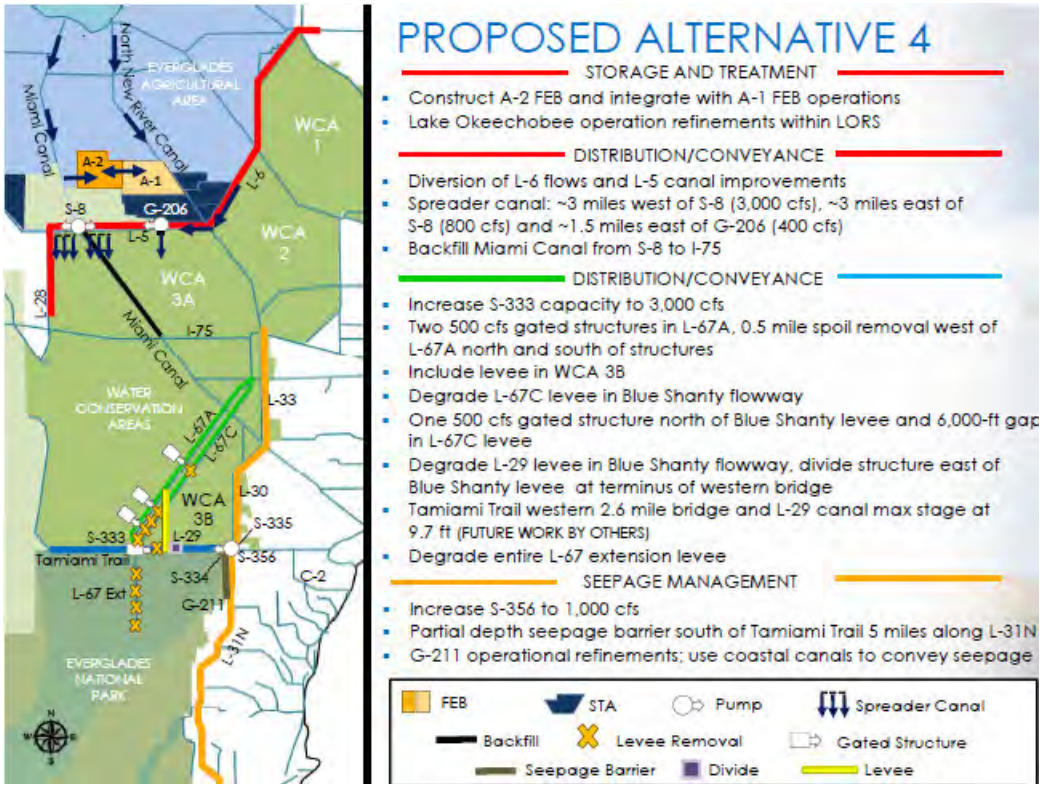

Figure A.5. Proposed alternative ALT4

Appendix B – LORS08 Operations Schedule and CEPP Schedule Modifications as Modeled

The LORS08 schedule used for operation of Lake Okeechobee in the CEPP baselines was modified as shown in **Figure B.1**. **Figures B.2 and B.3** show the pulse releases from Lake Okeechobee into the Caloosahatchee and St. Lucie Estuary, respectively.

Details of the final array model implementation of the schedule can be found in **Figures B.4, B.5 and B.6. Figure B.4** lists the range of values used to classify the tributary hydrologic conditions. **Figure B.5** lists the range of values used to classify the net inflow seasonal outlook. **Figure B.6** lists the range of values used to classify the net inflow multi-seasonal outlook.

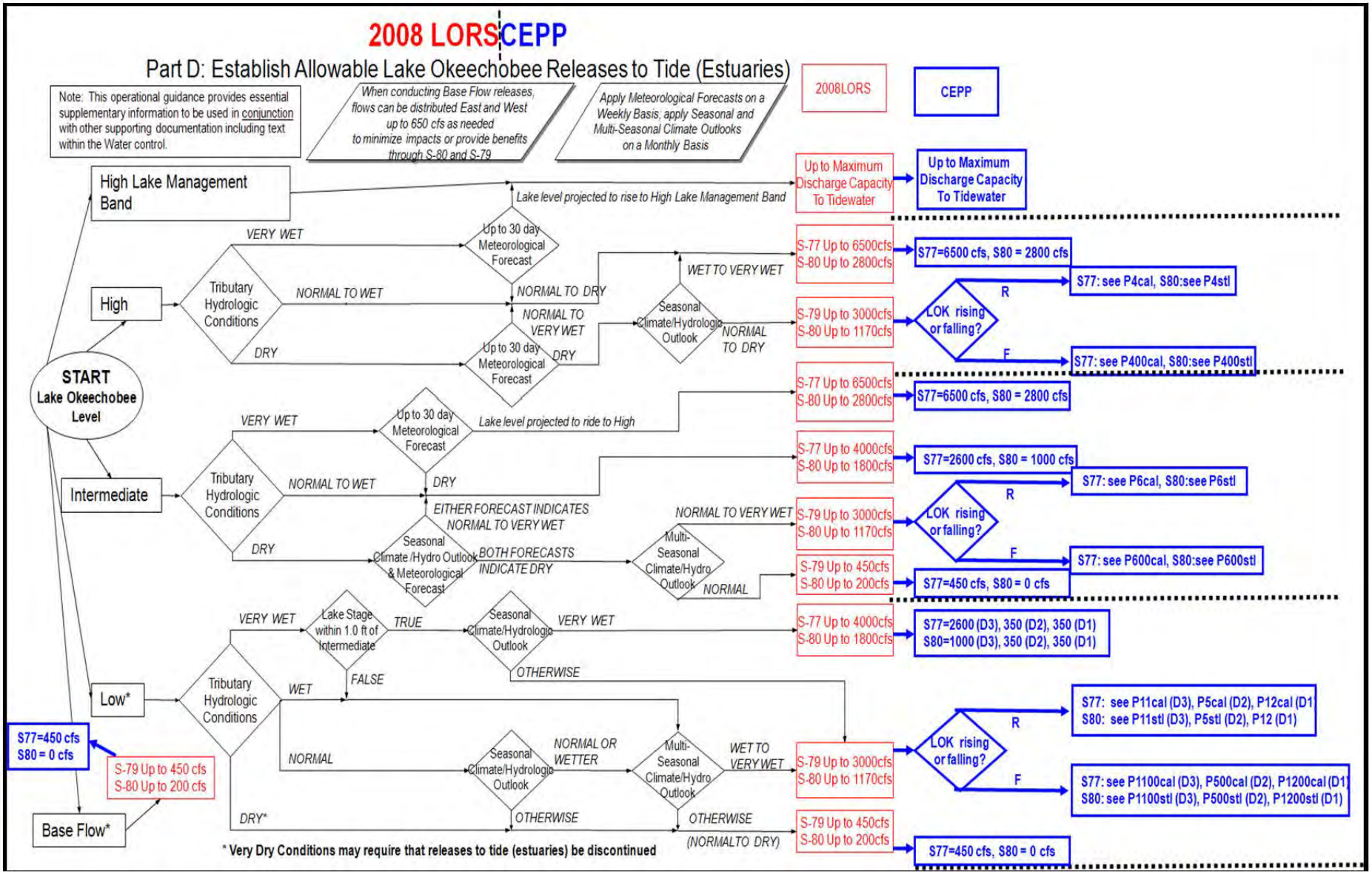

Figure B.1. LORS08 operations schedule, with CEPP final array modifications as modeled shown in blue.

	High		Intermediate		Low					
zone	A	A	B	B	D3	D3	D2	D2	D1	D1
	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling
Day of Pulse	P4cal	P400cal	P6cal	P600cal	P11cal	P1100cal	P5cal	P500cal	P12cal	P1200cal
1	500	125	840	504	125	125	850	850	504	504
2	1,375	343.75	1,920	1,152	344	344	2,200	2,200	1,152	1,152
3	1,625	406.25	2,220	1,332	406	406	2,600	2,600	1,332	1,332
4	1,250	312.50	1,680	1,008	313.50	313.50	2,000	2,000	1,008	1,008
5	1,000	250	1,440	864	250	250	1,600	1,600	864	864
6	750	187.50	1,140	684	188.50	188.50	1,200	1,200	684	684
7	500	125	960	576	125	125	850	850	576	576
8	250	62.50	720	432	62.50	62.50	500	500	432	432
9	125	31.25	540	324	31.25	31.25	350	350	324	324
10	125	31.25	540	324	31.25	31.25	350	350	324	324
Average Flow (cfs)	750	187.5	1200	720	187.7	187.7	1250	1250	720	720
Volume (ac-ft)	14,873	3,718	23,796	14,278	3,722	3,722	24,788	24,788	14,278	14,278
†equivalent depth (ft)	0.03	0.01	0.05	0.03	0.01	0.01	0.05	0.05	0.03	0.03

† : Volume to depth Conversion based on average Lake surface area of 467,000 acres.

Figure B.2. Pulse releases (as a function of lake level) from Lake Okeechobee into Caloosahatchee Estuary in cubic feet per second (cfs).

	High		Intermediate		Low					
zone	A	A	B	B	D3	D3	D2	D2	D1	D1
	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling
Day of Pulse	P4stl	P400stl	P6stl	P600stl	P11stl	P1100stl	P5stl	P500stl	P12stl	P1200stl
1	450	112.50	720	432	112.50	112.50	750	750	432	432
2	600	150	960	576	150	150	1,000	1,000	576	576
3	525	131.25	840	504	131.25	131.25	900	900	504	504
4	375	93.75	600	360	93.75	93.75	600	600	360	360
5	250	62.50	420	252	62.50	62.50	450	450	252	252
6	225	56.25	360	216	56.25	56.25	350	350	216	216
7	150	37.50	240	144	37.50	37.50	250	250	144	144
8	150	37.50	240	144	37.50	37.50	250	250	144	144
9	100	25	0	0	25	25	200	200	0	0
10	100	25	0	0	25	25	0	0	0	0
Average Flow (cfs)	292.5	73.1	438.0	262.8	73.1	73.1	475.0	475.0	262.8	262.8
Volume (ac-ft)	5,800	1,450	8,686	5,211	1,450	1,450	9,419	9,419	5,211	5,211
†equivalent depth (ft)	0.01	0.00	0.02	0.01	0.00	0.00	0.02	0.02	0.01	0.01

† : Volume to depth Conversion based on average Lake surface area of 467,000 acres.

Figure B.3. Pulse releases (as a function of lake level) from Lake Okeechobee into St. Lucie Estuary in cubic feet per second (cfs).

LORS2008

Classification of Lake Okeechobee Tributary Hydrologic Conditions

Palmer Index Class Limits	2-wk Mean LO Inflow Class Limit	Tributary Hydrologic Classification*
> 3.0	>= 6000 cfs	Very Wet
1.5 to 2.99	2500 - 5999 cfs	Wet
-1.49 to 1.49	500 - 2499 cfs	Near Normal
-2.99 to -1.5	-5000 - 500 cfs	Dry
-3.0 or less	< -5000 cfs	Very Dry

*use the wettest of the two indicators

CEPP-RSMBN

Classification of Lake Okeechobee Tributary Hydrologic Conditions

Palmer Index Class Limits	2-wk Mean LO Inflow Class Limit	Tributary Hydrologic Classification*
> 3.3	>= 8700 cfs	Very Wet
0.01 to 3.29	1000 - 8699 cfs	Wet
-0.5 to 0.0	500 - 999 cfs	Near Normal
NOT USED	-5000 - 500 cfs	Dry
NOT USED	< -5000 cfs	Very Dry

*use the wettest of the two indicators

Figure B.4. LORS08 and CEPP final array modified Tributary Hydrologic Conditions Classifications

LORS2008

Classification of Lake Okeechobee Net Inflow Seasonal Outlook**

Lake Net Inflow Prediction (million acre-feet) (Does not include ET)	Equivalent Depth (feet)	Lake Okeechobee Net Inflow Seasonal Outlook
> 0.93	> 2.0	Very Wet
0.71 to 0.93	1.51 to 2.0	Wet
0.35 to 0.70	0.75 to 1.5	Normal
< 0.35	< 0.75	Dry

**volume-depth conversion based on average lake surface area of 467,000 acres.

CEPP-RSMBN

Classification of Lake Okeechobee Net Inflow Seasonal Outlook**

Lake Net Inflow Prediction (million acre-feet) (Does include ET)	Equivalent Depth (feet)	Lake Okeechobee Net Inflow Seasonal Outlook
> 1.43	> 3.06	Very Wet
0.91 to 1.43	1.93 to 3.06	Wet
0.46 to 0.90	0.98 to 1.92	Normal
< 0.46	< 0.98	Dry

**volume-depth conversion based on average lake surface area of 467,000 acres.

Figure B.5. LORS08 and CEPP final array modified Seasonal Outlook Classifications

LORS2008

Classification of Lake Okeechobee Net Inflow Multi-Seasonal Outlook**

Lake Net Inflow Prediction (million acre-feet) (Does not include ET)	Equivalent Depth (feet)	Lake Okeechobee Net Inflow Multi-Seasonal Outlook
> 2.0	> 4.3	Very Wet
1.18 to 2.0	2.51 to 4.3	Wet
0.5 to 1.17	1.1 to 2.5	Normal
< 0.5	< 1.1	Dry

**volume-depth conversion based on average lake surface area of 467,000 acres.

CEPP-RSMBN

Classification of Lake Okeechobee Net Inflow Multi-Seasonal Outlook**

Lake Net Inflow Prediction (million acre-feet) (Does include ET)	Equivalent Depth (feet)	Lake Okeechobee Net Inflow Multi-Seasonal Outlook
NOT USED	> 4.3	Very Wet
> 1.17	> 2.5	Wet
0.6 to 1.17	1.3 to 2.5	Normal
< 0.6	< 1.3	Dry

**volume-depth conversion based on average lake surface area of 467,000 acres.

Figure B.6. LORS08 and CEPP final array modified Multi-Seasonal Outlook Classifications.

Appendix C – Structure Operations in South Miami-Dade County for CEPP Final Array Runs

In **Table C.1**, the list of structures is color-coded in three groupings:

green	Structures on the L-67, L-28, and L-29 canals. Structures included are S-345, S-349, S-344, S-343A-B, S-12A-D, S-333, S-334, S-355, and S-356
blue	Structures on the L-30 and part of the L-31 canals Structures included are S-337, S-151, S-335, S-338, G-211, S-173 & S-331P (COMBQ), S-176 and S-174
yellow	Structures on part of the L-31 canal and L-31W and C-111 canals Structures included are S-332A-D, S-357, S-332, S-175, S-200, S-199, S-177, S-18C, S-197 and S-332E

Table C.1 includes final array alternatives ALT1, ALT2, ALT3, and ALT4.

Table C.1. Final Array Alternatives (ALT1, ALT2, ALT3, ALT4)

Canal	Structure	**ALT1 (RSMGL)**	**ALT2 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-67	S-345*	S345E (physical model) gated spillway at L-67A Design Q= 750 cfs flood control only	S345E (physical model) gated spillway at L-67A Design Q= 750 cfs flood control only S345D & S345F 2 gated spillway at L-67A Design Q= 500 cfs each flood control only
	S-349*	Non-existent	Non-existent
L-28	S-344*	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15 2)flood control only	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15 2)flood control only
	S-343A-B*	Special code 1) Closed Nov 1- Jul15 2) flood control only 3)S343A&B- Design Q= 200 cfs each	Special code 1) Closed Nov 1- Jul15 2) flood control only 3)S343A&B- Design Q= 200 cfs each
L-29	S-12A-D*	per ERTP S12A closed Nov 1 to Jul 31; S12B closed Jan 1 to Jul 31; S12C no closure dates. S12D no closure dates. Special code 1) S12s = 8000 cfs per structure. 2) Each structure modeled individually. 3) Each Structure is a spillway 4) Flood Control only	per ERTP S12A closed Nov 1 to Jul 31; S12B closed Jan 1 to Jul 31; S12C no closure dates. S12D no closure dates. Special code 1) S12s = 8000 cfs per structure. 2) Each structure modeled individually. 3) Each Structure is a spillway 4) Flood Control only
	S-333*	Special code 1) L-29 canal max stage of 9.7 Wet/Dry 2) Design Q=3000 cfs 3) G-3273 stage constraint of 9.5 4) Flood Control only	Special code 1) L-29 canal max stage of 9.7 Wet/Dry 2) Design Q=3000 cfs 3) G-3273 stage constraint of 9.5 4) Flood Control only
	S-334	Non-existent No IOP wraparound operations. So, no flow through S334	Non-existent No IOP wraparound operations. So, no flow through S334
	S-355*	Special code 1) S355 A and B Modeled Design Q = 1000 cfs each, 2) L-29 Max stage of 9.7 3) Flood control only 4)G-3273 stage constraint of 9.5	Special code 1) S355 A and B Modeled Design Q = 1000 cfs each, 2) L-29 Max stage of 9.7 3) Flood control only 4)G-3273 stage constraint of 9.5
	S-356*	**6.0 / 5.5** open/closed wet & dry season 1) Design Q = 1000 cfs 2) Flood control only	**6.0 / 5.5** open/closed wet & dry season 1) Design Q = 1000 cfs 2) Flood control only

Canal	Structure	ALT3 (RSMGL)	ALT4 (RSMGL)
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-67	S-345*	S345C, S345D, S345E &S345F 4 gated spillways at L-67A Design Q= 500 cfs each flood control only	S345D, S345F &S345G 3 gated spillways at L-67A Design Q= 500 cfs each flood control only
	S-349*	Non-existent	Non-existent
L-28	S-344*	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15 2)flood control only	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15 2)flood control only
	S-343A-B*	Special code 1) Closed Nov 1- Jul15 2) flood control only 3)S343A&B- Design Q= 200 cfs each	Special code 1) Closed Nov 1- Jul15 2) flood control only 3)S343A&B- Design Q= 200 cfs each
L-29	S-12A-D*	per ERTP S12A closed Nov 1 to Jul 31; S12B closed Jan 1 to Jul 31; S12C no closure dates. S12D no closure dates. Special code 1) S12s = 8000 cfs per structure. 2) Each structure modeled individually. 3) Each Structure is a spillway 4) Flood Control only	per ERTP S12A closed Nov 1 to Jul 31; S12B closed Jan 1 to Jul 31; S12C no closure dates. S12D no closure dates. Special code 1) S12s = 8000 cfs per structure. 2) Each structure modeled individually. 3) Each Structure is a spillway 4) Flood Control only
	S-333*	Special code 1) L-29 canal max stage of 9.7 Wet/Dry 2) Design Q=3000 cfs 3) G-3273 stage constraint of 9.5 4) Flood Control only	Special code 1) L-29 canal max stage of 9.7 Wet/Dry 2) Design Q=3000 cfs 3) G-3273 stage constraint of 9.5 4) Flood Control only
	S-334	Non-existent No IOP wraparound operations. So, no flow through S334	Non-existent No IOP wraparound operations. So, no flow through S334
	S-355*	Special code 1) S355 A and B Modeled Design Q = 1000 cfs each, 2) L-29 Max stage of 9.7 3) Flood control only 4)G-3273 stage constraint of 9.5	Special code 1) S355 A and B Modeled Design Q = 1000 cfs each, 2) L-29 Max stage of 9.7 3) Flood control only 4)G-3273 stage constraint of 9.5
	S-356*	**6.0/5.5** open/closed wet & dry season 1) Design Q = 1000 cfs 2) Flood control only	**6.0/5.5** open/closed wet & dry season 1) Design Q = 1000 cfs 2) Flood control only

Canal	Structure	ALT1 (RSMGL)	ALT2 (RSMGL)
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-30	S337	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)
		mse_unit inlet L30; L30 localLevel=7.0 mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_ECB.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml	mse_unit inlet L30; L30 localLevel=7.0 mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_ECB.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml
	S-151*	Flow target based on WCA-3A regulation schedule 1) Water Supply / Flood Control 2) Design Q=1800 cfs (discharge coef. = 1154.48 in msestruc*.xml) mse_unit outlet for WCA-3A; "WCA3A local" localLevel = 7.5 mse_unit inlet C-304; C304 localLevel=99.0 Special Code for S151: S151_reg_max_zoneA=1000 (input variable Special_Assessors_ECB.so) S151_reg_max_zoneBC=500 (input variable Special_Assessors_ECB.so) S151_TWi & S151_HWi (input variable Special_Assessors_ECB.so) S151_FracGO & S151_FracGo_high & S151_FracGo_low variable output maxfracS12s xml	Flow target based on WCA-3A regulation schedule 1) Water Supply / Flood Control 2) Design Q=1800 cfs (discharge coef. = 1154.48 in msestruc*.xml) mse_unit outlet for WCA-3A; "WCA3A local" localLevel = 7.5 mse_unit inlet C-304; C304 localLevel=99.0 Special Code for S151: S151_reg_max_zoneA=1000 (input variable Special_Assessors_ECB.so) S151_reg_max_zoneBC=500 (input variable Special_Assessors_ECB.so) S151_TWi & S151_HWi (input variable Special_Assessors_ECB.so) S151_FracGO & S151_FracGo_high & S151_FracGo_low variable output maxfracS12s xml
	S-335	**7.6/ 7.4** open/closed wet &dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 localLevel=7.0 mse_unit inlet for L31NC; localLevel=99.0	**7.5/ 7.2** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 localLevel=7.0 mse_unit inlet for L31NC; localLevel=99.0

Canal	Structure	ALT3 (RSMGL)	ALT4 (RSMGL)
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-30	S337	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)
		mse_unit inlet L30; L30 localLevel=7.0 mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_ECB.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml	mse_unit inlet L30; L30 localLevel=7.0 mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_ECB.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml
	S-151*	Flow target based on WCA-3A regulation schedule 1) Water Supply / Flood Control 2) Design Q=1800 cfs (discharge coef. = 1154.48 in msestruc*.xml) mse_unit outlet for WCA-3A; "WCA3A local" localLevel = 7.5 mse_unit inlet C-304; C304 localLevel=99.0 Special Code for S151: S151_reg_max_zoneA=1000 (input variable Special_Assessors_ECB.so) S151_reg_max_zoneBC=500 (input variable Special_Assessors_ECB.so) S151_TWi & S151_HWi (input variable Special_Assessors_ECB.so) S151_FracGO & S151_FracGo_high & S151_FracGo_low variable output maxfracS12s xml	Flow target based on WCA-3A regulation schedule 1) Water Supply / Flood Control 2) Design Q=1800 cfs (discharge coef. = 1154.48 in msestruc*.xml) mse_unit outlet for WCA-3A; "WCA3A local" localLevel = 7.5 mse_unit inlet C-304; C304 localLevel=99.0 Special Code for S151: S151_reg_max_zoneA=1000 (input variable Special_Assessors_ECB.so) S151_reg_max_zoneBC=500 (input variable Special_Assessors_ECB.so) S151_TWi & S151_HWi (input variable Special_Assessors_ECB.so) S151_FracGO & S151_FracGo_high & S151_FracGo_low variable output maxfracS12s xml
	S-335	**7.6 / 7.4** open/closed wet &dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 localLevel=7.0 mse_unit inlet for L31NC; localLevel=99.0	**7.6 / 7.4** open/closed wet &dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 localLevel=7.0 mse_unit inlet for L31NC; localLevel=99.0

Canal	Structure	**ALT1 (RSMGL)**	**ALT2 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N	S-338	**5.8 / 5.5** open/closed wet season **5.6 / 5.4** open/closed dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0 mse_unit inlet for L31NC; localLevel=99.0	**5.8 / 5.5** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0 mse_unit inlet for L31NC; localLevel=99.0
	G-211	**6.0 / 5.5** open/closed wet & dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply / Flood Control 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N; L31N localLevel=99.0 no rulecurve	**6.0 / 5.5** open/closed wet & dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply / Flood Control 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N; L31N localLevel=99.0 no rulecurve
	S-173 & S-331P (COMBQ) *	1) Water Supply / Flood Control 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.	1) Water Supply / Flood Control 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.

Canal	Structure	ALT3 (RSMGL)	ALT4 (RSMGL)
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N	S-338	**5.8 / 5.5** open/closed wet & dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0 mse_unit inlet for L31NC; localLevel=99.0	**5.8 /5.5** open/closed wet season **5.6 /5.4** open/closed dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0 mse_unit inlet for L31NC; localLevel=99.0
	G-211	**6.0 / 5.5** open/closed wet & dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply / Flood Control 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N; L31N localLevel=99.0 no rulecurve	**6.0 / 5.5** open/closed wet & dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply / Flood Control 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N; L31N localLevel=99.0 no rulecurve
	S-173 & S-331P (COMBQ) *	1) Water Supply / Flood Control 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.	1) Water Supply / Flood Control 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.

Canal	Structure	ALT1 (RSMGL)	ALT2 (RSMGL)
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N (cont)	S-173 & S-331P (COMBQ) * (cont)	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations
	S-176	**5.0 / 4.75** open/closed wet & dry season 1) Water Supply / Flood Control 2) design Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)	**5.0 / 4.75** open/closed wet & dry season 1) Water Supply / Flood Control 2) design Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)
	S-174*	S174 not in model; canal is blocked near structure	S174 not in model; canal is blocked near structure

Canal	Structure	ALT3 (RSMGL)	ALT4 (RSMGL)
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N (cont)	S-173 & S-331P (COMBQ) * (cont)	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations
	S-176	**5.0 / 4.75** open/closed wet & dry season 1) Water Supply / Flood Control 2) design Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)	**5.0 / 4.75** open/closed wet & dry season 1) Water Supply / Flood Control 2) design Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)
	S-174*	S174 not in model; canal is blocked near structure	S174 not in model; canal is blocked near structure

Canal	Structure	ALT1 (RSMGL)		ALT2 (RSMGL)	
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	
L-31N (cont)	S-332A, B,C,D (pumps)	S332A Non-Existent S332B (5.0 Dec 1-Jul15, 4.9 Jul16-Nov30)/4.7 S332BN (5.0 Dec 1-Jul15, 4.9 Jul16-Nov30)/4.7 S332C (5.0 Dec 1-Jul15, 4.9 Jul16-Nov30)/4.7 S332D 4.85/4.65	S332A Non-Existent S332B (5.0 Dec 1-Jul15, 4.9 Jul16-Nov30)/4.7 S332BN (5.0 Dec 1-Jul15, 4.9 Jul16-Nov30)/4.7 S332C (5.0 Dec 1-Jul15, 4.9 Jul16-Nov30)/4.7 S332D 4.85/4.65	S332A non-existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A non-existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65
		S332A =300 cfs S332B =325 cfs S332BN =250cfs S332C = 575 cfs S332D = 500 cfs Jul16-Nov30, 325cfs Dec 1-Jan31, 165cfs Feb 1-Jul15 All Flood Control		S332A =300 cfs S332B =325 cfs S332BN =250cfs S332C = 575 cfs S332D = 500 cfs Jul16-Nov30, 325cfs Dec 1-Jan31, 165cfs Feb 1-Jul15 All Flood Control	
	S-357 (pump)	S357A (5.7' Nov 1-May31, 5.2' Jun1-Oct31)/(5.4' Nov 1-May31, 4.9' Jun1-Oct31) S357B (6.0' Nov 1-May31, 5.5' Jun1-Oct31)/(5.7' Nov 1-May31, 5.2' Jun1-Oct31) S357A = 250 cfs S357B = 250 cfs		S357A (5.7' Nov 1-May31, 5.2' Jun1-Oct31)/(5.4' Nov 1-May31, 4.9' Jun1-Oct31) S357B (6.0' Nov 1-May31, 5.5' Jun1-Oct31)/(5.7' Nov 1-May31, 5.2' Jun1-Oct31) S357A = 250 cfs S357B = 250 cfs	
L-31W	S-332 (pumps)*	Non-existent		Non-existent	
	S-175	Non-existent		Non-existent	
C-111	S-200	S-200A=75cfs; **3.8 / 3.6** S-200B=75cfs; **3.9 / 3.6** S-200C=75cfs; **4.0 / 3.6**		S-200A=75cfs; **3.8 / 3.6** S-200B=75cfs; **3.9 / 3.6** S-200C=75cfs; **4.0 / 3.6**	
	S-199	S-200A=75cfs; **3.8 / 3.6** S-200B=75cfs; **3.9 / 3.6** S-200C=75cfs; **4.0 / 3.6**		S-200A=75cfs; **3.8 / 3.6** S-200B=75cfs; **3.9 / 3.6** S-200C=75cfs; **4.0 / 3.6**	
	S-177	**4.2 / 3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.		**4.2 / 3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.	
	S-18C	**2.6 / 2.3** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.		**2.6 / 2.3** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.	
	S-197*	****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.		****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.	
	S-332E (pump)	Non-existent		Non-existent	

* SFWMM uses special code. Open/Close may or may not be used in operations.

**** S-197 Ops: Open 3 gates if S-177 full open & S-177>4.1 ft or S-18C> 2.8 ft
Open 7 gates if S-177 > 4.2 ft for 24 hrs or S-18C > 3.1 ft
Open 13 gates if S-177 > 4.3 ft or S-18C > 3.3 ft
Close when all the conditions below are met

1) S-176 < 5.2 ft and S-177 < 4.2 ft
2) Storm moved away from basin
3) After 1 and 2 are met, keep the number of S-197 culverts open necessary only to match residual flow through S-176

Canal	Structure	ALT3 (RSMGL)		ALT4 (RSMGL)	
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	
L-31N (cont)	S-332A, B,C,D (pumps)	S332A non-existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A non-existent S332B 5.0/4.7 S332BN 5.0/4.7 S332C 5.0/4.7 S332D 4.85/4.65	S332A Non-Existent S332B (5.0 Dec 1-Jul15, 4.9 Jul16-Nov30)/4.7 S332BN (5.0 Dec 1-Jul15, 4.9 Jul16-Nov30)/4.7 S332C (5.0 Dec 1-Jul15, 4.9 Jul16-Nov30)/4.7 S332D 4.85/4.65	S332A Non-Existent S332B (5.0 Dec 1-Jul15, 4.9 Jul16-Nov30)/4.7 S332BN (5.0 Dec 1-Jul15, 4.9 Jul16-Nov30)/4.7 S332C (5.0 Dec 1-Jul15, 4.9 Jul16-Nov30)/4.7 S332D 4.85/4.65
		S332A =300 cfs S332B =325 cfs S332BN =250cfs S332C = 575 cfs S332D = 500 cfs Jul16-Nov30, 325cfs Dec 1-Jan31, 165cfs Feb 1-Jul15 All Flood Control		S332A =300 cfs S332B =325 cfs S332BN =250cfs S332C = 575 cfs S332D = 500 cfs Jul16-Nov30, 325cfs Dec 1-Jan31, 165cfs Feb 1-Jul15 All Flood Control	
	S-357 (pump)	S357A (5.7' Nov 1-May31, 5.2' Jun1-Oct31)/(5.4' Nov 1-May31, 4.9' Jun1-Oct31) S357B (6.0' Nov 1-May31, 5.5' Jun1-Oct31)/(5.7' Nov 1-May31, 5.2' Jun1-Oct31) S357A = 250 cfs S357B = 250 cfs		S357A (5.7' Nov 1-May31, 5.2' Jun1-Oct31)/(5.4' Nov 1-May31, 4.9' Jun1-Oct31) S357B (6.0' Nov 1-May31, 5.5' Jun1-Oct31)/(5.7' Nov 1-May31, 5.2' Jun1-Oct31) S357A = 250 cfs S357B = 250 cfs	
L-31W	S-332 (pumps)*	Non-existent		Non-existent	
	S-175	Non-existent		Non-existent	
C-111	S-200	S-200A=75cfs; **3.8/3.6** S-200B=75cfs; **3.9/3.6** S-200C=75cfs; **4.0/3.6**		S-200A=75cfs; **3.8/3.6** S-200B=75cfs; **3.9/3.6** S-200C=75cfs; **4.0/3.6**	
	S-199	S-200A=75cfs; **3.8/3.6** S-200B=75cfs; **3.9/3.6** S-200C=75cfs; **4.0/3.6**		S-200A=75cfs; **3.8/3.6** S-200B=75cfs; **3.9/3.6** S-200C=75cfs; **4.0/3.6**	
	S-177	**4.2/3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.		**4.2/3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.	
	S-18C	**2.6 / 2.3** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.		**2.6 / 2.3** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.	
	S-197*	****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.		****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.	
	S-332E (pump)	Non-existent		Non-existent	

* SFWMM uses special code. Open/Close may or may not be used in operations.

**** S-197 Ops: Open 3 gates if S-177 full open & S-177>4.1 ft or S-18C> 2.8 ft
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1) S-176 < 5.2 ft and S-177 < 4.2 ft
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3) After 1 and 2 are met, keep the number of S-197 culverts open necessary only to match residual flow through S-176

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Central Everglades Planning Project (CEPP) Tentatively Selected Plan Model Documentation Report

IMC MSR 368 **February 14, 2014**

1.0 Overview

Identification

The Central Everglades Planning Project (CEPP) is an expedited planning effort undertaken as part of the overall Comprehensive Everglades Restoration Plan (CERP), a program led by the United States Army Corps of Engineers (USACE) with the South Florida Water Management District (SFWMD) as local sponsor. The project worked throughout 2012 and 2013 to develop a Project Implementation Report (PIR) that combines planning and design activities for three primary areas of interest in the south Flroida system as follows: 1) Storage & water treatment facilities in the Everglades Agricultural Area, 2) Decompartmentalization of levees within the Everglades Protection Area (EPA) and 3) Levee seepage management features along the Everglades / urban boundary in southeastern Florida. Modeling support to the CEPP effort was provided by a team comprised of modelers from the Hydrologic & Environmental Systems Modeling Section of the SFWMD and the Interagency Modeling Center (IMC), with direct support also provided by the USACE and Everglades National Park of the Department of the Interior (DOI). Modeling workflow and coordination were performed in a manner consistent with the procedures outlined in IMC Modeling Services Request (MSR) 368 and the CEPP Modeling Strategy (**SFWMD, 2012a**).

Scope and Objectives

Modeling support for CEPP focused on working with the larger project planning team and other interested parties to formulate and test project features leading to the ultimate identification and refinement of a tentatively selected plan (TSP). Modeling products were developed at the appropriate level of detail to support feature screening and detailed representation of project features and to provide information to all necessary evaluations required for plan development and documentation in the PIR. The project plan formulation framework is shown in **Figure 1.1** and illustrates a spatially determined workflow (moving north to south through the south Florida system) utilizing initial screening followed by detailed evaluation to identify final project planning alternatives and ultimately a TSP for the effort.

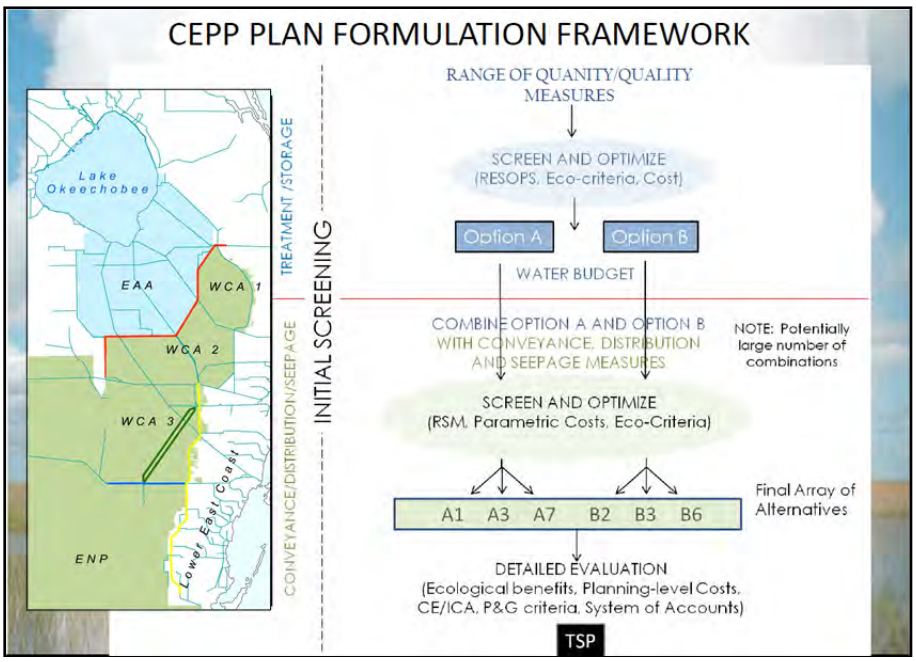

Figure 1.1. Central Everglades Planning Project Plan Formulation Framework

The CEPP Modeling Strategy document (**SFWMD, 2012a**) describes the modeling process and tools utilized, the associated rationale of the selection process and the means by which the tools could expediently support the project workflow. The primary model support tools utilized in CEPP are as follows:

Screening Tools:

- REservoir Sizing and OPerations Screening (RESOPS)
- Lake Okeechobee OPerations Screening (LOOPS)
- C-43 Spreadsheet Model
- iModel©

Detailed Planning Models:

- Regional Simulation Model Basins (RSMBN)
- Regional Simulation Model Glades-LECSA (RSMGL)
- Dynamic Model for Stormwater Treatment Areas (DMSTA)

From a modeling deliverable perspective, the entirety of the CEPP modeling support can be summarized by reviewing the following four Model Documentation Reports (MDRs):

1. CEPP Baseline Runs – Reviews the various non-CEPP model representations (e.g. current and future without project conditions) used in various aspects of the project planning. (**SFWMD & IMC, 2014a**)
2. CEPP Final Array of Alternatives – Reviews four proposed with-CEPP project model representations examined during plan formation (**SFWMD & IMC, 2014b**)
3. CEPP Tentatively Selected Plan – Reviews the model representation of the CEPP TSP and subsequent refinements during final plan formulation and project assurance planning (this document).
4. CEPP Model Supported Screening Efforts – Reviews the various model-supported feature screening efforts undertaken at various points in the planning process. (**SFWMD & IMC, 2014d**)

This Tentatively Selected Plan MDR describes the assumptions, model implementation steps and observed outcomes associated with the initial representation and subsequent refinement of the CEPP TSP. These model runs were predominantly used by the CEPP project team as the with-project plan representation compared back to various project baselines for various purposes. This document will focus on the modeling details of these scenarios; information on the use and rationale for the definition of these conditions is contained in the CEPP PIR (**USACE, 2013b**).

2.0 Basis

Project Assumptions

This Tentatively Selected Plan MDR describes the assumptions, model implementation steps and observed outcomes associated with modeling the following scenarios:

CEPP Initial Tentatively Selected Plan - released 2/28/2013
- 2050 Future With Project Alternative 4R (ALT4R)

CEPP Tentatively Selected Plan Sensitivity Run - released 6/25/2013
- 2050 Future With Project Alternative 4R1 (ALT4R1)

CEPP Final Tentatively Selected Plan - released 6/25/2013
- 2050 Future With Project Alternative 4R2 (ALT4R2)

The three TSP runs were identified and produced sequentially with the following high level intent:

1. ALT4R was developed as an initial representation of the project TSP incorporating all decisions from the final array analysis and plan formulation into one modeling scenario. From a modeling perspective, this scenario combined elements of the previously modeled ALTS RSMBN scenario and ALT1 (for northern and western WCA3A areas) & ALT4 (for other Greater Everglades areas) RSMGL scenarios with additional operational objectives to improve natural, developed and agricultural system performance beyond that observed in the final array. The CEPP project team identified a series of infrastructure changes relative to the FWO Baseline ALT4R as shown in **Figure 2.1**. In addition to the physical changes identified in the figure, the project team also identified a series of performance objectives to help guide operational decision making. These objectives largely remained the same as those utilized in the CEPP Final Array (**SFWMD, 2014b**), but final TSP modeling also sought additional improvement in areas where performance shortfalls were identified as follows:
    - Attempt to reduce water supply cutbacks in the Lake Okeechobee Service Area in particular for water year 2001, the worst drought in the simulation period, relative to ECB.
    - Maintain stages in WCA2B and adjacent LEC areas closer to ECB. Potentially, decrease the magnitude of L6 diversion operations
    - Increase stages in WCA3B (which in ALT4 were lower than ECB) and adjacent Pennsuco & LEC areas.
    - Reduce the impact of the assumed ENP seepage wall adjacent to the L31N canal which in ALT4 was resulting in significant reduction in groundwater entering the LEC and consequently lower stages and reduced flow to Biscayne Bay.

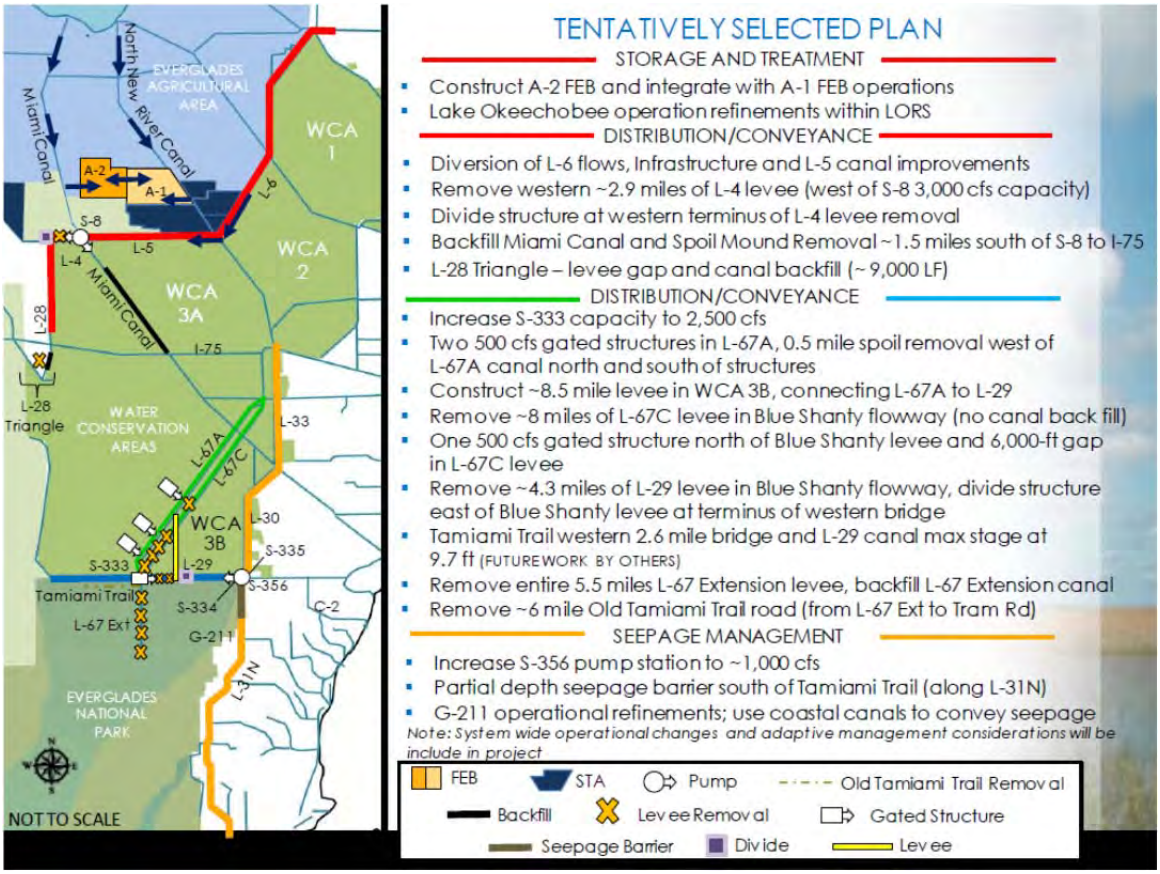

Figure 2.1. Generalized view of infrastructure changes modeled for alternative ALT4R

2. Building upon ALT4R, ALT4R1 was developed as a model sensitivity scenario to incorporate the following TSP changes:
   - Incorporate changes made in the IORBL1 baseline scenario (**SFWMD, 2014a**)
   - Project assumed modifications to infrastructure, namely the removal of the L28 project features and refined information related to the western hydropattern restoration feature. These changes relative to the FWO Baseline are shown in **Figure 2.2**.
   - Test the model response to additional assumed Lower East Coast surficial aquifer municipal pumping as provided by the project and shown in **Figure 2.3**.

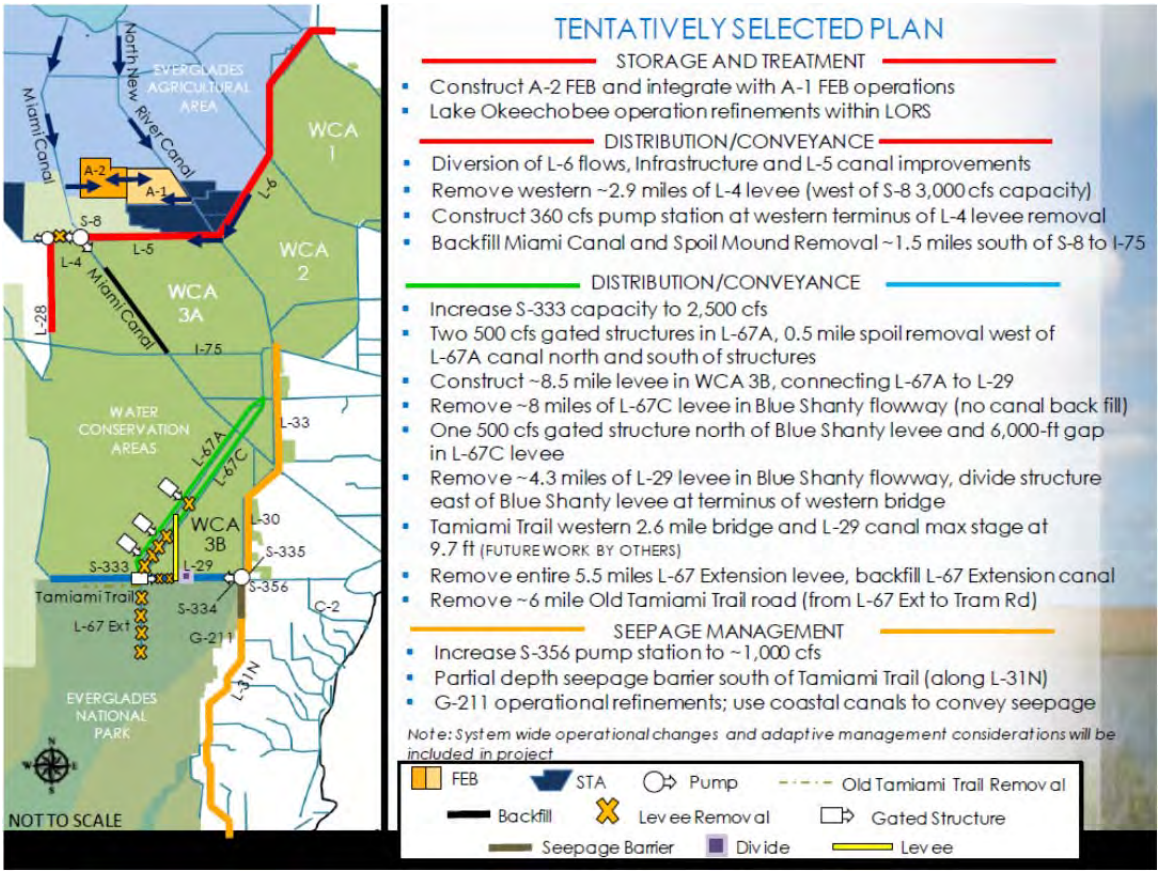

Figure 2.2. Generalized view of infrastructure changes modeled for alternatives ALT4R1 and ALT4R2

	IORBL1*	ALT4R1	
	CEPP Current ~2030	CEPP Proposed ~2050	Restudy 2050 w/ conservation
		MGD	
NPBSA	48	48	66
LECSA1	259	259	280
LECSA2	277	295	295
LECSA3	412	465	562
Total	996	1067	1203

Considers demands on surficial aquifer system only

Note: IORBL1 demand are the same as other CEPP runs to date including ECB, FWO, all ALT runs, 2012EC and IORBL

Figure 2.3. Assumed Lower East Coast surficial aquifer municipal pumping as provided by the project (CEPP Proposed 2050) for ALT4R1

3. ALT4R2 was the final representation of the CEPP TSP. No infrastructure changes were included in ALT4R2 relative to ALT4R1. The magnitude of Lower East Coast municipal pumping was reduced iteratively relative to ALT4R1 to minimize regional impacts and overall system operational refinement continued with the same objectives as those outlined for ALT4R.

The modeling team in implementing the RSM scenarios relied heavily on the outcomes of the screening and optimization steps summarized in the CEPP Model Supported Screening Efforts MDR (**SFWMD, 2014d**). Completion of these scenarios within the expedited project schedule would not have been possible without extensive use of iModel©, LOOPs and other tools to inform operational guidance prior to detailed modeling.

Detailed project assumption tables for all three scenarios are provided in **Appendix A** and key elements of model implementation are described in Section 3.

Model Limitations and Intended Use of Results

The primary modeling products of CEPP were evaluated based on outputs from the Regional Simulation Model (RSM (**SFWMD, 2005a** and **2005b**). The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g., use available input-driven options to represent more complex project operations).

The RSMBN, RSMGL (**SFWMD, 2010** and **2011**), and DMSTA (**Walker & Kadlec, 2005**; **Wang, 2012**) models were reviewed through the USACE validation process for engineering software, as part of the CEPP project. The RSM and DMSTA models were classified as “allowed for use” for South Florida applications in August 2012 and January 2013, respectively. Additionally, the RESOPS (**SFWMD, 2009**), LOOPS (Neidrauer et al, 2006), and C-43 spreadsheet model (**Starnes & Marlowe, 2007**) tools and the iModel© optimization tool (**Ali, 2009**) used in CEPP underwent USACE Agency Technical Review (ATR). Approval of these modeling tools for CEPP application was completed in November, 2012.

3.0 Simulation

Modeling Tools Used

RSM version 2.3.5 was used to run both the RSMBN and RSMGL models.
Release date 12/6/2012, SVN Version #4730.

Model Set Up

The CEPP TSP scenarios were developed using the RSMBN and RSMGL models. Collectively, these two models cover the spatial extent of the project planning area as shown in **Figure 3.1**. The RSMBN modeling for the TSP scenarios was built upon the CEPP ALTS final array representation. The RSMGL modeling for the final array was built upon a combination of the CEPP ALT1 & ALT4 final array representations. The period of simulation for both models utilizes a climate record from 1965 to 2005. Details about project rationale for defining these scenarios can be found in the CEPP PIR.

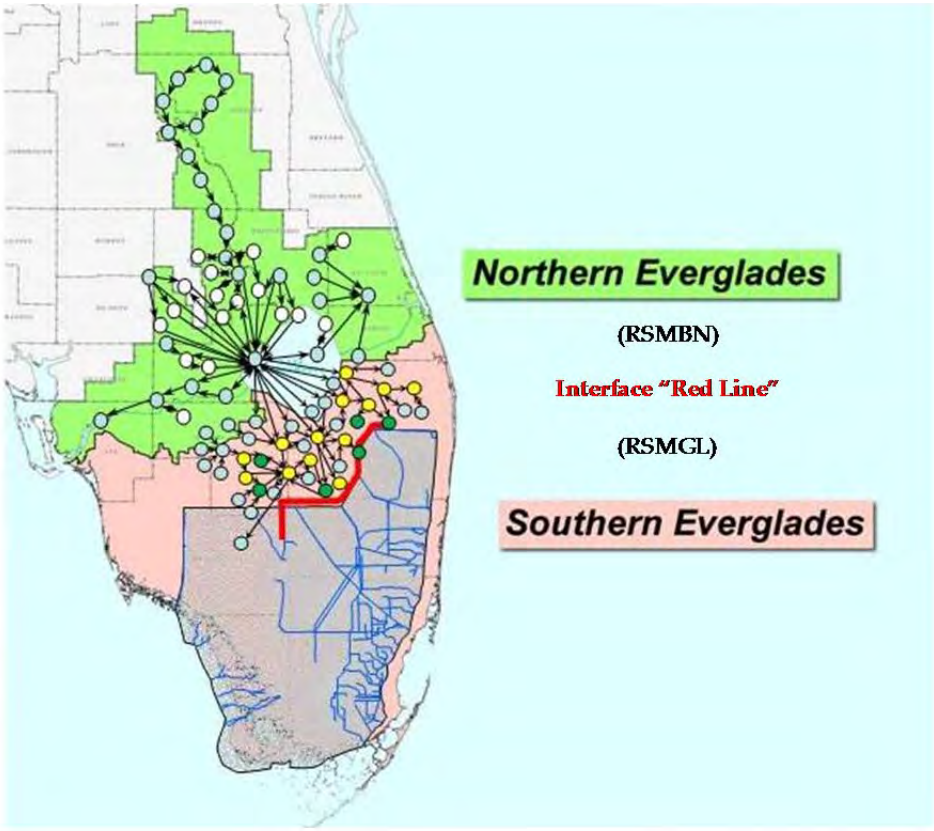

Figure 3.1. Decoupled CEPP Modeling Approach

RSMBN and RSMGL ALT4R Scenario

For ALT4R, modifications to system infrastructure relative to the FWO baseline are shown in **Figure 3.2**. Specific modeling details related to these elements are listed below. Operational intent for this scenario is generally consistent with that previously identified for the ALTS, ALT1 or ALT4 Final Array runs, unless otherwise described. Specific operational criteria may also be referenced in **Appendix C** for the South Dade area or in the assumption table in **Appendix A**.

- Water in the C44 reservoir is discharged and allowed to backflow to Lake Okeechobee when the Lake is below the baseflow zone. Environmental targets for the St Lucie Estuary are met from the reservoir prior to implementing this operation. C44 basin backflow is allowed when Lake stages are below 14.5 ft (this is a change from the baseline that assumes that backflow is allowed when Lake stages are lower than 0.25 feet below the low subband).
- For RSMBN, the FEB inflows and outflows are used to help meet established targets (improved model representation relative to ALTS scenario), as estimated using the Dynamic Model for Stormwater Treatment Areas (**Wang, 2012**) at STA-3/4, STA-2N, and STA-2S
- Western Hydropattern Restoration Feature (HRF) not modeled as a canal within the model domain but with boundary inflows into the three edge cells west of S8. No Central and Eastern HRF.
- Breaches across L28 levee modeled as weirs connecting two pairs of mesh cells between the L28 triangle south of Alligator Alley and WCA3A (9000 ft total length)
- One canal segment in L28 canal reach disabled to represent backfill of a portion of the L28 canal within the L28 triangle area
- Miami Canal removed from Alligator Alley to S8 structure
- S356 design capacity changed from 500 cfs to 1000 cfs
- Three S345 structures (S345D, S345G, S345F), each with a design discharge of 500 cfs at 1.5 ft differential head (flow is jumped directly into the nearest respective mesh cell within WCA3B east of the L67C levee). S345D is located ~9.7 mi south of S151, S345G is located ~16.4 mi south of S151, and S345F is located ~17.9 mi south of S151 along L67-A.
- S333 design capacity increased from 1350 cfs to 2500 cfs (discharge coefficient increased proportionally from 2548 to 4718)
- Using the iModel©, a system wide simulation and optimization tool that is based on artificial neural network and numerical optimization, WCA3A inflow and outflow structures are managed under a Rainfall Driven Operation (RDO) scheme, as in the Final Array modeling.
- WCA3A floor is defined in the modeling as being crossed when either of the following two criteria are met:
    - Stages at 3-69W marsh gauge falls below 7.5 ft
    - Stages in CA3 canal fall below 7.0 ft
- Western Tamiami Trail Bridge modeled as weirs connecting the L29 canal and the mesh cells intersecting the bridge location (~2.6 mi total length)
- Degraded sections of L-29 levee (between S333 and divide structure) as a part of Blue Shanty flowway
- Divide structure on L-29 canal at the end of 2.6 mile bridge (design capacity = 1230 cfs, discharge coefficient = 2841, consistent with S334 sizing)

  - Operate to send water from L29W to L29E to equilibrate canals when L29E falls below 7ft
- Tamiami Trail releases (S333 and S12s) use the same operating logic as today's ERTP schedule, namely the Rainfall Plan. CEPP alternative replace the calculation of the rainfall-driven component (i.e. environmental target) with RDO estimates. Spatially, CEPP alternatives also attempt to deliver 100% of both the environmental and regulatory calculation through S333 subject to capacity and hydraulic constraints (this is different than the current ratio used in ERTP).
  - After final calculations have been completed, a final check is made to quantify any flood control water to be delivered through the S12s. If hydraulic capacity exists at the 345s, then this discharge is made into 3B instead of at the S12s, essentially adding a flood control component to the 345s in addition to the existing RDO environmental target.
- Partial L31N seepage curtain wall from L29 canal ~4.9 miles south of L29
- Entire section of L-67 extension levee degraded
- CEPP delivers water supply from regional system (from WCA3A: S-151/S-337) to maintain the L30 as follows:
  - Seasonally varying maintenance level:

01jan	6.45
01jun	5.40
01nov	6.45
31dec	6.45

  - A lowered maintenance level (called reserve level); applies when WCA3A is below the floor and no in-kind Lake Okeechobee releases are occurring (i.e. when regional water availability does not meet water supply requirements). Seasonally varying reserve level:

01jan	6.25
01jun	5.20
01nov	6.25
31dec	6.25

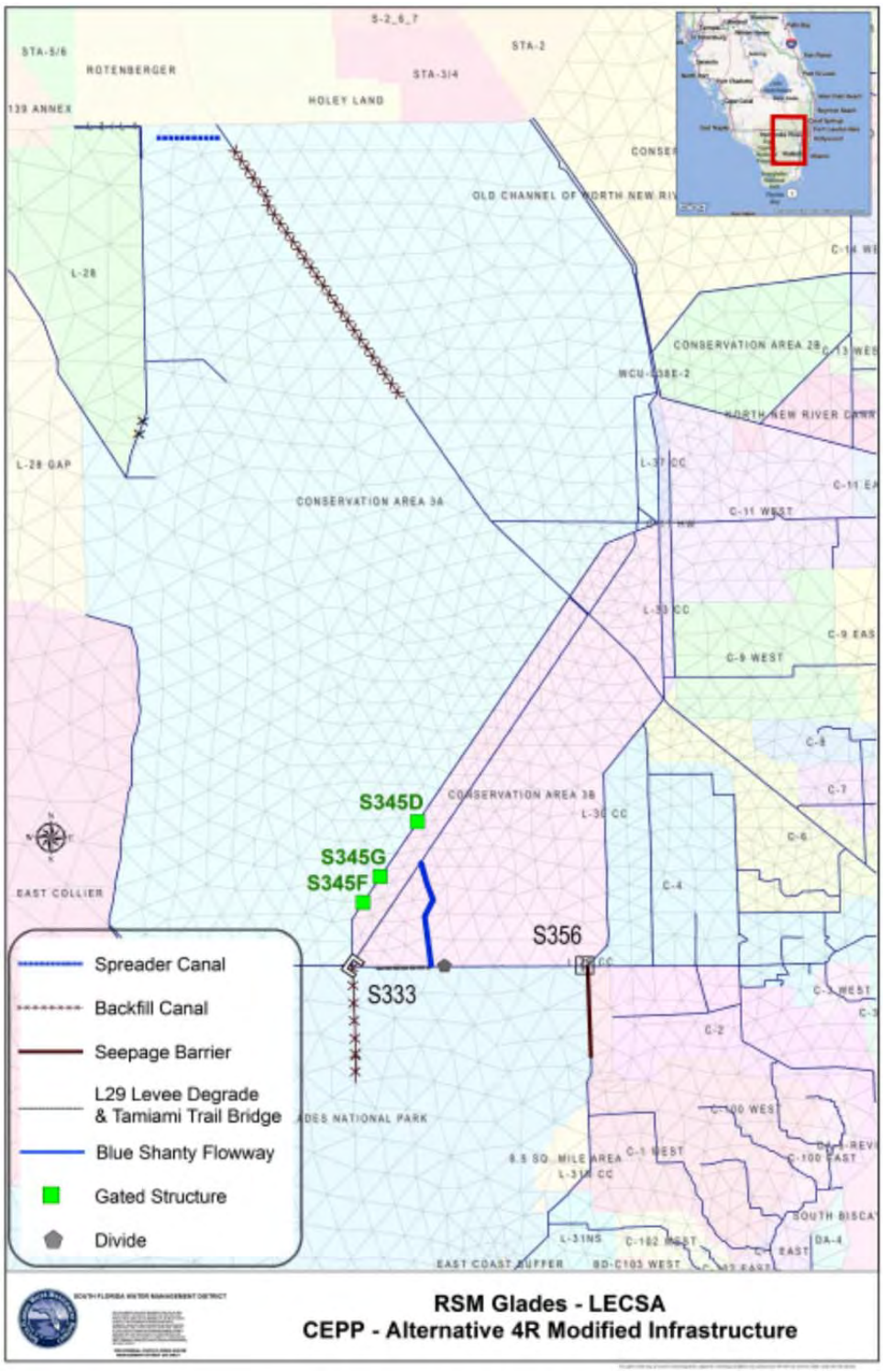

Figure 3.2. Alternative 4R Modified Infrastructure Relative to FWO Baseline

RSMBN and RSMGL ALT4R1 Scenario

For ALT4R1, modifications to system infrastructure relative to the FWO baseline are shown in **Figure 3.3.** The ALT4R1 scenario was built from the ALT4R scenario (retaining all modified assumptions) with the changes listed below. Specific operational criteria may also be referenced in **Appendix C** for the South Dade area or in the assumption table in **Appendix A**.

- In order to promote opportunity for Lake discharges to the south, LORS release criteria from the Northern Estuaries are modified to result in lower overall discharges. Specific changes can be found in **Appendix B**.
- Operational updates to Indian River Lagoon South (IRLS) project, consistent with Opti6-revised targets increasing flow down Ten Mile Creek (same assumptions as the IORBL1 Baseline run)
- A 360cfs conveyance limitation is implemented in the RSMBN model for water supply deliveries to the Seminole Big Cypress reservation and for water supply to maintain minimum depths in STA 5/6 from the L4 canal. The priority for deliveries is 1) tribal entitlement and 2) STA water supply
- Western HRF not modeled as a canal within the model domain but with boundary inflows into the two edge cells west of S8. No Central and Eastern HRF.
- No Breaches across L28 levee.
- No backfill for any of the segments of the L28 canal.
- Operational refinement to Broward Water Preserve Areas project to reduce discharges to S29 and refine model representation of S9/S9A operations (same assumptions as the IORBL1 Baseline run)
- Refined 8.5 SMA representation, including expansion of assumed length of collector canals to prevent higher groundwater stages in the western portion of the 8.5 SMA. (same assumptions as the IORBL1 Baseline run).
- Additional municipal public water supply pumping was assumed in ALT4R1 as shown in **Figure 3.4**. In Broward County, this was represented as a 28 MGD increase at the displayed wellfields, with a spatial distribution that was prorated based on the current wellfield allocation. In Miami-Dade County, this was represented as a 53 MGD increase at the displayed wellfields, with a spatial distribution that was prorated based on the current wellfield allocation.

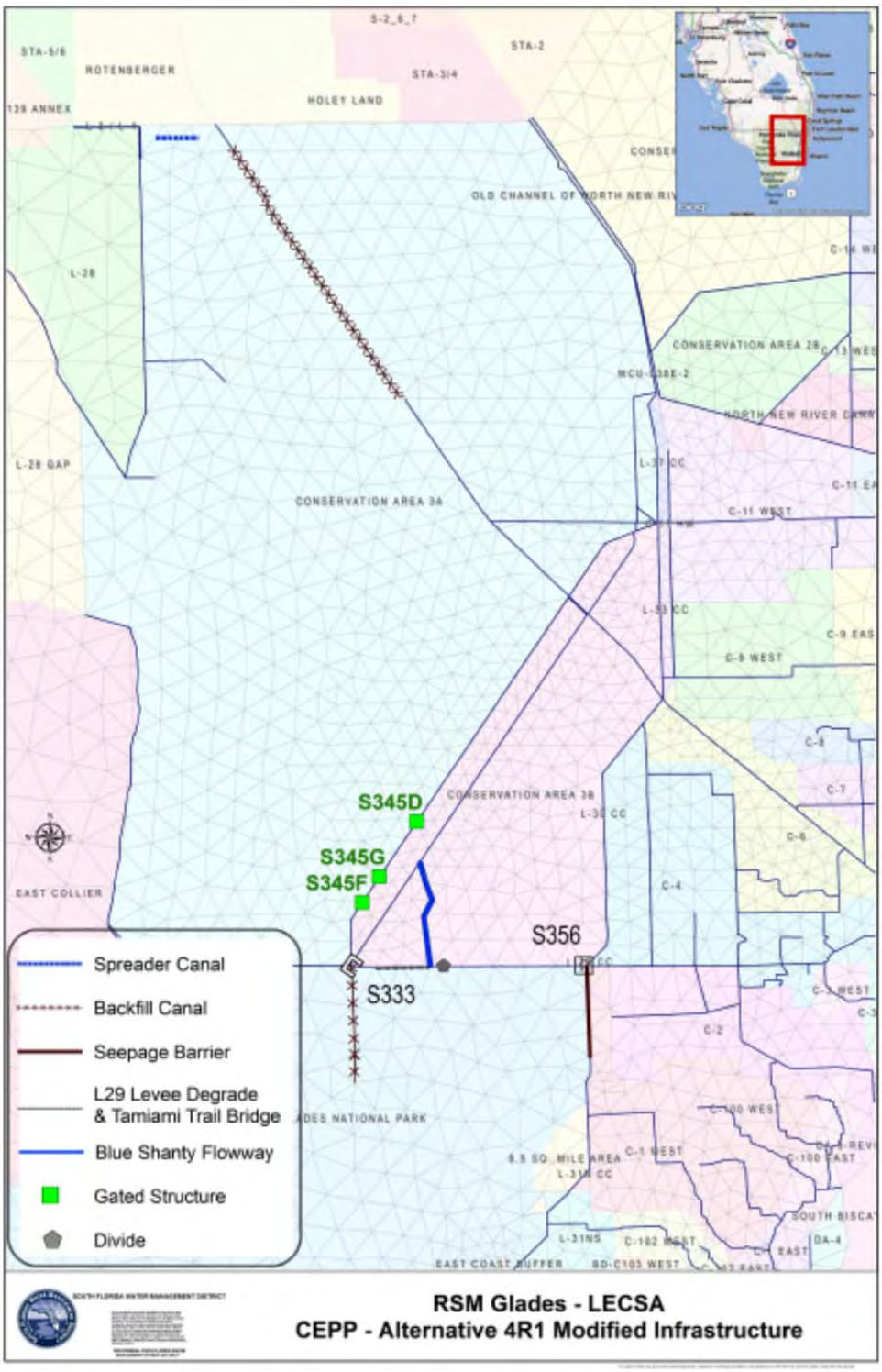

Figure 3.3. Alternative 4R1 Modified Infrastructure Relative to FWO Baseline

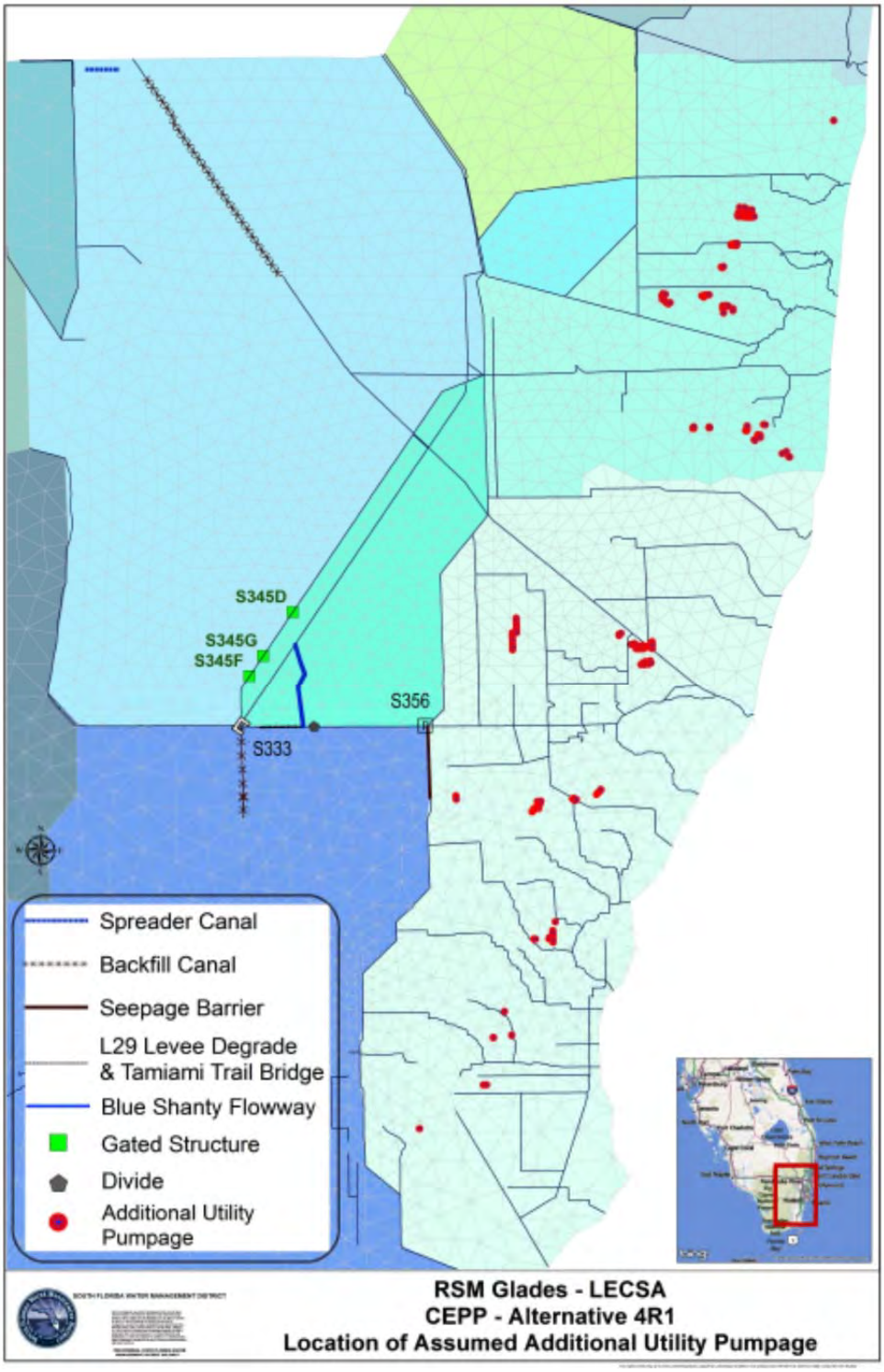

Figure 3.4. Locations with assumed increase in surficial aquifer pumped withdrawals in the Lower East Coast for ALT4R1

RSMBN and RSMGL ALT4R2 Scenario

For ALT4R2, modifications to system infrastructure relative to the FWO baseline are shown in **Figure 3.5**. The ALT4R2 scenario was built from the ALT4R1 scenario (retaining all modified assumptions) with the changes listed below. For the RSMBN model, no changes were made from ALT4R1 to ALT4R2, so the model assumptions and runs are identical. Specific operational criteria may also be referenced in Appendix B for the South Dade area or in the assumption table in Appendix A.

- After L6 diversion criteria are applied as in the Final Array, 40% of L6 diverted water targeted for S8 is returned to the S7 pump station. In the real world, this water would not need to be pumped and could just be released across the southern L6 levee degrade into WCA2A.
- WCA2A floor is defined in the modeling as being crossed when either of the following two criteria are met:
    - Stages at 2A-U1 marsh gauge falls below 10.5 ft
    - Stages in L38 canal fall below 10.0 ft
- Revised South Dade operations (see Appendix B)
- Additional municipal public water supply pumping was assumed in ALT4R2 as shown in **Figure 3.6**. In Broward County, this was represented as a 10 MGD increase at wellfield 06-01474-W and a 2 MGD combined increase for wellfields 06-00123-W, 06-00129-W, and 06-00103W. In Miami-Dade County, 5 MGD increase was assumed for the west wellfield, 13-0017-W.

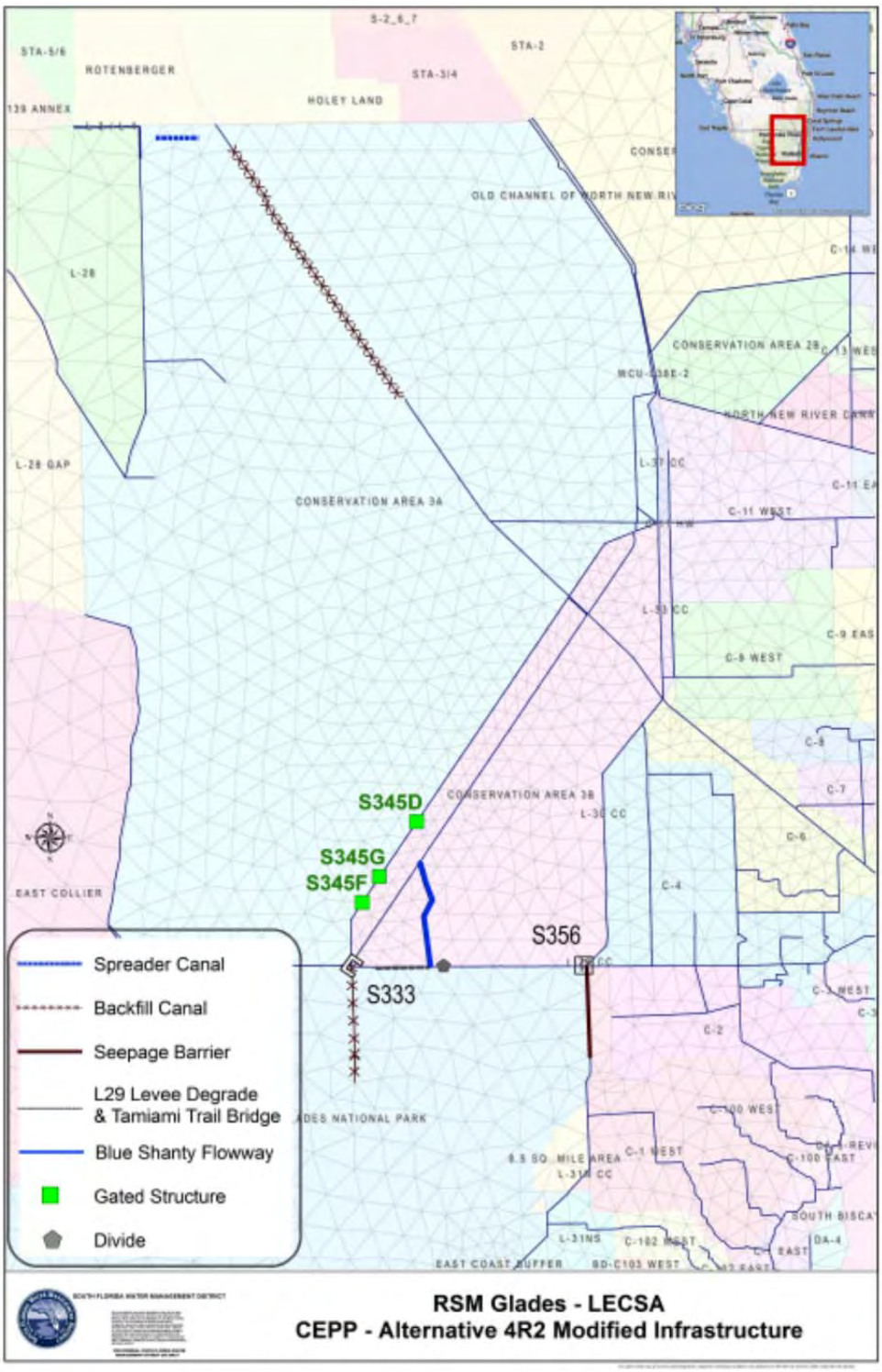

Figure 3.5. Alternative 4R2 Modified Infrastructure Relative to FWO Baseline

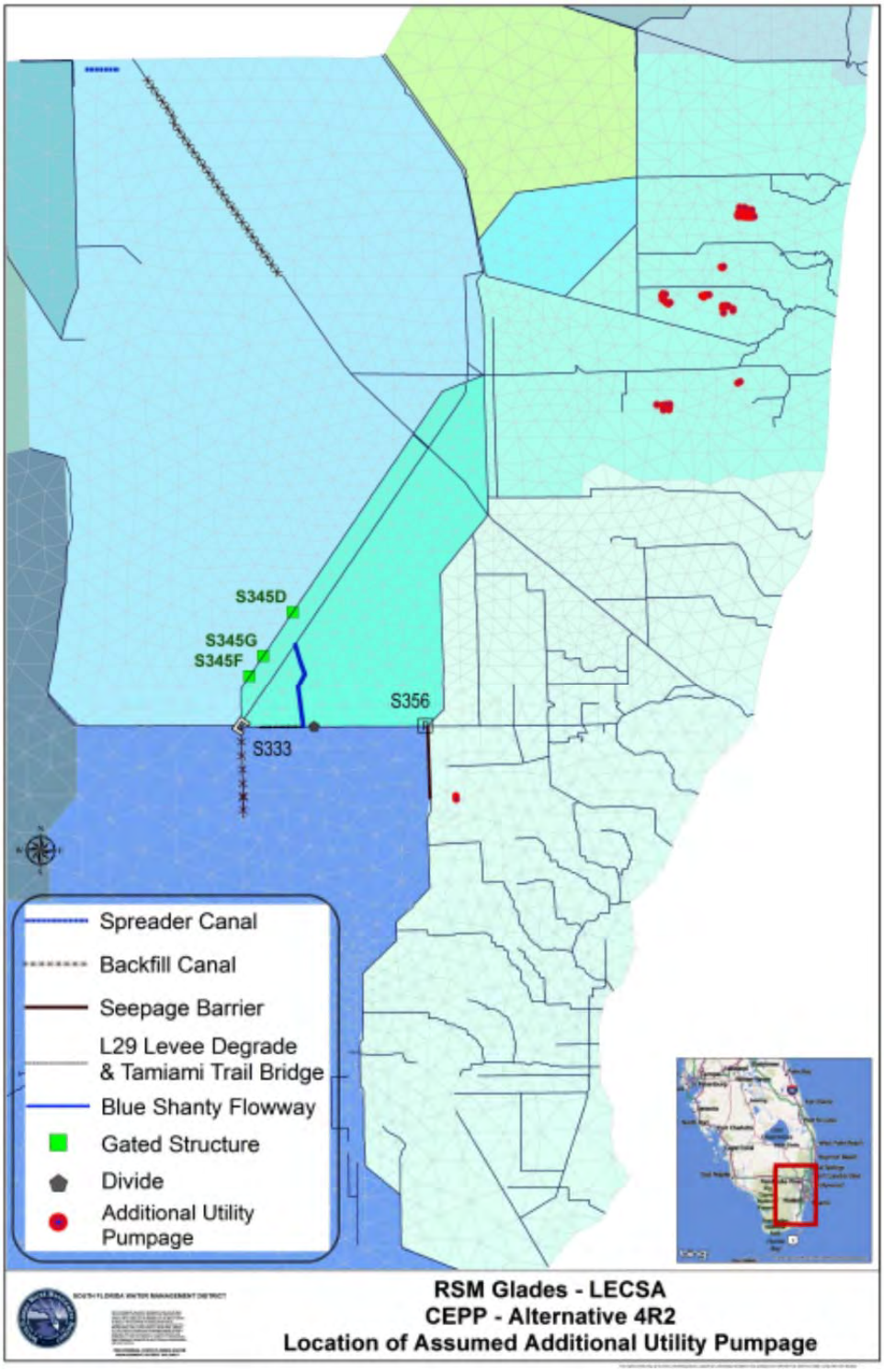

Figure 3.6. Locations with assumed increase in surficial aquifer pumped withdrawals in the Lower East Coast for ALT4R2

4.0 Results

Final CEPP modeling products have been uploaded to the CERP Model Management System (MMS), a geographic information system (GIS) based application that includes model input data, select model output data, source code/executable files and documentation. This system can be accessed at http://www.evergladesplan.org/pm/progr_mms.aspx. CEPP modeling products in MMS can be accessed directly at the project page:

http://cerpmap1.cerpzone.org/arcgisapps/CERPMMS/CerpReport/ProjectReport.aspx?projectID=687

Due to the large size of many of the CEPP modeling files, the majority of the modeling output has been archived in the Data Access Storage and Retrieval (DASR) application of CERPzone at www.cerpzone.org. CEPP modeling products in DASR can be accessed within the project modeling folder:

P:\IMC_Final_Modeling_Results\PROJ 51 - Central Everglades Planning

While the modeling products have been archived in the above systems, the table below lists more specific information including model version, inputs used and detailed DASR archival location. Version numbers and "svnroot" paths refer to a model version control system found on the SFWMD network that is not generally accessible, but inputs, model executables and source code have been copied into the MMS system for ease of access.

Version information and model file locations

RSMBN ALT4R 02282013	**RSM_v4728 and xml_v9207**
Input: …svnroot/trunk/CentEver/rsmbn/TSP_Assurances/InitialOperatingRegime/02282013/ALT4R Output (DASR):...\3TSP_Assurances\2InitialOperatingRegime\Final_Output_022813\rsmbn_model_output\ALT4R	
RSMBN ALT4R1/ALT4R2 06252013	**RSM_v4728 and xml_v9362**
Input: …svnroot/trunk/CentEver/rsmbn/FinalArray/06252013/alt4r2 Output (DASR): ...\2PlanFormulation\4FinalArray\Final_Output_062513\rsmbn_model_output\ALT4R2	
RSMGL ALT4R 02282013	**RSM_REL_2.3.5 and xml_v9188**
Input: ……svnroot/trunk/CentEver/rsmgl/Assurances/ALT4R Output (DASR):.../2PlanFormulation/4FinalArray/Final_Output_022813/rsmgl_model_output/ALT4R	
RSMGL ALT4R1 06032013	**RSM_REL_2.3.5 and xml_v9362**
Input: … svnroot/trunk/CentEver/rsmgl/Assurances/ALT4R1 Output (DASR):../4OtherWRN_Sens/Sens_Output_060313/rsmgl_model_output/ALT4R1	
RSMGL ALT4R2 06252013	**RSM_REL_2.3.5 and xml_v9386**
Input: … svnroot/trunk/CentEver/rsmgl/Assurances/ALT4R2 Output (DASR):.../2PlanFormulation/4FinalArray/Final_Output_062513/rsmgl_model_output/ALT4R2	

Review of Local and Regional-Level Results

The RSMBN and RSMGL baseline modeling scenarios were reviewed from the perspective of ensuring that localized effects of project implementations were observed as expected and that regional performance was considered reasonable. Specific checks on RSM outputs included the following:

- The TSP scenarios generally maintain Lake Okeechobee performance relative to ECB as shown in **Figure 4.1**.

- There is a progression in performance from ALT4R to ALT4R2 for the St. Lucie and Caloosahatchee Estuaries. Ultimately, ALT4R2 reduces the number of high discharge events to northern estuaries and maintain Caloosahatchee Estuary low flow performance as shown in **Figure 4.2(a) and (b)**. An improvement in low flow event counts in the St Lucie Estuary is observe due to updated assumptions in the IORBL1; ALT4R2 (labeled as ALT4R1, which was the same run for RSMBN) maintains low flow event frequency relative to the updated baseline as shown in **Figure 4.3.**
- The ALT42 scenario demonstrates improved or equal LOSA (**Figure 4.4**) and Tribal water supply performance relative to the project baselines.
- Compared to FWO, ALT4R2 provides approximately 200 kac-ft additional flow to Everglades as shown in **Table 4.1**.
- There is reduced frequency & magnitude of CEPP L-6 Diversion operations in ALT4R2 relative to ALT4R. ALT4R2 performs similar to ECB (lower highs) in WCA2A (**Figure 4.5**) and WCA2B (**Figure 4.6**). Adjacent LEC areas perform similarly to baselines.
- CEPP TSP scenarios all perform similarly and increase stages and hydroperiods in northern WCA3A (an example in **Figure 4.7**). In CEPP TSP scenarios, performance in northeastern WCA3A is similar to defined sawgrass targets.
- CEPP TSP scenarios all perform similarly to FWO (lower highs) in central & southern WCA3A (**Figure 4.8**).
- CEPP TSP scenarios all perform similarly and increase stages in WCA3B relative to ALT4 in the Final Array. Results now show water depths equal to or higher than the ECB baseline (**Figure 4.9**).
- CEPP TSP scenarios all perform similarly and all significantly increase stages and hydroperiods (**Figure 4.10**) in Shark River Slough. All alternatives show flow increases down Shark River Slough (**Figure 4.11**). The majority of Marl areas do not show increased hydroperiods, but immediately adjacent to Shark River Slough, wetter conditions do exist. Higher stage conditions could improve conditions in Florida Bay.
- In the Lower East Coast, the additional pumpage assumed in ALT4R1 resulted in significant local groundwater impacts (**Figure 4.12**). The reduced pumpage assumed in ALT4R2 minimized the spatial extent of these local effects (**Figures 4.13 to 4.14**), returning conditions to ALT4R levels despite the increased withdrawals.
- Extreme canal / groundwater conditions are generally somewhat mitigated by additional CEPP infrastructure (**Figure 4.15**), but in some reaches more moderate and dry conditions (**Figure 4.16**) may show undesirable trends, such as lower stages in the lowest 3% of the distribution.
- Surface water discharges throughout the LEC east of ENP and toward Biscayne Bay are increased relative to the final array and generally show an increasing trend through the TSP refinement as shown in **Table 4.2**. The obvious exception to this observation is S29 which is influenced by baseline updates from the IORBL1 and as shown in comparison to the assurances baseline in **Table 4.3**. The ALT4R2 volumes and timing return these conditions to near baseline levels.

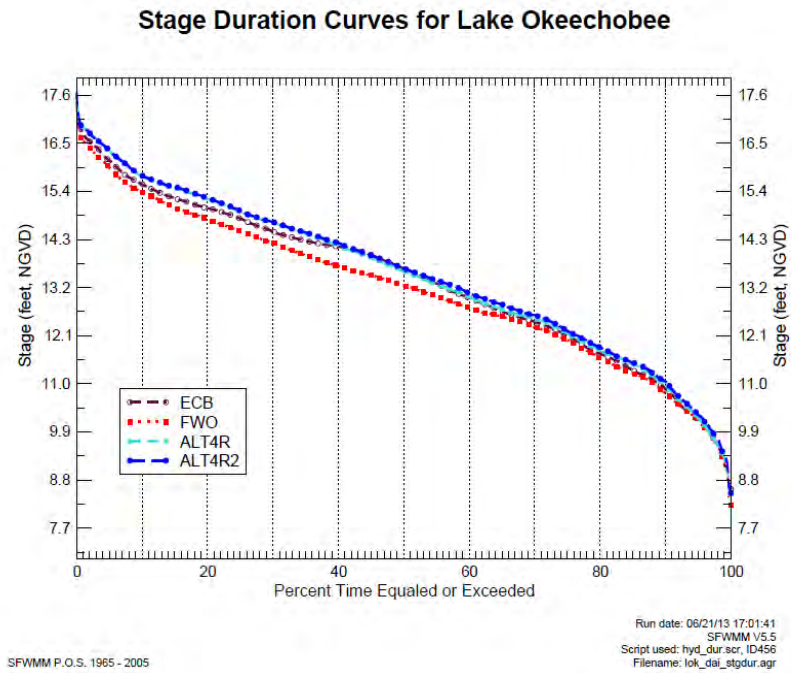

Figure 4.1. Lake Okeechobee performance for TSP runs relative to the baselines.

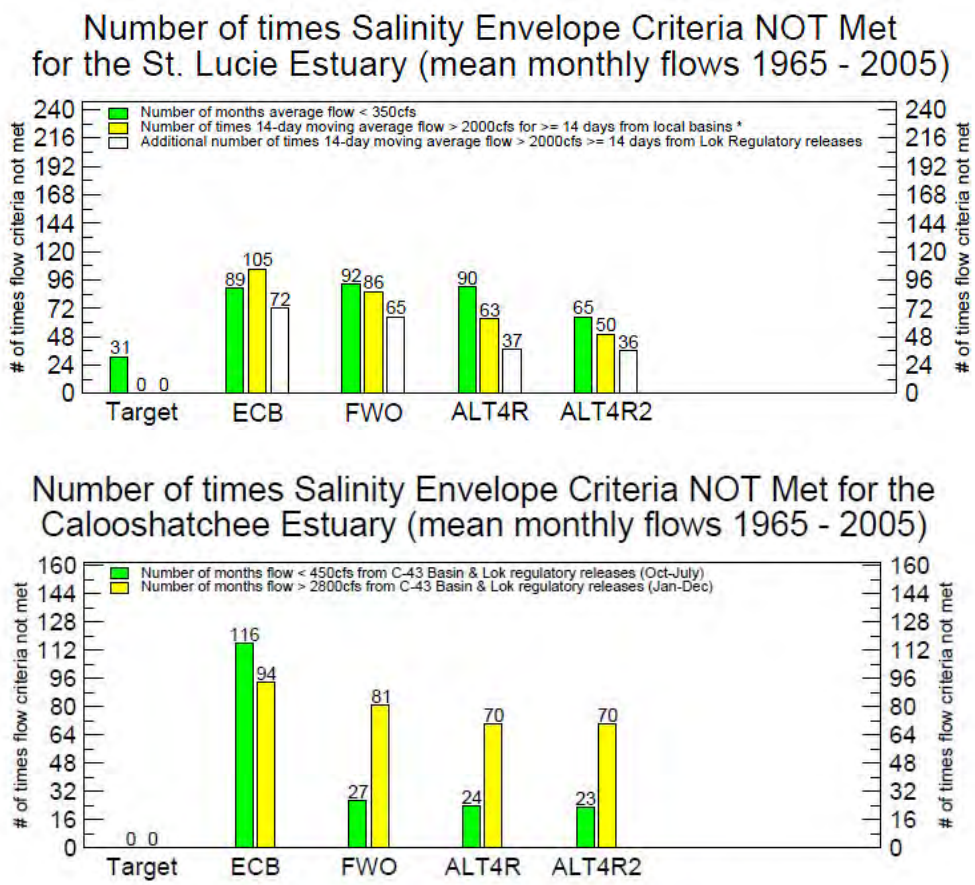

Figure 4.2. High & low discharge events to northern estuaries (a) St. Lucie Estuary and (b) Caloosahatchee Estuary relative to the plan formulation baselines for TSP scenarios.

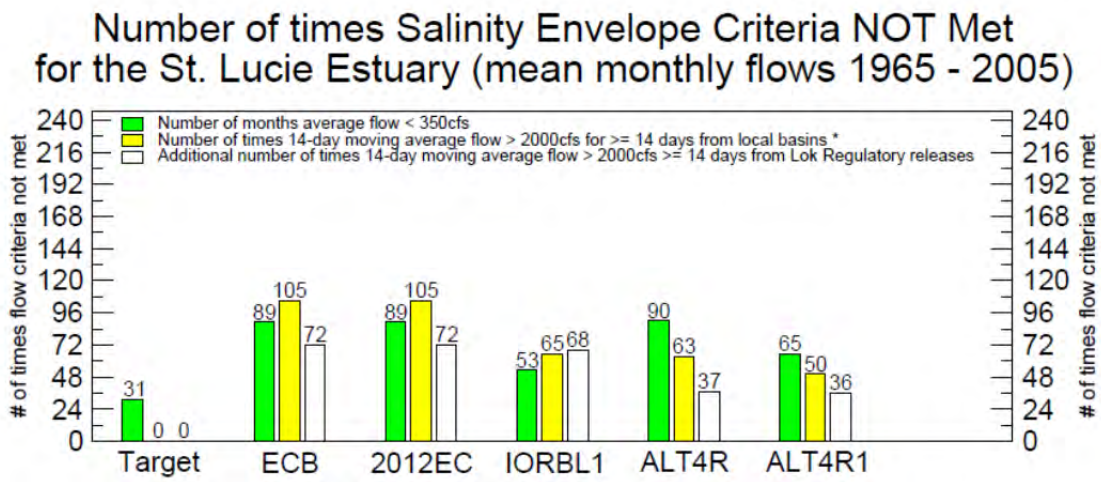

Figure 4.3. High & low discharge events to the St. Lucie Estuary relative to the plan assurances baselines for TSP scenarios.

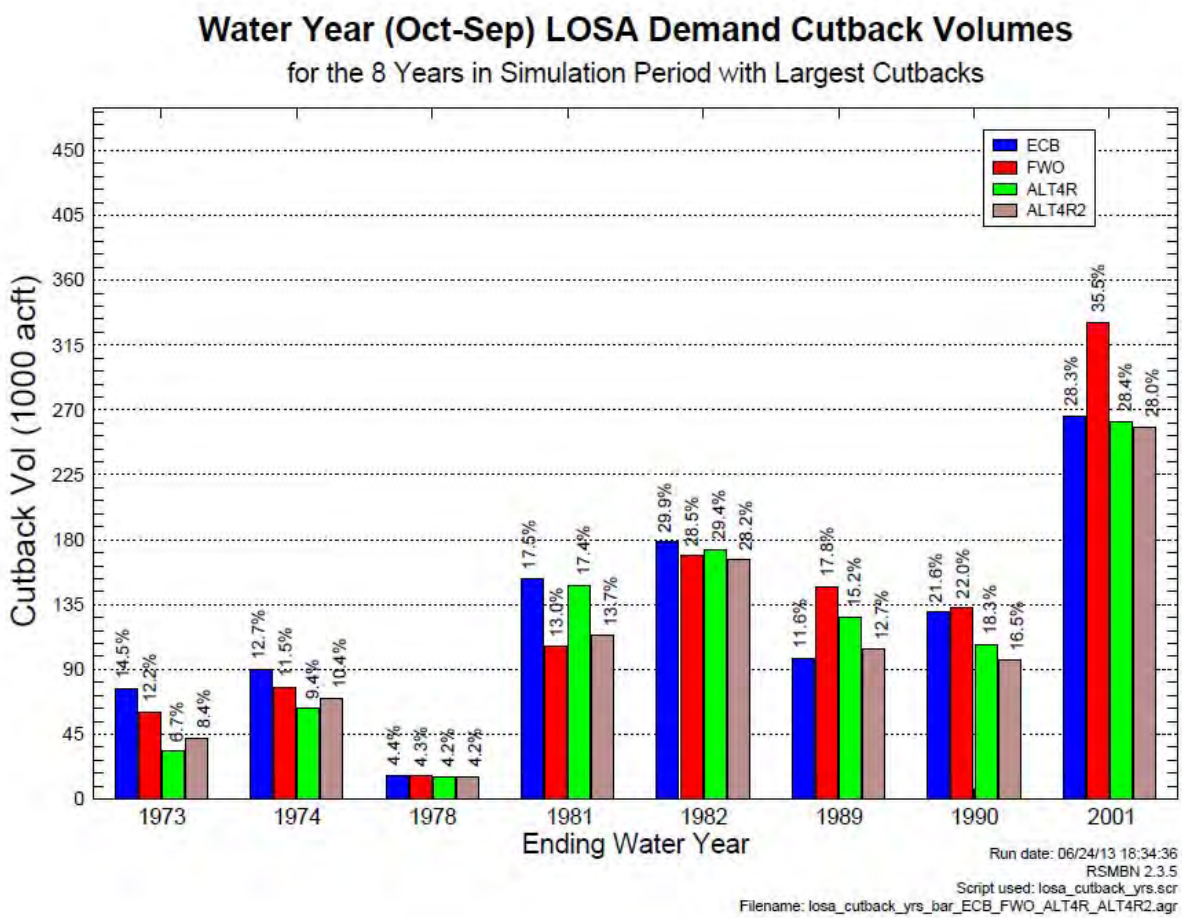

Figure 4.4. . Water shortage cutbacks for water years with large cutback volumes

Table 4.1. Average annual Discharges (kac-ft) from STA2 and STA34 toward the Greater Everglades

	ECB	FWO	ALT4R	ALT4R2	Diff (ALT4R2-FWO)
STA2	234.5	381.0	374.2	383.7	(2.7)
STA34	538.5	382.2	596.2	596.2	(214.0)
Total Additional Water in ALT4R2 =					+216.7
Total Additional Water in ALT4R =					+207.2

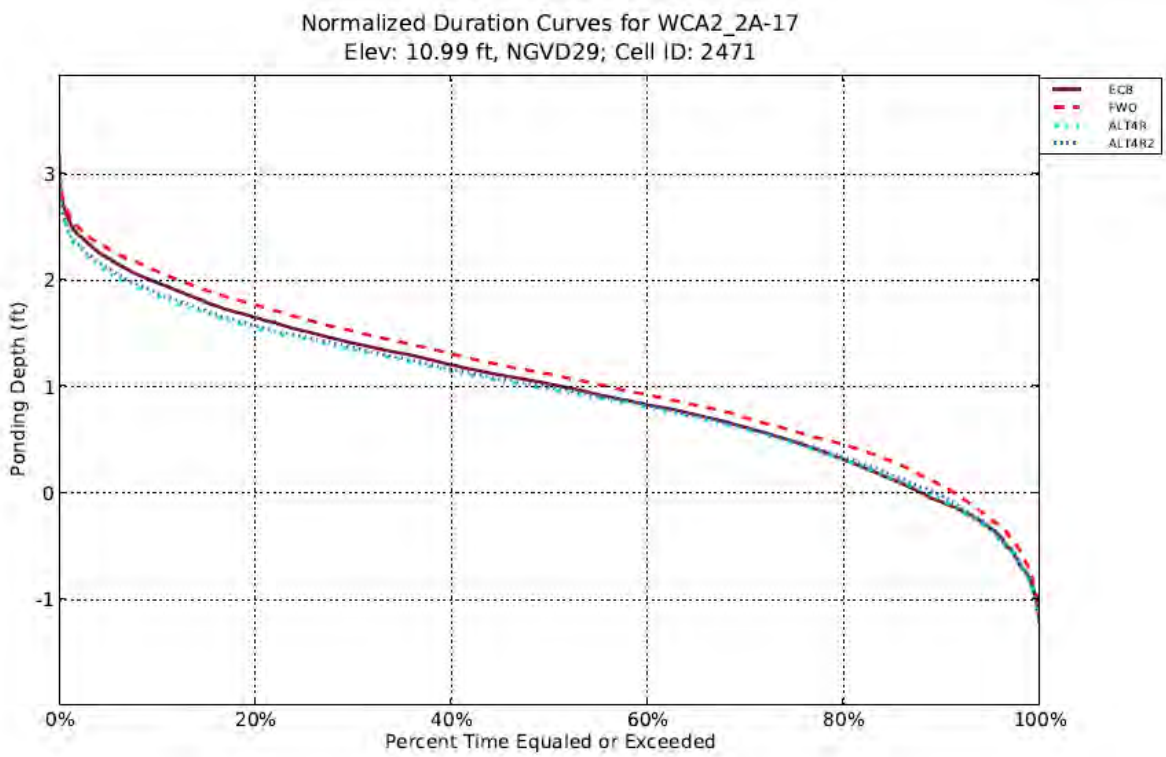

Figure 4.5. Stage duration curve for Gauge 2A-17 in Water Conservation Area 2A

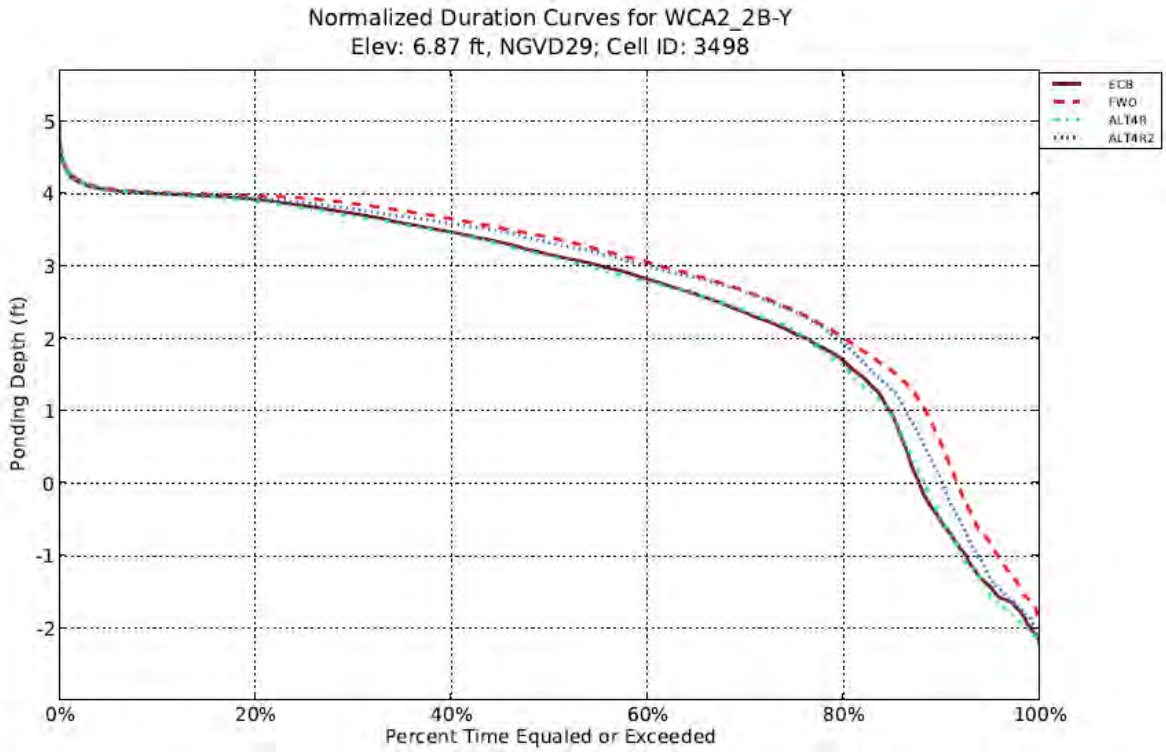

Figure 4.6. Stage duration curve for Gauge 2B-Y in Water Conservation Area 2B.

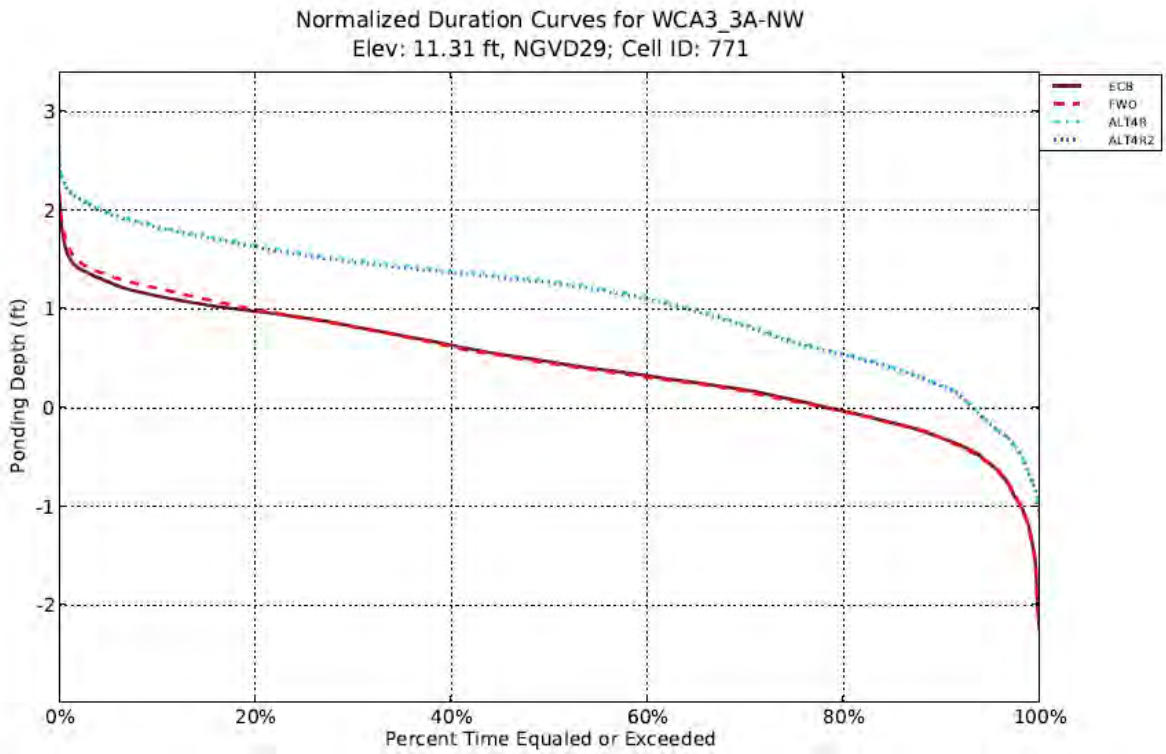

Figure 4.7. Stage duration curve for Gauge 3A-NW in Northern Water Conservation Area 3A

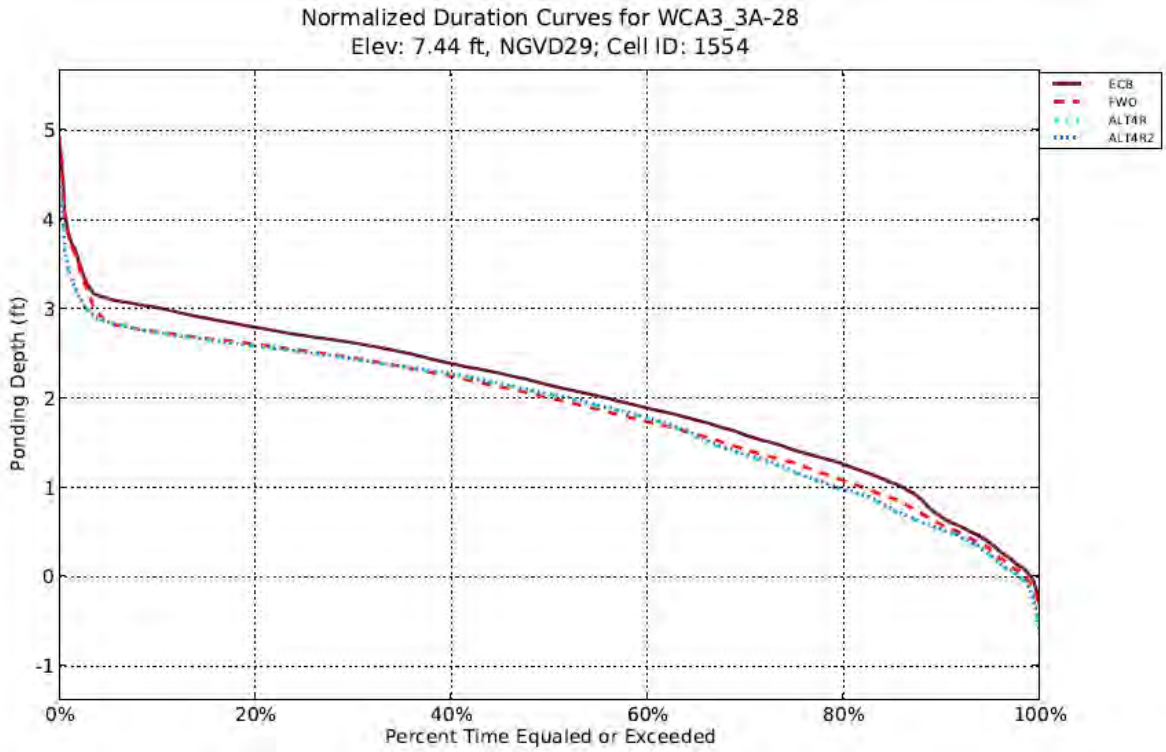

Figure 4.8. Stage duration curve for Gauge 3A-28 in Water Conservation Area 3A

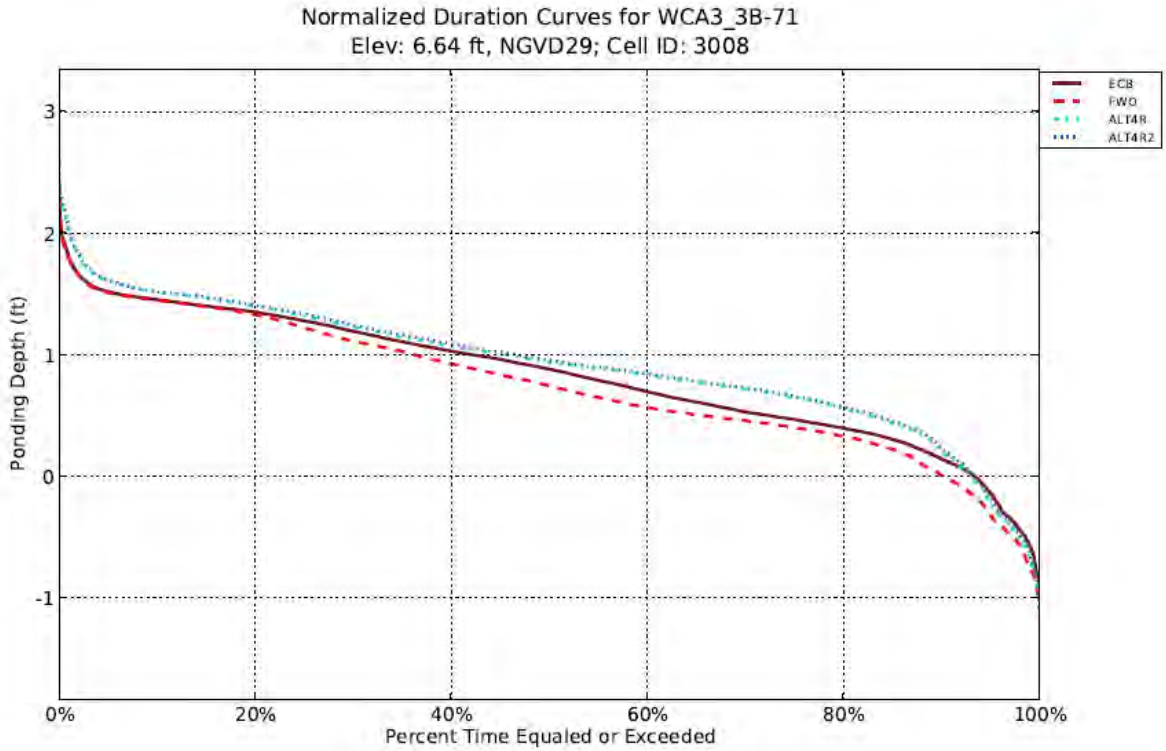

Figure 4.9. Stage duration curve for Gauge 3B-71 in Water Conservation Area 3B

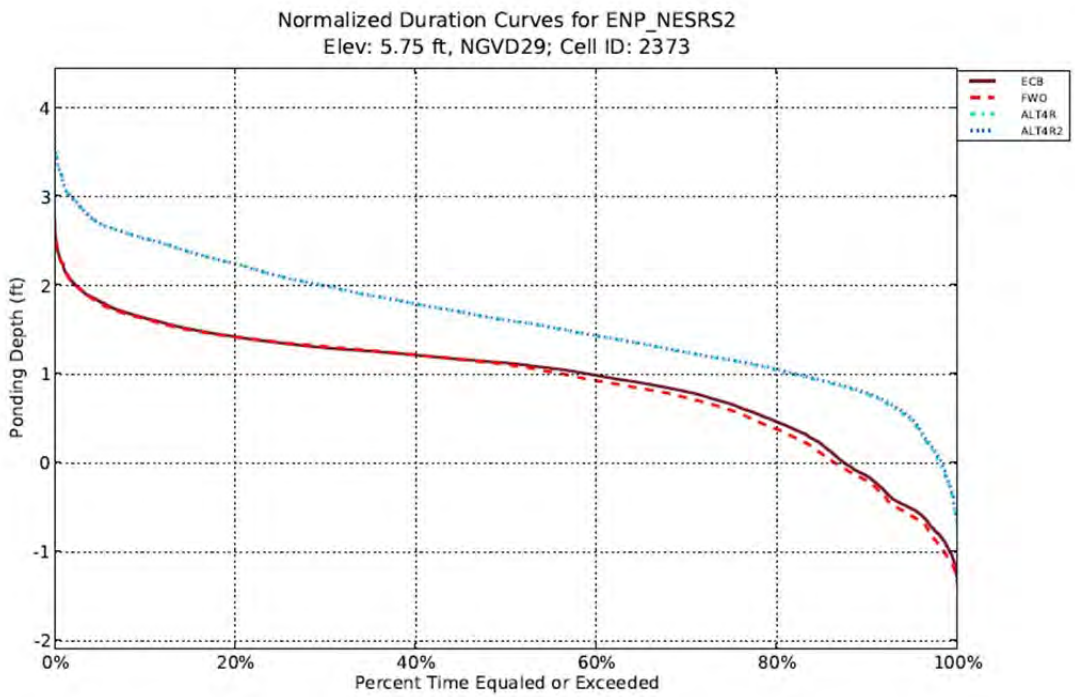

Figure 4.10. Stage duration curve for Gauge NESRS2 in Everglades National Park

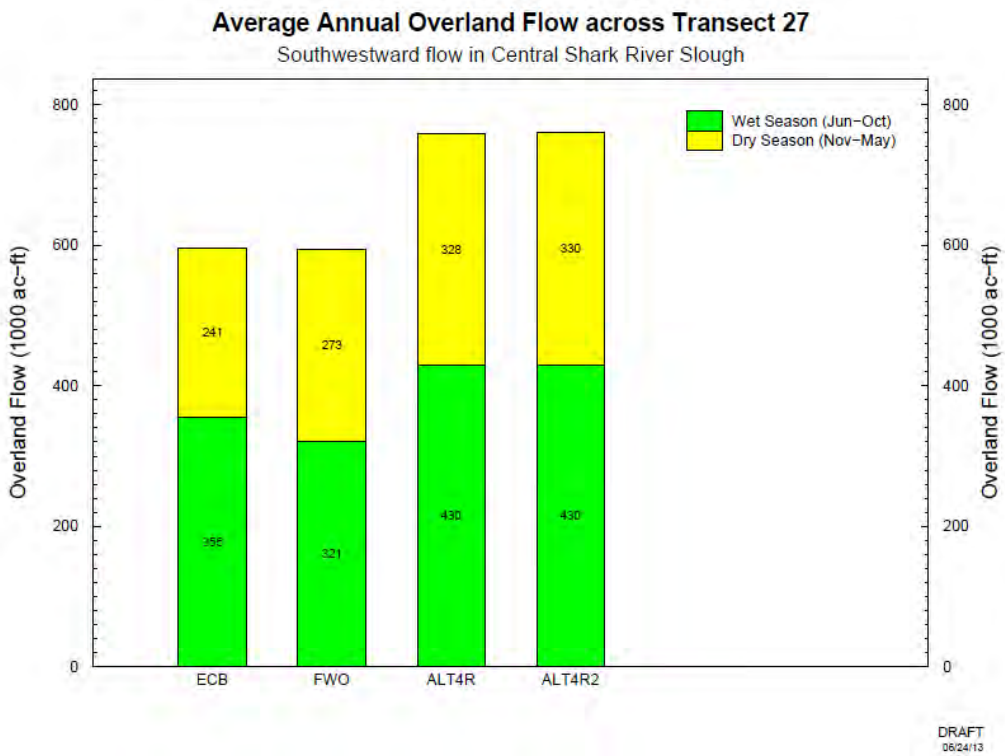

Figure 4.11. Flow differences between FWO and Alternatives in central Shark River Slough

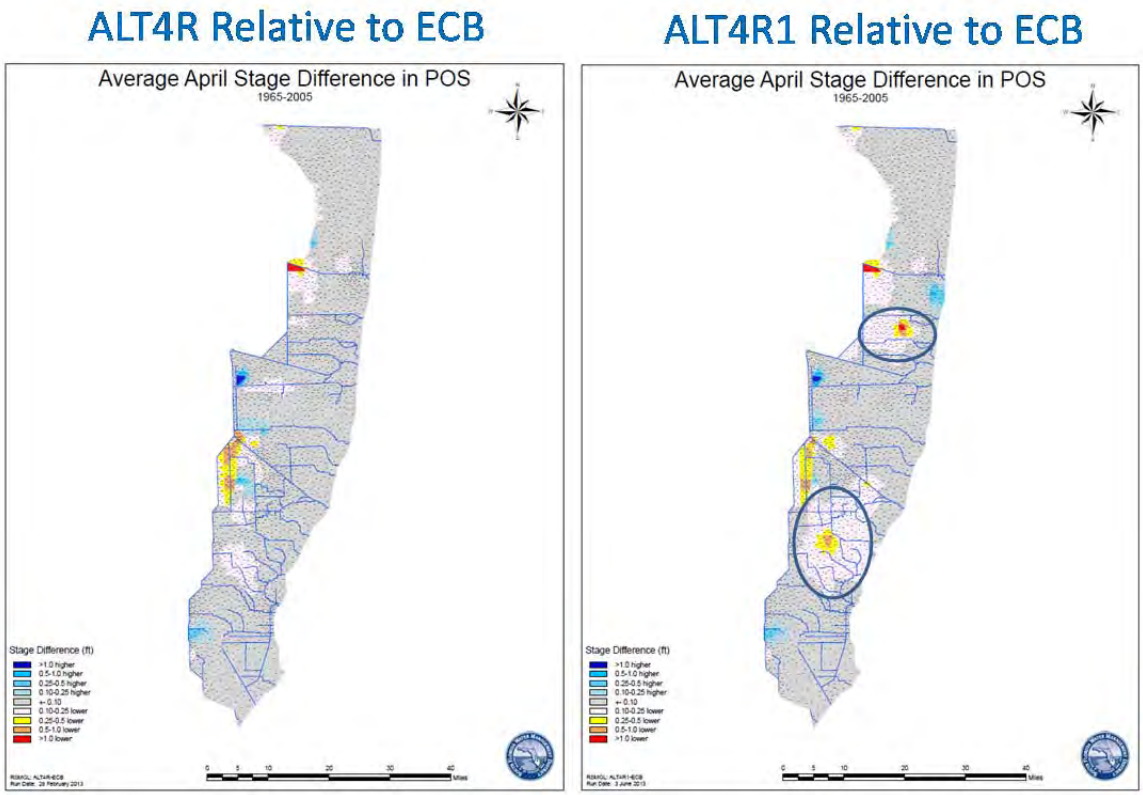

Figure 4.12. Difference between ALT4R and ECB (left) and ALT4R1 and ECB (right) stages for an average April condition in the Lower East Coast

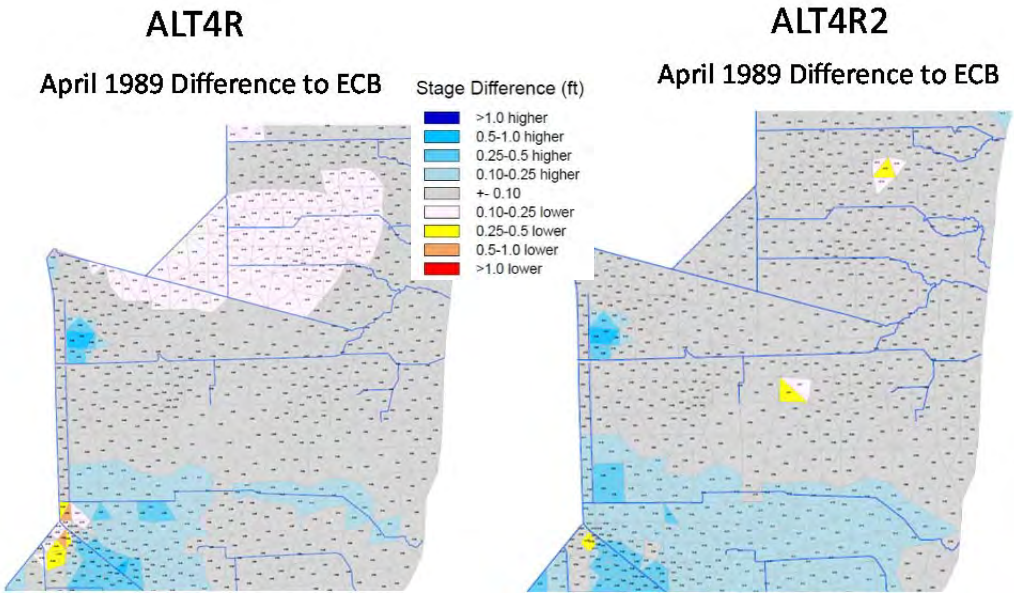

Figure 4.13. Difference between ALT4R and ECB (left) and ALT4R2 and ECB (right) stages for the April 1989 condition in Broward County

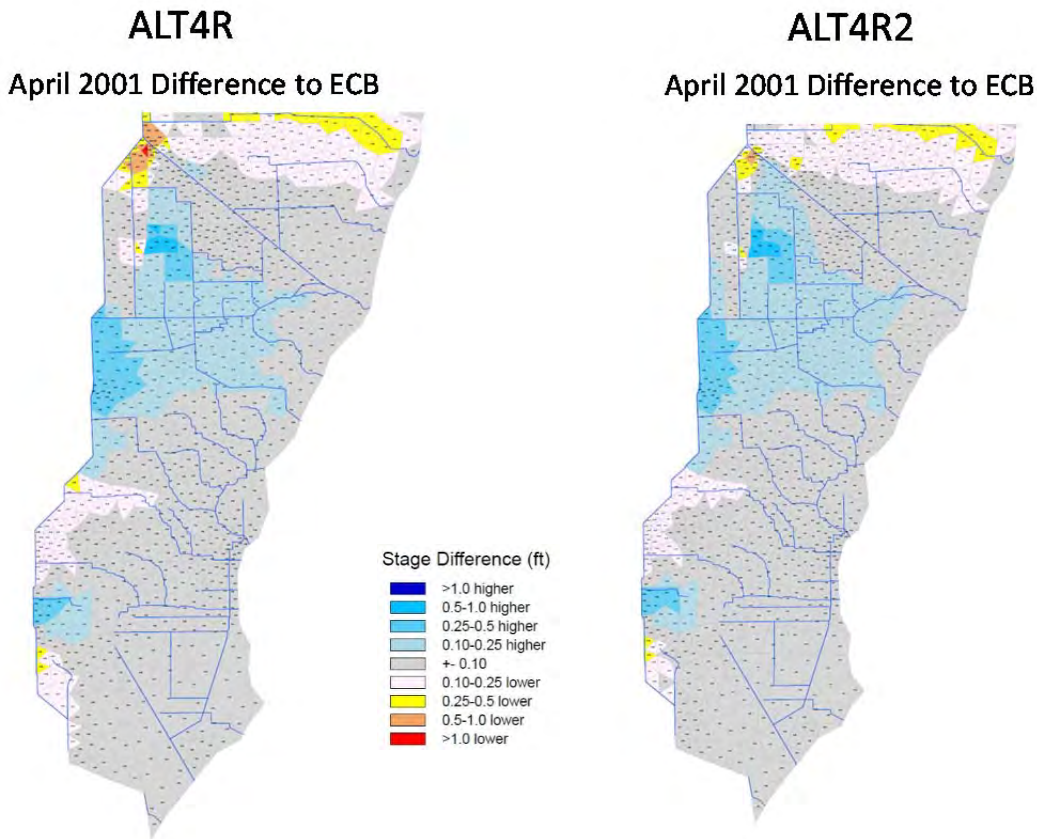

Figure 4.14. Difference between ALT4R and ECB (left) and ALT4R2 and ECB (right) stages for the April 2001 condition in Miami-Dade County

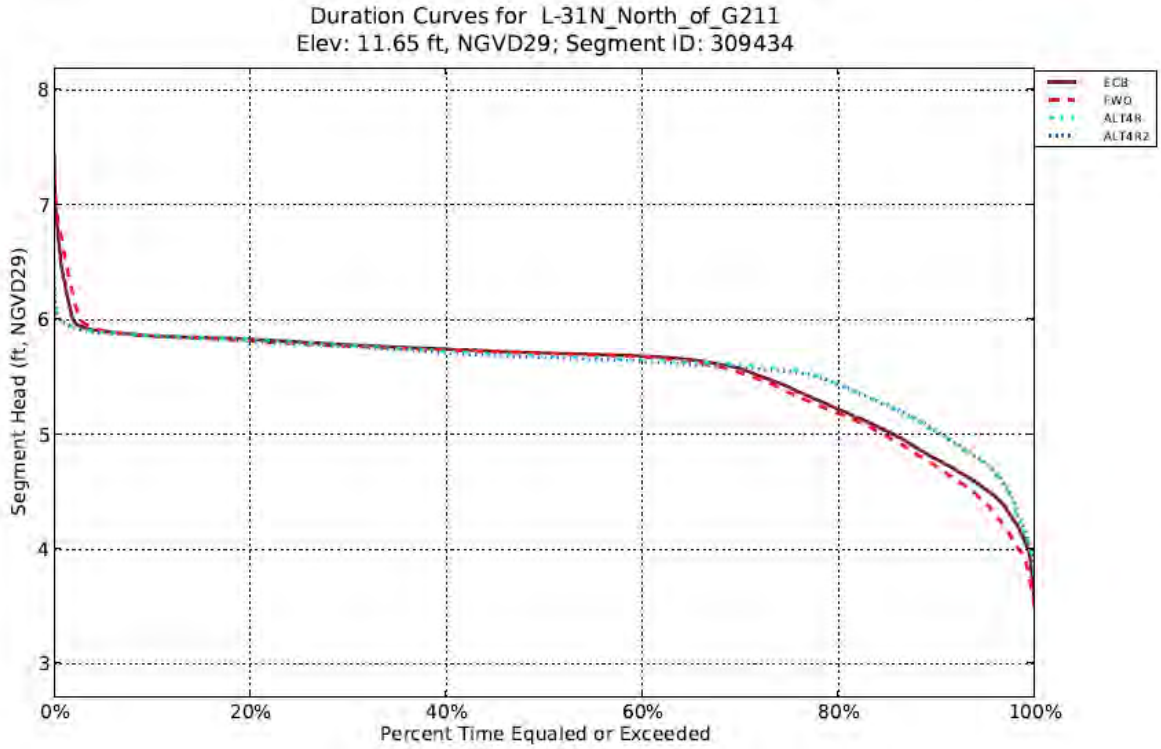

Figure 4.15. Stage duration curve for L31N Canal in Miami-Dade County

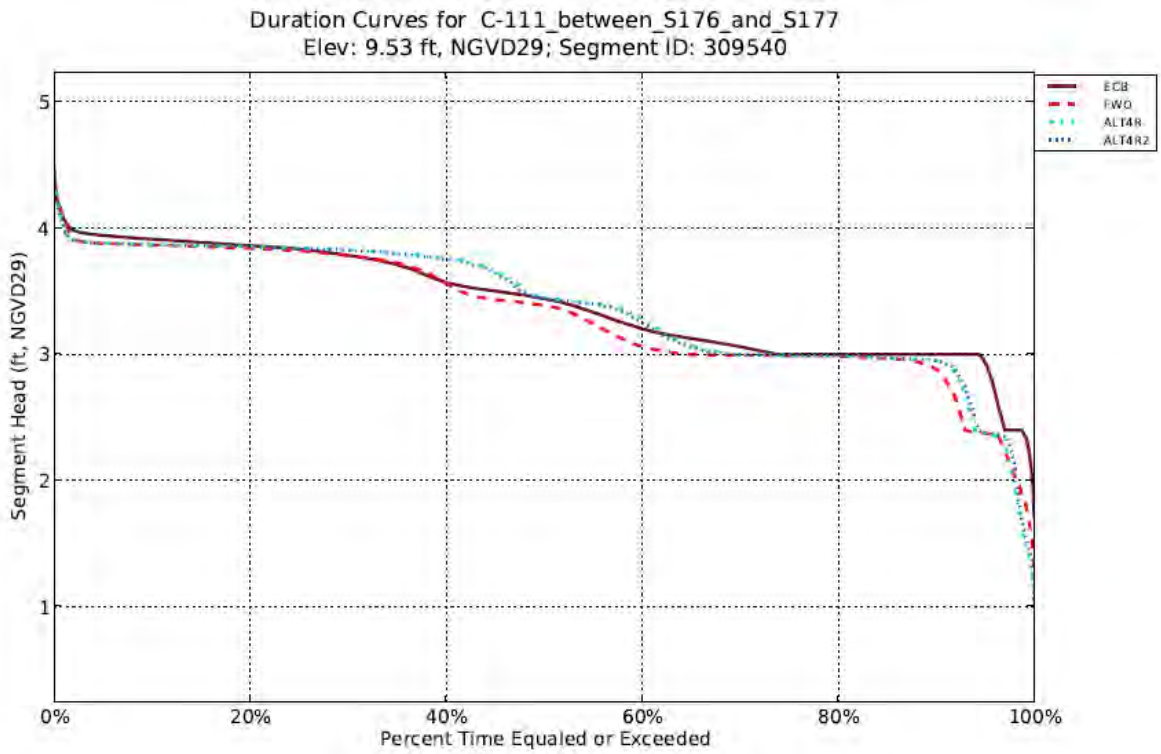

Figure 4.16. Stage duration curve for C111 Canal in Miami-Dade County

Table 4.2. Average annual (kac-ft) surface water discharges at coastal structures toward Biscayne and Florida Bay (comparison with plan formulation baselines).

	ECB	ECB	FWO	FWO	FWO	ALT4R	ALT4R	ALT4R	ALT4R2	ALT4R2	ALT4R2
Structure	Mean	% within PM	Mean	% dif ECB	% within PM	Mean	% dif ECB	% within PM	Mean	% dif ECB	% within PM
S29	282.8	68%	372.3	32%	79%	374.5	32%	81%	310.8	10%	73%
S28	90.9	--	93.2	3%	--	93.0	2%	--	90.8	0%	--
S27	115.2	--	114.5	-1%	--	115.1	0%	--	115.1	0%	--
S26	124.6	--	116.4	-7%	--	124.5	0%	--	124.9	0%	--
S25B	109.3	--	102.4	-6%	--	103.3	-5%	--	105.6	-3%	--
S25	9.7	--	9.6	-2%	--	9.6	-2%	--	9.7	-1%	--
G93	28.4	--	26.7	-6%	--	26.8	-6%	--	27.8	-2%	--
S22	121.2	12%	113.9	-6%	11%	115.3	-5%	12%	117.7	-3%	12%
S123	17.5	21%	17.3	-1%	21%	17.5	0%	22%	17.7	1%	22%
S21	101.3	67%	101.9	1%	66%	106.3	5%	64%	115.3	14%	65%
S21A	58.2	46%	60.6	4%	46%	60.8	5%	45%	62.8	8%	44%
S20G	0.4	--	0.3	-1%	--	0.3	0%	--	0.4	0%	--
S20F	145.7	43%	154.7	6%	43%	152.7	5%	44%	154.9	6%	42%
S20	6.6	--	6.6	0%	--	6.6	0%	--	6.6	0%	--
S197	22.8	3%	9.2	-60%	1%	11.2	-51%	1%	11.3	-50%	2%
Sum	1234.5		1299.6			1317.7			1271.2		

Table 4.3. Average annual (kac-ft) surface water discharges at coastal structures toward Biscayne and Florida Bay(comparison with assurances baselines).

	ECB	ECB	2012EC	2012EC	2012EC	IORBL1	IORBL1	IORBL1	ALT4R	ALT4R	ALT4R	ALT4R1	ALT4R1	ALT4R1
Structure	Mean	% within PM	Mean	% dif ECB	% within PM	Mean	% dif ECB	% within PM	Mean	% dif ECB	% within PM	Mean	% dif ECB	% within PM
S29	282.8	68%	282.3	0%	67%	315.5	12%	72%	374.5	32%	81%	305.8	8%	72%
S28	90.9	--	91.0	0%	--	90.9	0%	--	93.0	2%	--	89.4	-2%	--
S27	115.2	--	115.4	0%	--	115.4	0%	--	115.1	0%	--	110.3	-4%	--
S26	124.6	--	131.5	6%	--	124.8	0%	--	124.5	0%	--	113.8	-9%	--
S25B	109.3	--	109.7	0%	--	106.9	-2%	--	103.3	-5%	--	97.2	-11%	--
S25	9.7	--	9.7	0%	--	9.7	0%	--	9.6	-2%	--	9.1	-7%	--
G93	28.4	--	28.5	0%	--	27.8	-2%	--	26.8	-6%	--	25.8	-9%	--
S22	121.2	12%	122.0	1%	12%	118.7	-2%	12%	115.3	-5%	12%	107.8	-11%	11%
S123	17.5	21%	17.4	-1%	21%	17.6	0%	22%	17.5	0%	22%	15.8	-10%	19%
S21	101.3	67%	100.4	-1%	66%	103.0	2%	66%	106.3	5%	64%	100.9	0%	62%
S21A	58.2	46%	59.3	2%	47%	61.4	5%	46%	60.8	5%	45%	59.5	2%	43%
S20G	0.4	--	0.4	1%	--	0.4	1%	--	0.3	0%	--	0.3	-1%	--
S20F	145.7	43%	146.3	0%	43%	155.0	6%	43%	152.7	5%	44%	149.7	3%	42%
S20	6.6	--	6.6	0%	--	6.6	0%	--	6.6	0%	--	6.6	0%	--
S197	22.8	3%	22.8	0%	3%	9.3	-59%	1%	11.2	-51%	1%	11.6	-49%	2%
Sum	1234.5		1243.2			1263.0			1317.7			1203.6		
S26+S25B+S25	243.6	35%	250.9	3%	34%	241.4	-1%	34%	237.3	-3%	31%	220.1	-10%	28%

In summary, the three progressively delivered TSP runs provided to the CEPP project team are deemed to adequately represent the intended planning conditions and when utilized in conjunction with the CEPP Baseline scenarios, provide a reasonable basis of comparison for the necessary evaluations required to draft the PIR.

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Appendix A – Tables of Assumptions

RSMBN:

- **ALT4R**
- **ALT4R1**
- **ALT4R2**

RSMGL:

- **ALT4R**
- **ALT4R1**
- **ALT4R2**

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Basins (RSMBN)
Alternative 4 Revised (ALT4R) Scenario
Table of Assumptions

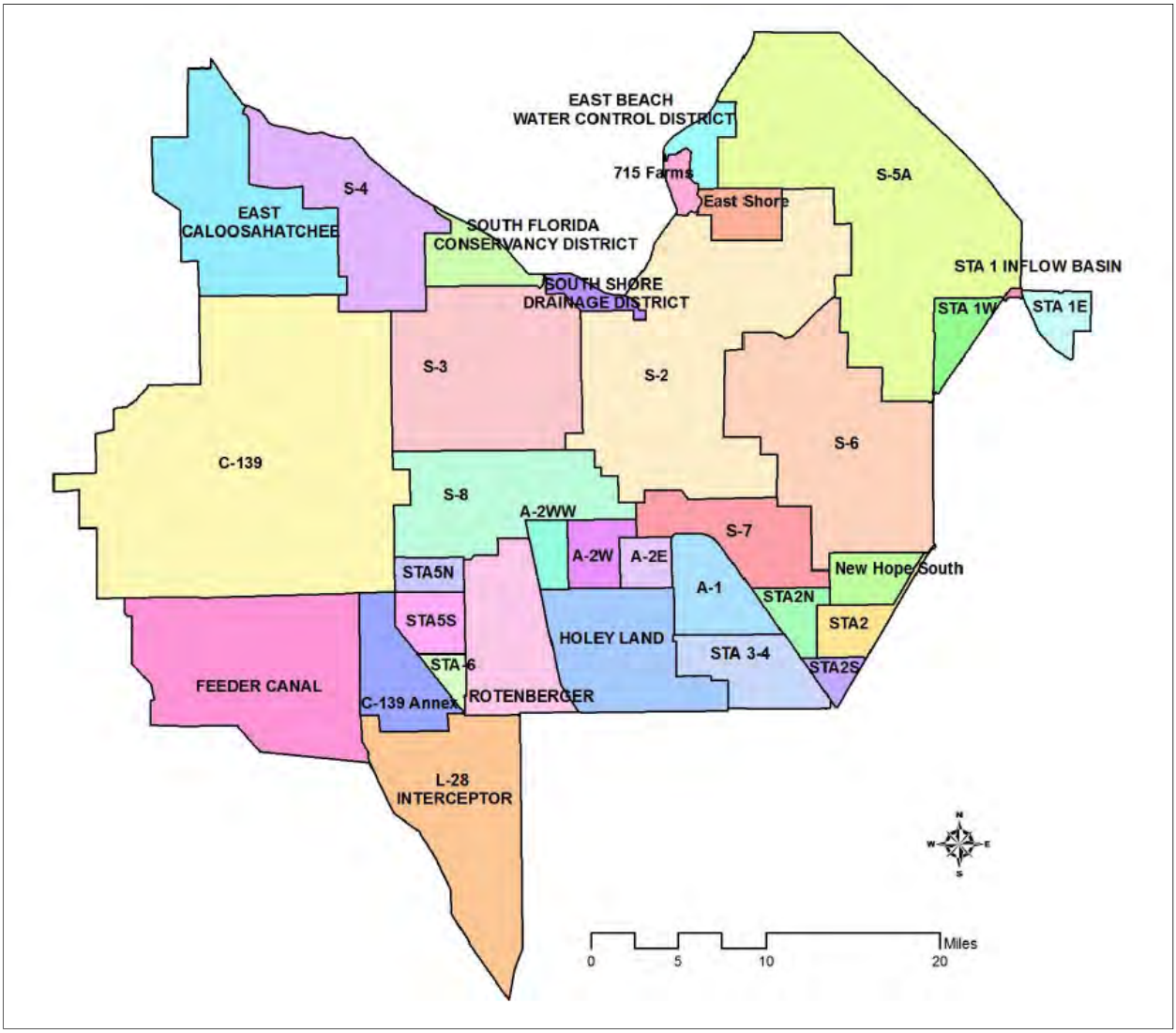
Feature	
Climate	• The climatic period of record is from 1965 to 2005. • Rainfall estimates have been revised and updated for 1965-2005. • Revised evapotranspiration methods have been used for 1965-2005.
Topography	The Topography dataset for RSM was Updated in 2009 using the following datasets: • South Florida Digital Elevation Model, USACE, 2004; • High Accuracy Elevation Data, US Geological Survey 2007; • Loxahatchee River LiDAR Study, Dewberry and Davis, 2004; • St. Lucie North Fork LiDAR, Dewberry and Davis, 2007; • Palm Beach County LiDAR Surve, Dewberry and Davis, 2004; and • Stormwater Treatment Area stage-storage-area relationships based on G. Goforth spreadsheets.
Land Use	• Lake Okeechobee Service Area (LOSA) Basins were updated using consumptive use permit information as of 2/21/2012, as reflected in the LOSA Ledger produced by the Water Use Bureau. • C-43 Groundwater irrigated basins – Permitted as of 2010, the dataset was updated using land use, aerial imagery and 2010 consumptive use permit information . • Dominant land use in EAA is sugar cane other land uses consist of shrub land, wet land, ridge and slough, and sawgrass.
LOSA Basins	• Lower Istokpoga, North Lake Shore and Northeast Lake Shore demands and runoff estimated using the AFSIRS model and assumed permitted land use (see land use assumptions row).
Lake Okeechobee	• Lake Okeechobee Regulation Schedule 2008 (LORS 2008) o CEPP optimized release guidance in order to improve selected performance within LOK, the northern estuaries and LOSA while meeting environmental targets in the Glades. o Lake Okeechobee can send flood releases south through the Miami Canal and North New River Canal to the FEB when the LOK stage is above the bottom of Zone D and the FEB depth is below 2' (EAA basin runoff used to limit conveyance capacity: 1,550 cfs for Miami Canal and 1,350 cfs for North New River Canal). o Lake Okeechobee can send flood releases south to help meet water-quality based flow targets at STA-3/4, STA-2N, and STA-2S when the LOK stage is above the bottom of the Baseflow Zone (EAA basin runoff used to limit conveyance capacity: 1,550 cfs for Miami Canal and 1,350 cfs for North New River Canal). o Includes Lake Okeechobee regulatory releases to tide via L8 canal.

Feature	
	o Releases via S-77 can be diverted into C43 Reservoir • Lake Okeechobee Water Shortage Management (LOWSM) Plan. • Interim Action Plan (IAP) for Lake Okeechobee (under which backpumping to the lake at S-2 and S-3 is to be minimized). • "Temporary" forward pumps as follows: o S354 – 400 cfs o S351 – 600 cfs o S352 – 400 cfs o All pumps reduce to the above capacities when Lake Okeechobee stage falls below 10.2 ft and turn off when stages recover to greater than 11.2 ft • No reduction in EAA runoff associated with the implementation of Best Management Practices (BMPs); No BMP makeup water deliveries to the WCAs • Backpumping of 298 Districts and 715 Farms into lake minimized
Northern Lake Okeechobee Watershed Inflows	• Headwaters Revitalization schedule for Kissimmee Chain of Lakes using the UKISS model. • Kissimmee River Restoration complete. • Fisheating Creek, Istokpoga & Taylor Creek / Nubbin Slough Basin Inflows calculated from historical runoff estimates.
Caloosahatchee River Basin	• Caloosahatchee River Basin irrigation demands and runoff estimated using the AFSIRS model and assumed permitted land use as of February 2012. (see land use assumptions row) • Public water supply daily intake from the river is included in the analysis. • Maximum reservoir height of 41.7 ft NGVD with a 9,379-acre footprint in Western C43 basin with a 175,800 acre-feet effective storage. • Proposed reservoir meets estuary demands while C-43 basin supplemental demands for surface water irrigation are met by Lake Okeechobee.
St. Lucie Canal Basin	• St. Lucie Canal Basin demands estimated using the AFSIRS model and assumed permitted land use as of February 2012 (see land use assumptions row). • Excess C-44 basin runoff is allowed to backflow into the Lake if lake stage is below 14.5 ft before being pumped into the C-44 reservoir. • Basin demands include the Florida Power & Light reservoir at Indiantown. • Indian River Lagoon South Project features o Ten-mile Creek Reservoir and STA: 7,078 acre-feet storage capacity at 10.79 maximum depth on 820 acre footprint; receives excess water from North Folk Basin; o C-44 reservoir: 50,246 acre-feet storage capacity at 5.18 feet maximum depth on 12,125 acre footprint; C44 reservoir releases water back to Lake Okeechobee when Lake stages are below the bottom of the Baseflow Zone. o C-23/C-24 reservoir: 92,094 acre-feet storage capacity at 13.27 maximum depth on 8,675 acre footprint; o C-23/C-24 STA: 3,852 acre-feet storage capacity at 1.5 maximum depth on 2,568 acre footprint; and o All proposed reservoirs meet estuary demands.

Feature	
Seminole Brighton Reservation	• Brighton reservation demands were estimated using AFSIRS method based on existing planted acreage. • The 2-in-10 demand set forth in the Seminole Compact Work plan equals 2,262 MGM (million gallons per month). AFSIRS modeled 2-in-10 demands equaled 2,383 MGM. • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per Table 7, Agreement 41-21 (Nov. 1992), tribal rights to these quantities are preserved. • LOWSM applies to this agreement.
Seminole Big Cypress Reservation	• Big Cypress Reservation irrigation demands and runoff were estimated using the AFSIRS method based on existing planted acreage. • The 2-in-10 demand set forth in the Seminole Compact Work Plan equals 2,606 MGM. • AFSIRS modeled 2-in-10 demands equaled 2,659 MGM. • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per the District's Final Order and Tribe's Resolution establishing the Big Cypress Reservation entitlement, tribal rights to these quantities are preserved. • LOWSM applies to this agreement.
Everglades Agricultural Area	• Model water-body components as shown in Figure 1. • Simulated runoff from the North New River – Hillsboro basin apportioned based on the relative size of contributing basins via S7 route vs. S6 route. • G-341 routes water from S-5A Basin to Hillsboro Basin. • RSMBN ECB EAA runoff and irrigation demand compared to SFWMM ECB simulated runoff and demand from 1965-2005 for reasonability.
Everglades Construction Project Stormwater Treatment Areas	• STAs are simulated as single waterbodies • STA-1E: 6,546 acres total area • STA-1W: 7,488 acres total area • S-5A Basin runoff is to be treated in STA-1W first and when conveyance capacities are exceeded, rerouted to STA-1E • STA-2: cells 1,2 & 3: 7,681 acres total area • STA-2N: cells 4,5 & 6; refers to Comp B-North; 6,531 acres total area • STA-2S: cells 7 & 8; refers to Comp B-South; 3,570 acres total area • STA-3/4: 17,126 acres total area • STA-5N: includes cells 1 & 2: 5,081 acres total area • STA-5S: includes cells 3, 4 & 5; uses footprint of Compartment C: 8,469 acres total area • STA-6: expanded with phase 2: 3,054 acres total area

Feature	
	• Assumed operations of STAs: o 0.5 ft minimum depth below which supply from external sources is triggered; o 4 ft maximum depth above which inflows are discontinued; and o Inflow targets established for STA-3/4, STA-2N and STA-2S based on DMSTA simulation; met from local basin runoff, LOK flood releases and available FEB storage. • A 29,617-acre Flow Equalization Basin (FEB) located north of STA-3/4 and Holeyland. The total footprint represents the original 15,853-acre A-1 footprint plus the additional 13,764-acre A-2 footprint operated as follows: o Assumed average topography of 9.63 ft NGVD. FEB inflows are from excess EAA basin runoff above the established inflow targets at STA-3/4, STA-2N, and STA-2S, and from LOK flood releases south; o FEB outflows are used to help meet established inflow targets at STA-3/4, STA-2N, and STA-2S if EAA basin runoff and LOK flood releases are not sufficient; o 0.5 ft minimum depth below which no releases are allowed; o 3.8 ft maximum depth above which inflows are discontinued; o No supplemental water supply provided to FEB; o Assumed inlet pump from STA-3/4 supply canal with capacity equal to combined capacity of G-372 and G-370 structures; and o Outflow weirs, with similar discharge characteristics as STA-3/4 outlet structure, discharging into lower Miami and lower North New River canals.
Holey Land Wildlife Management Area	• G-372HL is the only inflow structure for Holey Land used for keeping the water table from going lower than half a foot below land surface elevation. • Operations are similar to the existing condition as in the 1995 base simulation for the Lower East Coast Regional Water Supply Plan (LECRWSP, May 2000), as per the memorandum of agreement between the FL Fish and Wildlife Conservation (FWC) Commission and the SFWMD.
Rotenberger Wildlife Management Area	• Operational Schedule as defined in the Operation Plan for Rotenberger WMA. (SFWMD, March 2010)
Public Water Supply and Irrigation	• Regional water supply demands to maintain Lower East Coast canals as simulated from RSMGL FWO.
Western Basins	• C139 RSM basin is being modeled. Period is 1965-2005. • C139 basin runoff is modeled as follows: G136 flows is routed to Miami Canal; G342A-D flows routed to STA5N; G508 flows routed to STA5S; G406 flows routed to STA6. • C139 basin demand is met primarily by local groundwater.

Feature	
Water Shortage Rules	• Reflects the existing water shortage policies as in South Florida Water Management District Chapters 40E-21 and 40E-22, FAC, including Lake Okeechobee Water Shortage Management (LOWSM) Plan.



Water-Body Components:
Miami Water-Body = S3 + S8 + A-2WW
NNR/HILLS Water-Body = S2 + S6 + S7 + New Hope South
WPB Water-Body = S-5A
FEB = A-2W + A-2E + A-1

Fig. 1 RSMBSN Basin Definition within the EAA: Alternative 4 Revised (ALT4R) Scenario

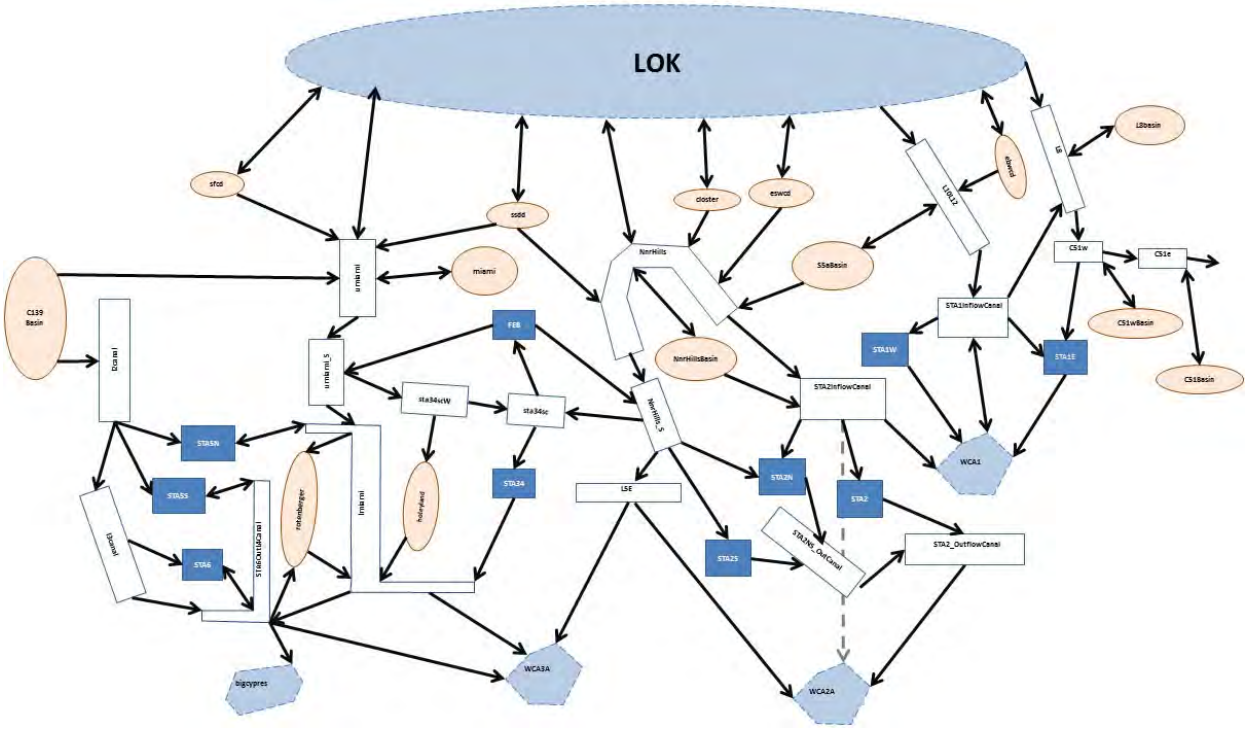


Fig. 2 RSMBSN Link-Node Routing Diagram: Alternative 4 Revised (ALT4R) Scenario

Note:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the eastern and southern boundaries of the RSMBN model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Glades-LECSA Model (RSMGL). The SFWMM was the source of the eastern boundary groundwater/surface water flows, while the RSMGL was the source of the southern boundary structural flows.

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Basins (RSMBN)
Tentatively Selected Plan Other Water Related Needs
Sensitivity Scenario (ALT4R1)
Table of Assumptions

Feature	
Climate	• The climatic period of record is from 1965 to 2005. • Rainfall estimates have been revised and updated for 1965-2005. • Revised evapotranspiration methods have been used for 1965-2005.
Topography	The Topography dataset for RSM was Updated in 2009 using the following datasets: • South Florida Digital Elevation Model, USACE, 2004; • High Accuracy Elevation Data, US Geological Survey 2007; • Loxahatchee River LiDAR Study, Dewberry and Davis, 2004; • St. Lucie North Fork LiDAR, Dewberry and Davis, 2007; • Palm Beach County LiDAR Surve, Dewberry and Davis, 2004; and • Stormwater Treatment Area stage-storage-area relationships based on G. Goforth spreadsheets.
Land Use	• Lake Okeechobee Service Area (LOSA) Basins were updated using consumptive use permit information as of 2/21/2012, as reflected in the LOSA Ledger produced by the Water Use Bureau. • C-43 Groundwater irrigated basins – Permitted as of 2010, the dataset was updated using land use, aerial imagery and 2010 consumptive use permit information . • Dominant land use in EAA is sugar cane other land uses consist of shrub land, wet land, ridge and slough, and sawgrass.
LOSA Basins	• Lower Istokpoga, North Lake Shore and Northeast Lake Shore demands and runoff estimated using the AFSIRS model and assumed permitted land use (see land use assumptions row).
Lake Okeechobee	• Lake Okeechobee Regulation Schedule 2008 (LORS 2008) o CEPP optimized release guidance in order to improve selected performance within LOK, the northern estuaries and LOSA while meeting environmental targets in the Glades. o Lake Okeechobee can send flood releases south through the Miami Canal and North New River Canal to the FEB when the LOK stage is above the bottom of Zone D and the FEB depth is below 2' (EAA basin runoff used to limit conveyance capacity: 1,550 cfs for Miami Canal and 1,350 cfs for North New River Canal). o Lake Okeechobee can send flood releases south to help meet water-quality based flow targets at STA-3/4, STA-2N, and STA-2S when the LOK stage is above the bottom of the Baseflow Zone (EAA basin runoff used to limit conveyance capacity: 1,550 cfs for Miami Canal and 1,350 cfs for North New River Canal).

Feature	
	o Includes Lake Okeechobee regulatory releases to tide via L8 canal. o Releases via S-77 can be diverted into C43 Reservoir • Lake Okeechobee Water Shortage Management (LOWSM) Plan. • Interim Action Plan (IAP) for Lake Okeechobee (under which backpumping to the lake at S-2 and S-3 is to be minimized). • "Temporary" forward pumps as follows: o S354 – 400 cfs o S351 – 600 cfs o S352 – 400 cfs o All pumps reduce to the above capacities when Lake Okeechobee stage falls below 10.2 ft and turn off when stages recover to greater than 11.2 ft • No reduction in EAA runoff associated with the implementation of Best Management Practices (BMPs); No BMP makeup water deliveries to the WCAs • Backpumping of 298 Districts and 715 Farms into lake minimized
Northern Lake Okeechobee Watershed Inflows	• Headwaters Revitalization schedule for Kissimmee Chain of Lakes using the UKISS model. • Kissimmee River Restoration complete. • Fisheating Creek, Istokpoga & Taylor Creek / Nubbin Slough Basin Inflows calculated from historical runoff estimates.
Caloosahatchee River Basin	• Caloosahatchee River Basin irrigation demands and runoff estimated using the AFSIRS model and assumed permitted land use as of February 2012. (see land use assumptions row) • Public water supply daily intake from the river is included in the analysis. • Maximum reservoir height of 41.7 ft NGVD with a 9,379-acre footprint in Western C43 basin with a 175,800 acre-feet effective storage. • Proposed reservoir meets estuary demands while C-43 basin supplemental demands for surface water irrigation are met by Lake Okeechobee.
St. Lucie Canal Basin	o St. Lucie Canal Basin demands estimated using the AFSIRS model and assumed permitted land use as of February 2012 (see land use assumptions row). o Excess C-44 basin runoff is allowed to backflow into the Lake if lake stage is below 14.5 ft before being pumped into the C-44 reservoir. o Basin demands include the Florida Power & Light reservoir at Indiantown. o Indian River Lagoon South Project features o Ten-mile Creek Reservoir and STA: 7,078 acre-feet storage capacity at 10.79 maximum depth on 820 acre footprint; receives excess water from North Folk Basin; o C-44 reservoir: 50,246 acre-feet storage capacity at 5.18 feet maximum depth on 12,125 acre footprint; C44 reservoir releases water back to Lake Okeechobee when Lake stages are below the bottom of the Baseflow Zone. o C-23/C-24 reservoir: 92,094 acre-feet storage capacity at 13.27 maximum depth on 8,675 acre footprint;

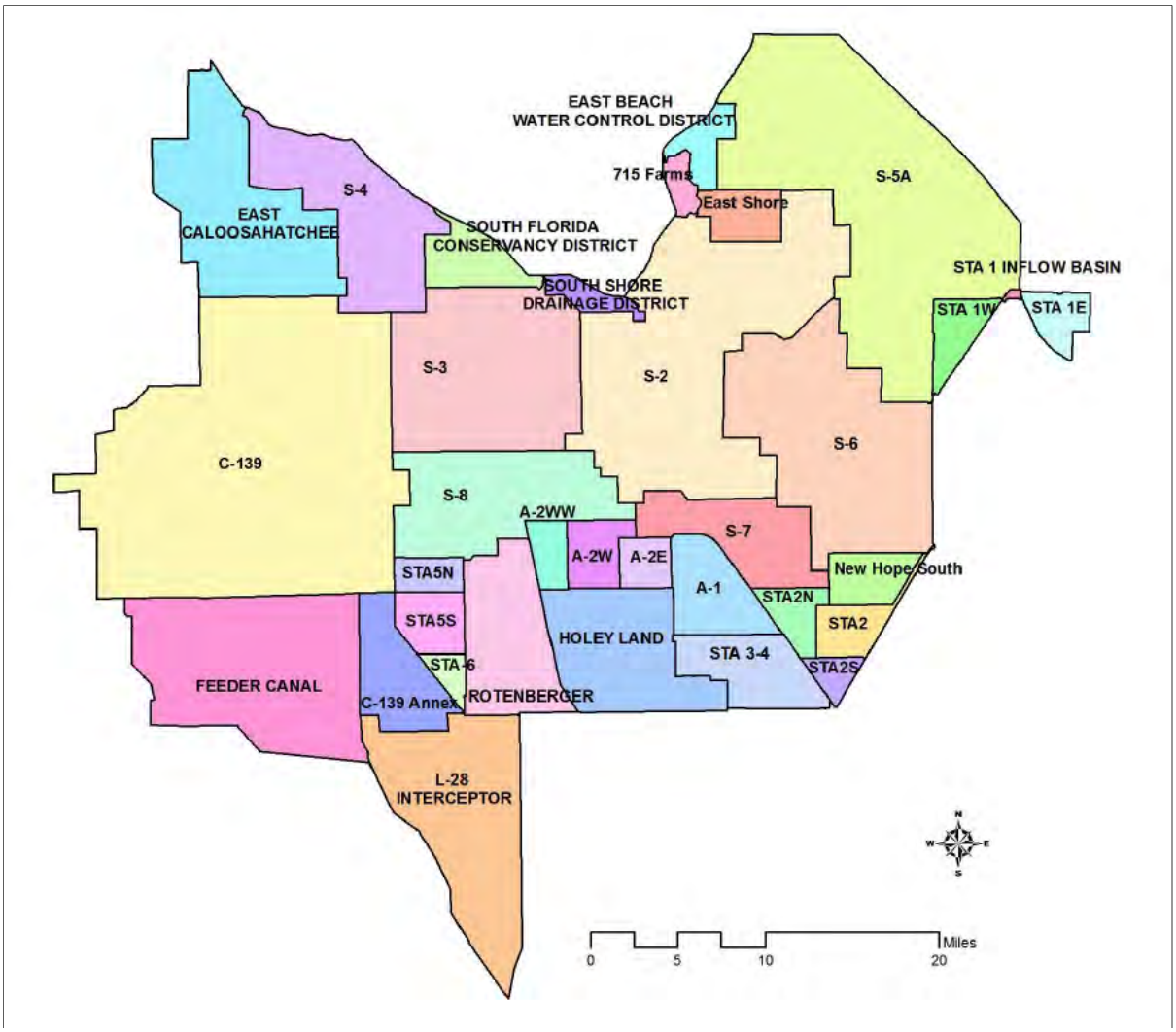
Feature	
	o C-23/C-24 STA: 3,852 acre-feet storage capacity at 1.5 maximum depth on 2,568 acre footprint; and o All proposed reservoirs meet estuary demands. o IRL operations assumed are consistent with the March 2010 St. Lucie River Water Reservation Rule update. o Excess C23 basin water not needed to meet estuary demands can be diverted to the C44 reservoir if capacity exists. o C44 reservoir can discharge to C44 canal and backflow to Lake Okeechobee when the lake is below the baseflow zone.
Seminole Brighton Reservation	• Brighton reservation demands were estimated using AFSIRS method based on existing planted acreage. • The 2-in-10 demand set forth in the Seminole Compact Work plan equals 2,262 MGM (million gallons per month). AFSIRS modeled 2-in-10 demands equaled 2,383 MGM. • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per Table 7, Agreement 41-21 (Nov. 1992), tribal rights to these quantities are preserved. • LOWSM applies to this agreement.
Seminole Big Cypress Reservation	• Big Cypress Reservation irrigation demands and runoff were estimated using the AFSIRS method based on existing planted acreage. • The 2-in-10 demand set forth in the Seminole Compact Work Plan equals 2,606 MGM. • AFSIRS modeled 2-in-10 demands equaled 2,659 MGM. • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per the District's Final Order and Tribe's Resolution establishing the Big Cypress Reservation entitlement, tribal rights to these quantities are preserved. • LOWSM applies to this agreement.
Everglades Agricultural Area	• Model water-body components as shown in Figure 1. • Simulated runoff from the North New River – Hillsboro basin apportioned based on the relative size of contributing basins via S7 route vs. S6 route. • G-341 routes water from S-5A Basin to Hillsboro Basin. • RSMBN ECB EAA runoff and irrigation demand compared to SFWMM ECB simulated runoff and demand from 1965-2005 for reasonability.
Everglades Construction Project Stormwater Treatment Areas	• STAs are simulated as single waterbodies • STA-1E: 6,546 acres total area • STA-1W: 7,488 acres total area • S-5A Basin runoff is to be treated in STA-1W first and when conveyance capacities are exceeded, rerouted to STA-1E • STA-2: cells 1,2 & 3: 7,681 acres total area • STA-2N: cells 4,5 & 6; refers to Comp B-North; 6,531 acres total area • STA-2S: cells 7 & 8; refers to Comp B-South; 3,570 acres total

Feature	
	area • STA-3/4: 17,126 acres total area • STA-5N: includes cells 1 & 2: 5,081 acres total area • STA-5S: includes cells 3, 4 & 5; uses footprint of Compartment C: 8,469 acres total area • STA-6: expanded with phase 2: 3,054 acres total area • Assumed operations of STAs: o 0.5 ft minimum depth below which supply from external sources is triggered; o 4 ft maximum depth above which inflows are discontinued; and o Inflow targets established for STA-3/4, STA-2N and STA-2S based on DMSTA simulation; met from local basin runoff, LOK flood releases and available FEB storage. • A 29,617-acre Flow Equalization Basin (FEB) is located north of STA-3/4 and Holeyland. The total footprint represents the original 15,853-acre A-1 footprint plus the additional 13,764-acre A-2 footprint operated as follows: o Assumed average topography of 9.63 ft NGVD. FEB inflows are from excess EAA basin runoff above the established inflow targets at STA-3/4, STA-2N, and STA-2S, and from LOK flood releases south; o FEB outflows are used to help meet established inflow targets at STA-3/4, STA-2N, and STA-2S if EAA basin runoff and LOK flood releases are not sufficient; o 0.5 ft minimum depth below which no releases are allowed; o 3.8 ft maximum depth above which inflows are discontinued; o No supplemental water supply provided to FEB; o Assumed inlet pump from STA-3/4 supply canal with capacity equal to combined capacity of G-372 and G-370 structures; and o Outflow weirs, with similar discharge characteristics as STA-3/4 outlet structure, discharging into lower Miami and lower North New River canals.
Holey Land Wildlife Management Area	• G-372HL is the only inflow structure for Holey Land used for keeping the water table from going lower than half a foot below land surface elevation. • Operations are similar to the existing condition as in the 1995 base simulation for the Lower East Coast Regional Water Supply Plan (LECRWSP, May 2000), as per the memorandum of agreement between the FL Fish and Wildlife Conservation (FWC) Commission and the SFWMD.
Rotenberger Wildlife Management Area	• Operational Schedule as defined in the Operation Plan for Rotenberger WMA. (SFWMD, March 2010)

Feature	
Public Water Supply and Irrigation	• Regional water supply demands to maintain Lower East Coast canals as simulated from RSMGL FWO.
Western Basins	• C139 RSM basin is being modeled. Period is 1965-2005. • C139 basin runoff is modeled as follows: G136 flows is routed to Miami Canal; G342A-D flows routed to STA5N; G508 flows routed to STA5S; G406 flows routed to STA6. • C139 basin demand is met primarily by local groundwater.
Water Shortage Rules	• Reflects the existing water shortage policies as in South Florida Water Management District Chapters 40E-21 and 40E-22, FAC, including Lake Okeechobee Water Shortage Management (LOWSM) Plan.

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the eastern and southern boundaries of the RSMBN model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Glades-LECSA Model (RSMGL). The SFWMM was the source of the eastern boundary groundwater/surface water flows, while the RSMGL was the source of the southern boundary structural flows.
- The RSMBN CEPP representation of ALT4R1 is the same as the June 25, 2013 ALT4R2 scenario.



Water-Body Components:
Miami Water-Body = S3 + S8 + A-2WW
NNR/HILLS Water-Body = S2 + S6 + S7 + New Hope South
WPB Water-Body = S-5A
FEB = A-2W + A-2E + A-1

Fig. 1 RSMBSN Basin Definition within the EAA: Updated Tentatively Selected Plan (ALT4R2)

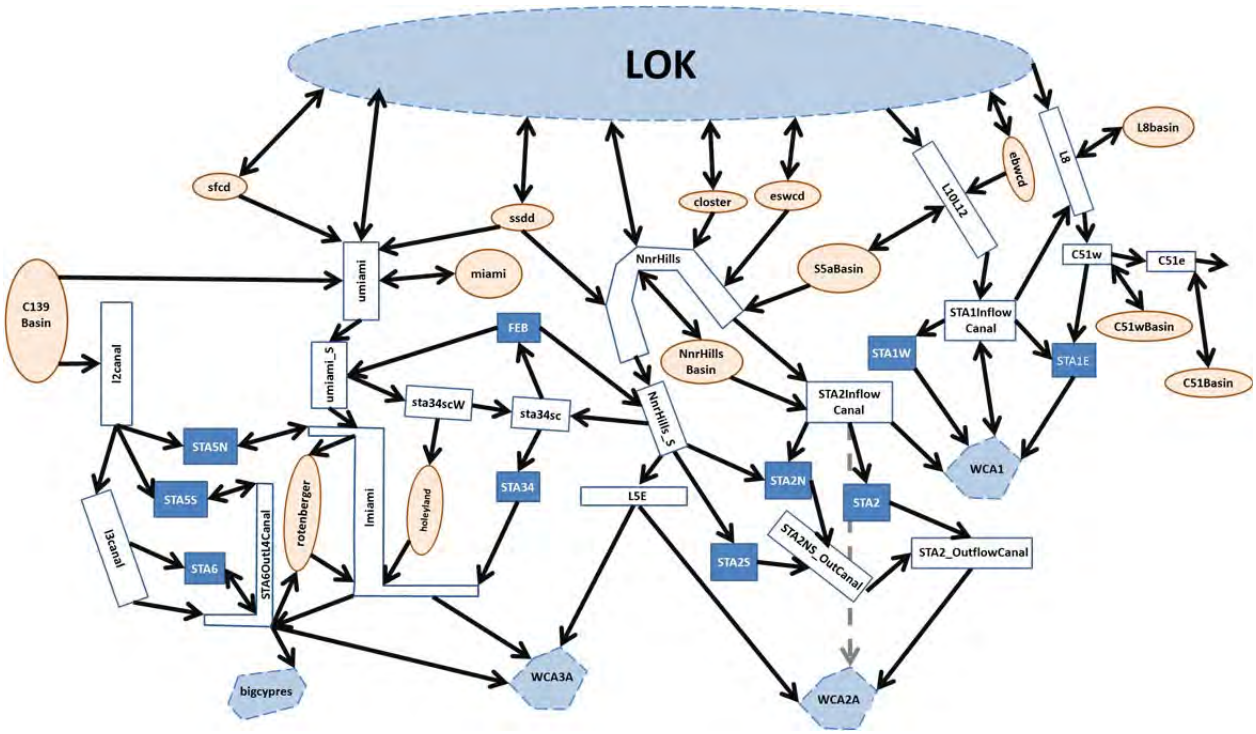


Fig. 2 RSMBSN Link-Node Routing Diagram: Updated Tentatively Selected Plan (ALT4R2)

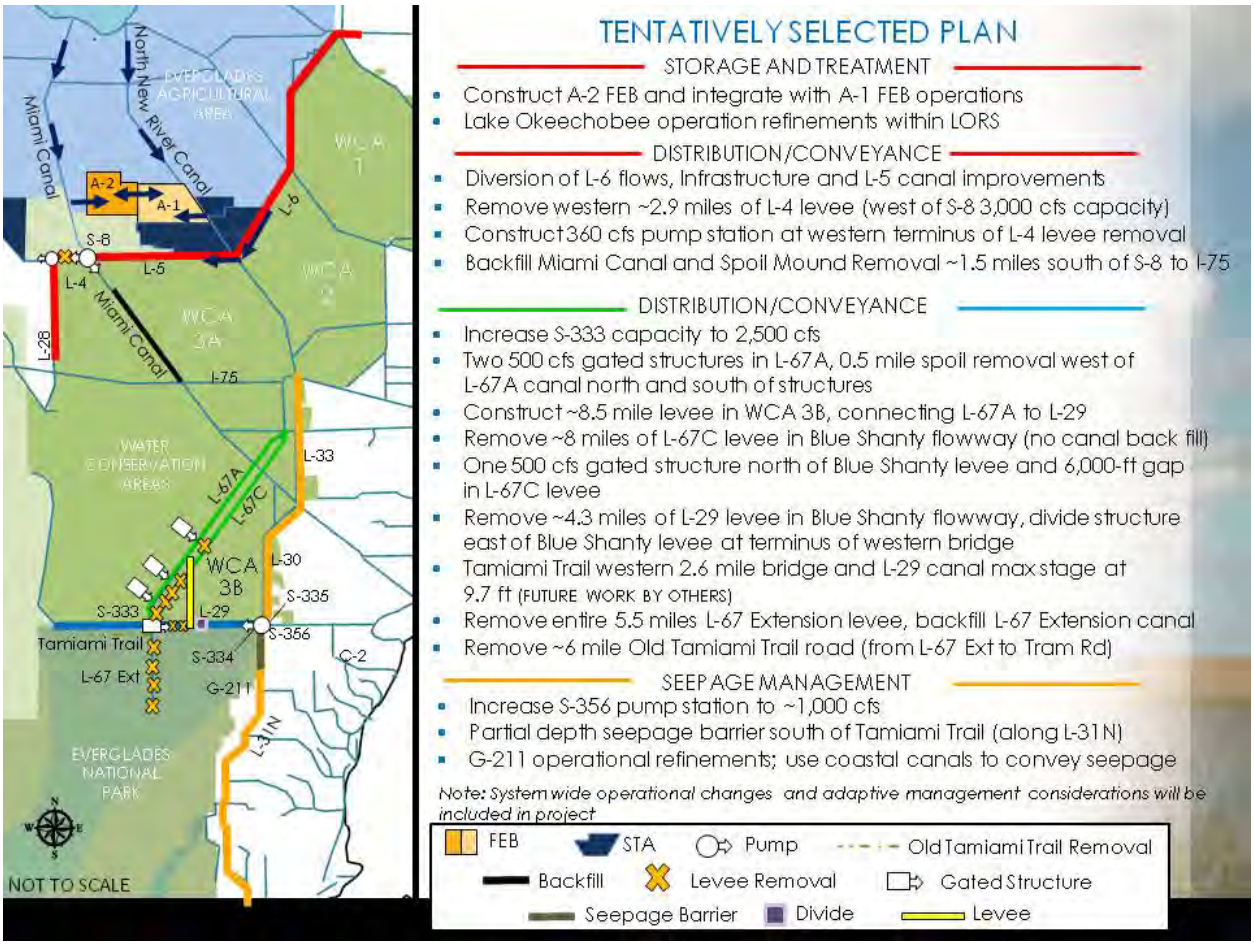


Fig. 3 CEPP ALT4R2 Features as defined by CEPP project team

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Basins (RSMBN)
Updated Tentatively Selected Plan (ALT4R2)
Table of Assumptions

Feature	
Climate	• The climatic period of record is from 1965 to 2005. • Rainfall estimates have been revised and updated for 1965-2005. • Revised evapotranspiration methods have been used for 1965-2005.
Topography	The Topography dataset for RSM was Updated in 2009 using the following datasets: • South Florida Digital Elevation Model, USACE, 2004; • High Accuracy Elevation Data, US Geological Survey 2007; • Loxahatchee River LiDAR Study, Dewberry and Davis, 2004; • St. Lucie North Fork LiDAR, Dewberry and Davis, 2007; • Palm Beach County LiDAR Surve, Dewberry and Davis, 2004; and • Stormwater Treatment Area stage-storage-area relationships based on G. Goforth spreadsheets.
Land Use	• Lake Okeechobee Service Area (LOSA) Basins were updated using consumptive use permit information as of 2/21/2012, as reflected in the LOSA Ledger produced by the Water Use Bureau. • C-43 Groundwater irrigated basins – Permitted as of 2010, the dataset was updated using land use, aerial imagery and 2010 consumptive use permit information . • Dominant land use in EAA is sugar cane other land uses consist of shrub land, wet land, ridge and slough, and sawgrass.
LOSA Basins	• Lower Istokpoga, North Lake Shore and Northeast Lake Shore demands and runoff estimated using the AFSIRS model and assumed permitted land use (see land use assumptions row).
Lake Okeechobee	• Lake Okeechobee Regulation Schedule 2008 (LORS 2008) o CEPP optimized release guidance in order to improve selected performance within LOK, the northern estuaries and LOSA while meeting environmental targets in the Glades. o Lake Okeechobee can send flood releases south through the Miami Canal and North New River Canal to the FEB when the LOK stage is above the bottom of Zone D and the FEB depth is below 2' (EAA basin runoff used to limit conveyance capacity: 1,550 cfs for Miami Canal and 1,350 cfs for North New River Canal). o Lake Okeechobee can send flood releases south to help meet water-quality based flow targets at STA-3/4, STA-2N, and STA-2S when the LOK stage is above the bottom of the Baseflow Zone (EAA basin runoff used to limit conveyance capacity: 1,550 cfs for Miami Canal and 1,350 cfs for North New River Canal). o Includes Lake Okeechobee regulatory releases to tide via L8 canal.

Feature	
	o Releases via S-77 can be diverted into C43 Reservoir • Lake Okeechobee Water Shortage Management (LOWSM) Plan. • Interim Action Plan (IAP) for Lake Okeechobee (under which backpumping to the lake at S-2 and S-3 is to be minimized). • "Temporary" forward pumps as follows: o S354 – 400 cfs o S351 – 600 cfs o S352 – 400 cfs o All pumps reduce to the above capacities when Lake Okeechobee stage falls below 10.2 ft and turn off when stages recover to greater than 11.2 ft • No reduction in EAA runoff associated with the implementation of Best Management Practices (BMPs); No BMP makeup water deliveries to the WCAs • Backpumping of 298 Districts and 715 Farms into lake minimized
Northern Lake Okeechobee Watershed Inflows	• Headwaters Revitalization schedule for Kissimmee Chain of Lakes using the UKISS model. • Kissimmee River Restoration complete. • Fisheating Creek, Istokpoga & Taylor Creek / Nubbin Slough Basin Inflows calculated from historical runoff estimates.
Caloosahatchee River Basin	• Caloosahatchee River Basin irrigation demands and runoff estimated using the AFSIRS model and assumed permitted land use as of February 2012. (see land use assumptions row) • Public water supply daily intake from the river is included in the analysis. • Maximum reservoir height of 41.7 ft NGVD with a 9,379-acre footprint in Western C43 basin with a 175,800 acre-feet effective storage. • Proposed reservoir meets estuary demands while C-43 basin supplemental demands for surface water irrigation are met by Lake Okeechobee.
St. Lucie Canal Basin	o St. Lucie Canal Basin demands estimated using the AFSIRS model and assumed permitted land use as of February 2012 (see land use assumptions row). o Excess C-44 basin runoff is allowed to backflow into the Lake if lake stage is below 14.5 ft before being pumped into the C-44 reservoir. o Basin demands include the Florida Power & Light reservoir at Indiantown. o Indian River Lagoon South Project features o Ten-mile Creek Reservoir and STA: 7,078 acre-feet storage capacity at 10.79 maximum depth on 820 acre footprint; receives excess water from North Folk Basin; o C-44 reservoir: 50,246 acre-feet storage capacity at 5.18 feet maximum depth on 12,125 acre footprint; C44 reservoir releases water back to Lake Okeechobee when Lake stages are below the bottom of the Baseflow Zone. o C-23/C-24 reservoir: 92,094 acre-feet storage capacity at 13.27 maximum depth on 8,675 acre footprint; o C-23/C-24 STA: 3,852 acre-feet storage capacity at 1.5 maximum depth on 2,568 acre footprint;

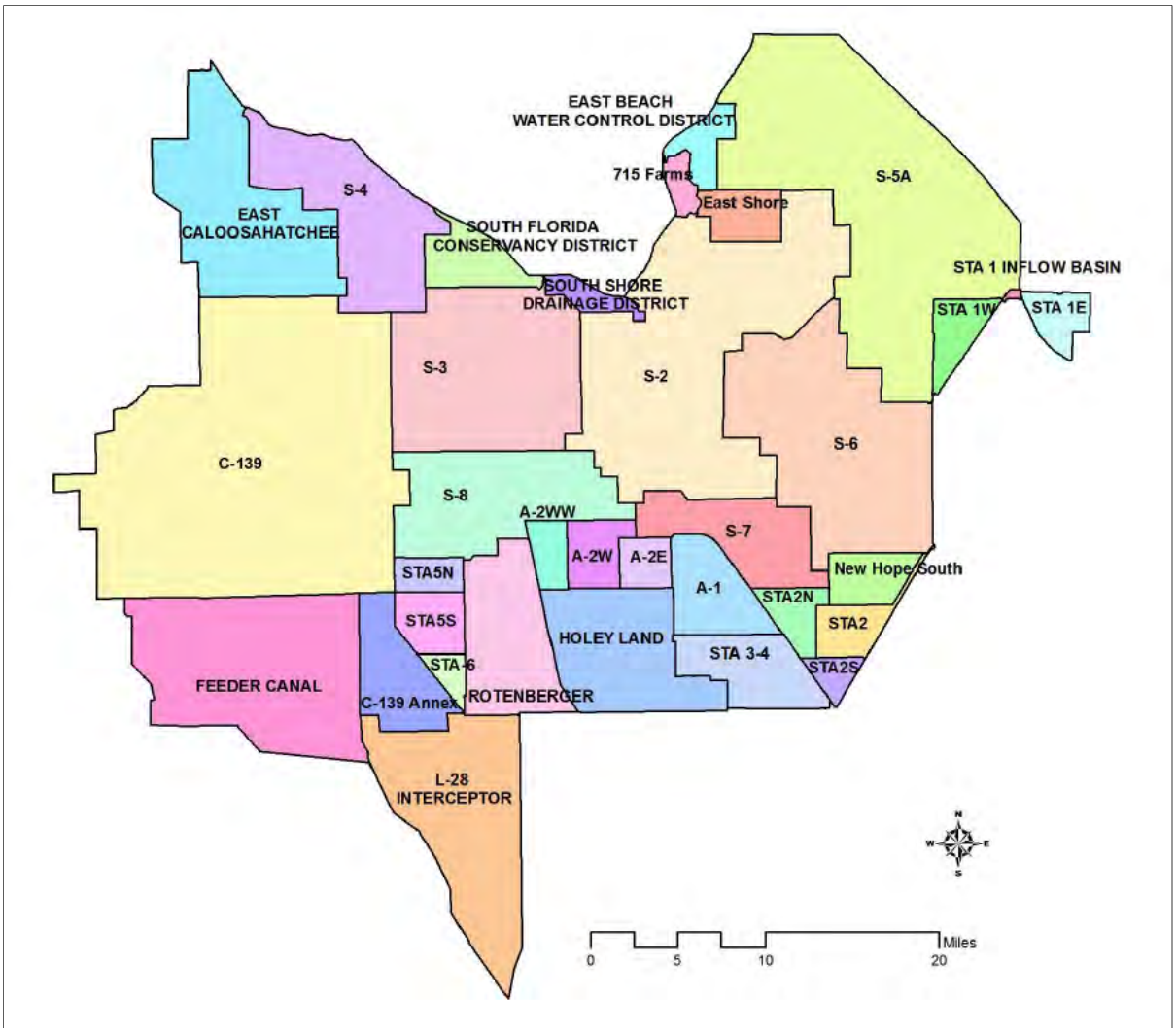
Feature	
	o All proposed reservoirs meet estuary demands. o IRL operations assumed are consistent with the March 2010 St. Lucie River Water Reservation Rule update. o Excess C23 basin water not needed to meet estuary demands can be diverted to the C44 reservoir if capacity exists. o C44 reservoir can discharge to C44 canal and backflow to Lake Okeechobee when the lake is below the baseflow zone.
Seminole Brighton Reservation	• Brighton reservation demands were estimated using AFSIRS method based on existing planted acreage. • The 2-in-10 demand set forth in the Seminole Compact Work plan equals 2,262 MGM (million gallons per month). AFSIRS modeled 2-in-10 demands equaled 2,383 MGM. • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per Table 7, Agreement 41-21 (Nov. 1992), tribal rights to these quantities are preserved. • LOWSM applies to this agreement.
Seminole Big Cypress Reservation	• Big Cypress Reservation irrigation demands and runoff were estimated using the AFSIRS method based on existing planted acreage. • The 2-in-10 demand set forth in the Seminole Compact Work Plan equals 2,606 MGM. • AFSIRS modeled 2-in-10 demands equaled 2,659 MGM. • While estimated demands, and therefore deliveries, for every month of simulation do not equate to monthly entitlement quantities as per the District's Final Order and Tribe's Resolution establishing the Big Cypress Reservation entitlement, tribal rights to these quantities are preserved. • LOWSM applies to this agreement.
Everglades Agricultural Area	• Model water-body components as shown in Figure 1. • Simulated runoff from the North New River – Hillsboro basin apportioned based on the relative size of contributing basins via S7 route vs. S6 route. • G-341 routes water from S-5A Basin to Hillsboro Basin. • RSMBN ECB EAA runoff and irrigation demand compared to SFWMM ECB simulated runoff and demand from 1965-2005 for reasonability.
Everglades Construction Project Stormwater Treatment Areas	• STAs are simulated as single waterbodies • STA-1E: 6,546 acres total area • STA-1W: 7,488 acres total area • S-5A Basin runoff is to be treated in STA-1W first and when conveyance capacities are exceeded, rerouted to STA-1E • STA-2: cells 1,2 & 3: 7,681 acres total area • STA-2N: cells 4,5 & 6; refers to Comp B-North; 6,531 acres total area • STA-2S: cells 7 & 8; refers to Comp B-South; 3,570 acres total area • STA-3/4: 17,126 acres total area

Feature	
	• STA-5N: includes cells 1 & 2: 5,081 acres total area • STA-5S: includes cells 3, 4 & 5; uses footprint of Compartment C: 8,469 acres total area • STA-6: expanded with phase 2: 3,054 acres total area • Assumed operations of STAs: o 0.5 ft minimum depth below which supply from external sources is triggered; o 4 ft maximum depth above which inflows are discontinued; and o Inflow targets established for STA-3/4, STA-2N and STA-2S based on DMSTA simulation; met from local basin runoff, LOK flood releases and available FEB storage. • A 29,617-acre Flow Equalization Basin (FEB) is located north of STA-3/4 and Holeyland. The total footprint represents the original 15,853-acre A-1 footprint plus the additional 13,764-acre A-2 footprint operated as follows: o Assumed average topography of 9.63 ft NGVD. FEB inflows are from excess EAA basin runoff above the established inflow targets at STA-3/4, STA-2N, and STA-2S, and from LOK flood releases south; o FEB outflows are used to help meet established inflow targets at STA-3/4, STA-2N, and STA-2S if EAA basin runoff and LOK flood releases are not sufficient; o 0.5 ft minimum depth below which no releases are allowed; o 3.8 ft maximum depth above which inflows are discontinued; o No supplemental water supply provided to FEB; o Assumed inlet pump from STA-3/4 supply canal with capacity equal to combined capacity of G-372 and G-370 structures; and o Outflow weirs, with similar discharge characteristics as STA-3/4 outlet structure, discharging into lower Miami and lower North New River canals.
Holey Land Wildlife Management Area	• G-372HL is the only inflow structure for Holey Land used for keeping the water table from going lower than half a foot below land surface elevation. • Operations are similar to the existing condition as in the 1995 base simulation for the Lower East Coast Regional Water Supply Plan (LECRWSP, May 2000), as per the memorandum of agreement between the FL Fish and Wildlife Conservation (FWC) Commission and the SFWMD.
Rotenberger Wildlife Management Area	• Operational Schedule as defined in the Operation Plan for Rotenberger WMA. (SFWMD, March 2010)
Public Water Supply and Irrigation	• Regional water supply demands to maintain Lower East Coast canals as simulated from RSMGL FWO.

Feature	
Western Basins	• C139 RSM basin is being modeled. Period is 1965-2005. • C139 basin runoff is modeled as follows: G136 flows is routed to Miami Canal; G342A-D flows routed to STA5N; G508 flows routed to STA5S; G406 flows routed to STA6. • C139 basin demand is met primarily by local groundwater.
Water Shortage Rules	• Reflects the existing water shortage policies as in South Florida Water Management District Chapters 40E-21 and 40E-22, FAC, including Lake Okeechobee Water Shortage Management (LOWSM) Plan.

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the eastern and southern boundaries of the RSMBN model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Glades-LECSA Model (RSMGL). The SFWMM was the source of the eastern boundary groundwater/surface water flows, while the RSMGL was the source of the southern boundary structural flows.
- The RSMBN CEPP representation of ALT4R2 is the same as the June 2, 2013 ALT4R1 scenario.



Water-Body Components:
Miami Water-Body = S3 + S8 + A-2WW
NNR/HILLS Water-Body = S2 + S6 + S7 + New Hope South
WPB Water-Body = S-5A
FEB = A-2W + A-2E + A-1

Fig. 1 RSMBSN Basin Definition within the EAA: Updated Tentatively Selected Plan (ALT4R2)

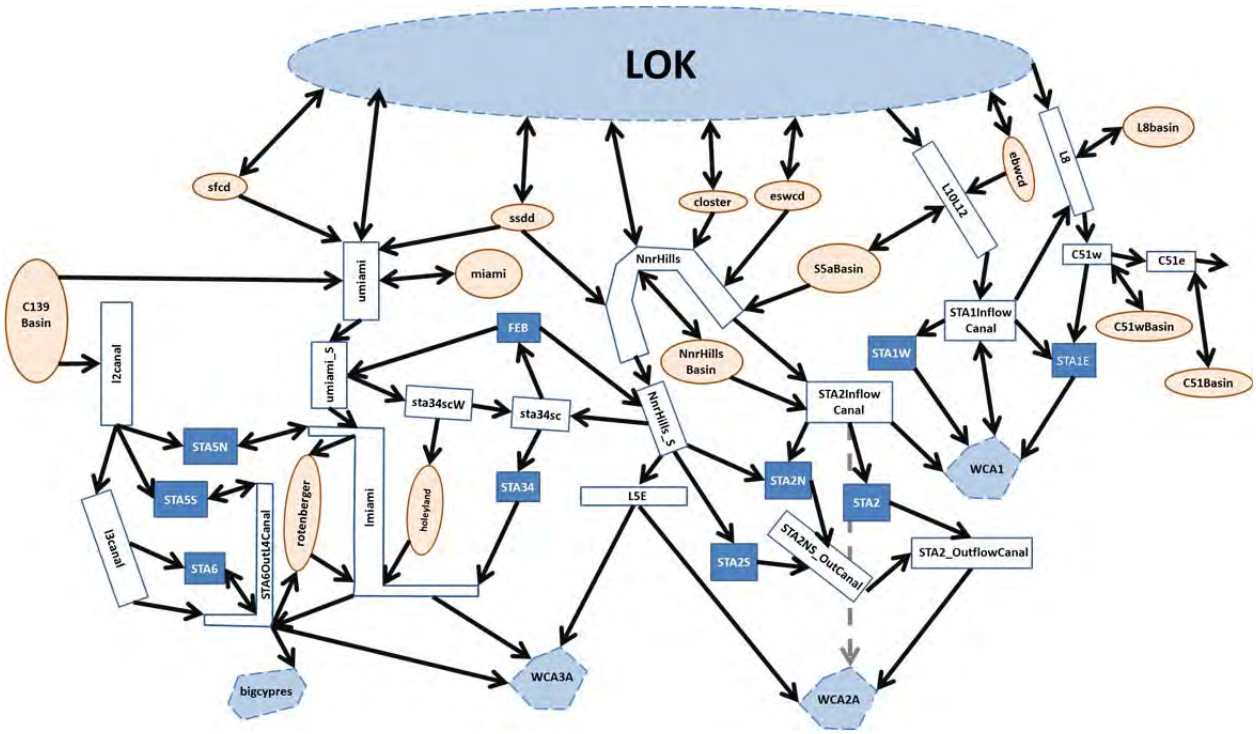


Fig. 2 RSMBSN Link-Node Routing Diagram: Updated Tentatively Selected Plan (ALT4R2)

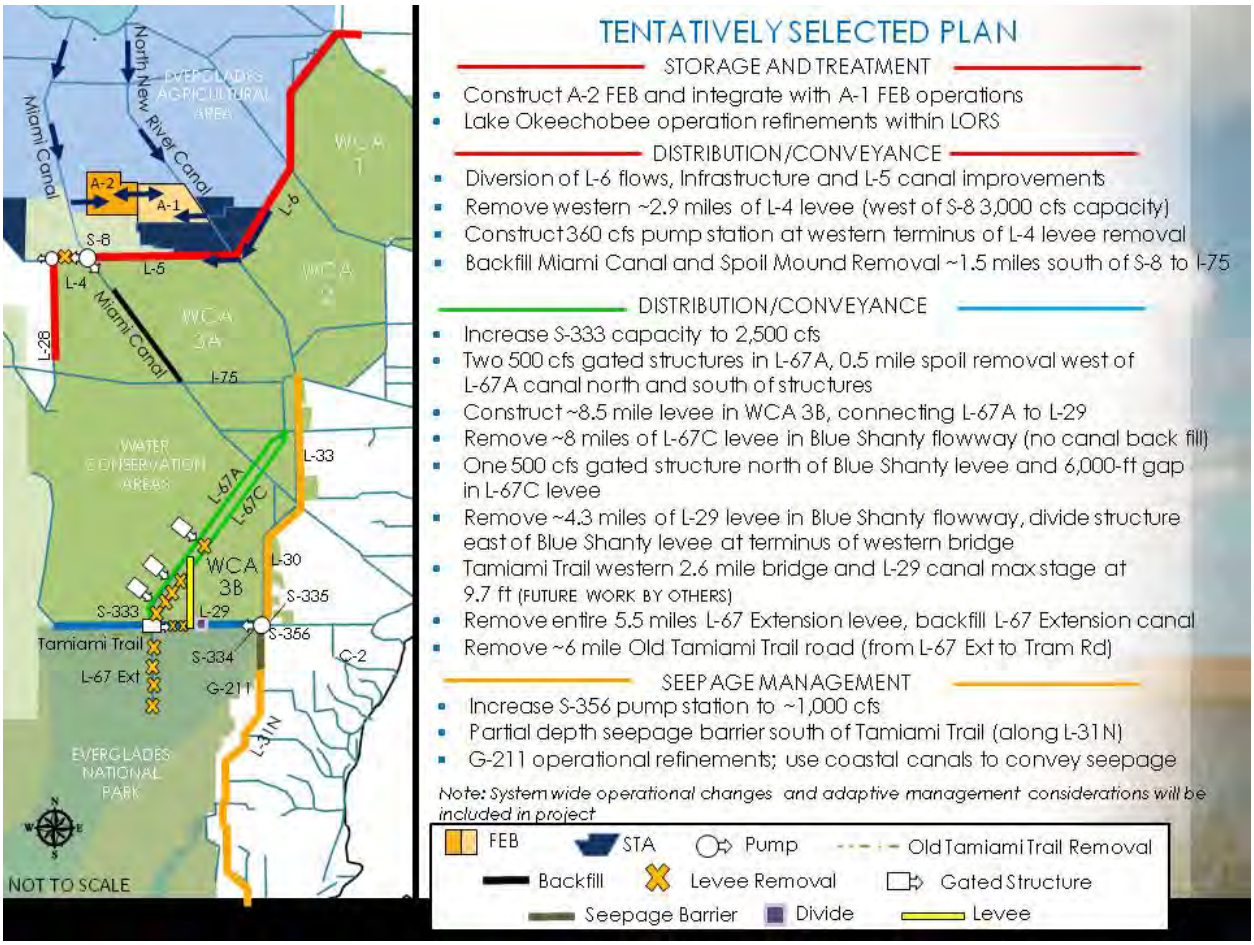


Fig. 3 CEPP ALT4R2 Features as defined by CEPP project team

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Glades-LECSA (RSMGL)
Tentatively Selected Plan (ALT4R)
Table of Assumptions

Feature	
Meteorological Data	• Rainfall file used: rain_v3.0_beta_tin_14_05.bin • Reference Evapotranspiration (RET) file used: RET_48_05_MULTIQUAD_v1.0.bin (ARCADIS, 2008)
Topography	• Same as calibration topographic data set except where reservoirs are introduced (STA1-E, C4 Impoundment and C-111 reservoirs). • United States Geological Survey (USGS) High-Accuracy Elevation Data Collection (HAEDC) for the Water Conservation Areas (1, 2A, 2B, 3A, and 3B), the Big Cypress National Preserve and Everglades National Park.
Tidal Data	• Tidal data from two primary (Naples and Virginia Key) and five secondary NOAA stations (Flamingo, Everglades, Palm Beach, Delray Beach and Hollywood Beach) were used to generate a historic record to be used as sea level boundary conditions for the entire simulation period.
Land Use and Land Cover	• Land Use and Land Cover Classification for the Lower East Coast urban areas (east of the Lower East Coast Flood Protection Levee) use 2008-2009 Land Use coverage as prepared by the SFWMD, consumptive use permits as of 2011 were used to update the land use in areas where it did not reflect the permit information. • Land Use and Land Cover Classification for the natural areas (west of the Lower East Coast Flood Protection Levee) is the same as the Calibration Land Use and Land Cover Classification for that area.Modified at locations where reservoirs are introduced (STA1-E, Site 1 Impoundment, Broward WPAs, C4 Impoundment, Lakebelt Lakes and C-111 Reservoirs).
Water Control Districts (WCDs)	• Water Control Districts in Palm Beach and Broward Counties and in the Western Basins assumed. • 8.5 SMA seepage canal is modeled as a WCD in ENP area.
Lake Belt Lakes	• Based on the permitted 2020 Lake Belt Lakes coverage obtained from USACE.
CERP Projects	• 1st Generation CERP – Site 1 Impoundment project is modeled as an above ground reservoir of area 1600 acres, with a maximum depth of 8 ft. • 2nd Generation CERP – Broward County Water Preserve Areas (WPAs) comprised of C-11 and C-9 impoundments were modeled as above ground reservoirs with areas 1221 and 1971 acres and maximum depths 4.3 and 4.0 ft. respectively. • 2nd Generation CERP – C-111 Spreader Canal Project includes the

Feature	
	Frog Pond Detention Area, which is modeled as an above ground impoundment with the S200 A, B and C pumps as inflow structures. In addition, the Aerojet canal is modeled with the inflow pumps S199 A, B and C. The S199 and S200 pumps are turned off based on the stage at the remote monitoring location EVER4 for the protection of the CSS Critical Habitat Unit 3. • 2nd Generation CERP – Biscayne Bay Coastal Wetlands project features were not modeled since these features along the coast in Miami-Dade County were not considered significant for CEPP. • Areal corrections were applied to the impoundment storages to account for the discrepancies of the areas in the model of the impoundments not matching the design areas.
Water Conservation Area 1 (Arthur R. Marshall Loxahatchee National Wildlife Refuge)	• Current C&SF Regulation Schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 14 ft. The bottom floor of the schedule (Zone C) is the area below 14 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow. • Structure S10E connecting LNWR to the northeastern portion of WCA-2A is no longer considered part of the simulated regional System
Water Conservation Area 2A & 2B	• Current C&SF regulation schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels in WCA-2A are less than minimum operating criteria of 10.5 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Water Conservation Area 3A & 3B	• Diversion of L-6 flows with additional 500 cfs structure and improvements to the L-5 canal • STA-3/4 outflows routed based on Rainfall Driven Operations (RDO) – a maximum of 2500 cfs is routed to S8 and G404, with the remainder being sent to S7 • Western L-4 levee degrade (west of S-8 = 3,000 cfs capacity) • Miami Canal backfilled and spoil mound removed 1.5 miles south of S-8 to I-75 • L-28 Triangle – levee gap and canal backfill approximately 9000 ft. • Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 (USACE, 2012) • One 500 cfs gated structure in L-67A north of Blue Shanty levee (S345D) and associated gap in L-67C levee • Two 500 cfs gated structures in L-67A (S345F & S345G) discharging into Blue Shanty Flowway

Feature	
	• Environmental target deliveries through the S345s are determined through RDO and is spatially distributed as 40% to 345D, 35% to 345F and 25% to 345G • Blue Shanty Flowway assumed as follows: o Construction of ~8.5 mile levee in WCA 3B, connecting L-67A to L-29 o Removal of L-67C levee in Blue Shanty Flowway (no canal back fill) o Removal of L-29 levee in Blue Shanty Flowway. • Includes regulatory releases to tide through LEC canals. Documented in Water Control Plan (USACE, June 2002) • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 7.5 ft in WCA-3A, defined as when 3-69W marsh gauge falls below 7.5 ft or CA3 canal stage fall below 7.0 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Everglades Construction Project Stormwater Treatment Areas	• STA-1E: 5,132 acres total treatment area. • A uniform bottom elevation equal to the spatial average over the extent of STA-1E is assumed.
Everglades National Park	• Water deliveries to Everglades National Park are based upon Everglades Restoration Transition Plan (ERTP), with the WCA-3A Regulation Schedule including the lowered Zone A (compared to IOP) and extended Zones D and E1. The environmental component of the schedule is defined by RDO. If hydraulic capacity exists at the 345s, then flood control discharges are made into 3B instead of at the S12s. • S-333 capacity increased to 2,500 cfs • L29 Divide structure assumed and is operated to send water from L29W to L29E to equilibrate canals when L29E falls below 7 ft. • L29 canal can receive inflow up to 9.7 ft (applies to both E and W segments / i.e. S333 & S356) • G-3273 constraint for operation of S-333 assumed to be 9.5 ft, NGVD. • The one mile Tamiami Trail Bridge as per the 2008 Tamiami Trail Limited Reevaluation Report is modeled as a one mile weir. Located east of the L67 extension and west of the S334 structure. • Western 2.6 mile Tamiami Trail Bridge, modeled as a 2.6 mile long weir, and is located east of Osceola Camp and west of Frog City. • Tamiami Trail culverts east of the L67 Extension are simulated where the bridge is not located. • Removal of the entire 5.5 miles L-67 Extension levee, with backfill of L-67 Extension canal • S-355A & S-355B are operated.

Feature	
	• Capacity of S-356 pump increased to 1000 cfs. S-356 is operated to manage seepage. • Full construction of C-111 project reservoirs consistent with the as-built information from USACE plus addition of contract 8 and contract 9 features. A uniform bottom elevation equal to the spatial average over the extent of each reservoir is assumed. • 8.5 SMA project feature as per federally authorized Alternative 6D of the MWD/8.5 SMA Project (USACE, 2000 GRR); operations per 2011 Interim Operating Criteria (USACE, June 2011) including S-331 trigger shifted from Angel's well to LPG-2. Outflow assumed from 8.5 SMA detention cell to the C-111 North Detention Area. o An additional length of seepage canal is assumed in the model to allow water to be collected for S357 operation. • Partial depth, approximately 4 mile long seepage barrier south of Tamiami Trail (along L-31N)
Other Natural Areas	• Flows to Biscayne Bay are simulated through Snake Creek, North Bay, the Miami River, Central Bay and South Bay
Pumpage and Irrigation	• Public Water Supply pumpage for the Lower East Coast was updated using 2010 consumptive use permit information as documented in the C-51 Reservoir Feasibility Study; permits under 0.1 MGD were not included • Residential Self Supported (RSS) pumpage are based on 2030 projections of residential population from the SFWMD Water Supply Bureau. • Industrial pumpage is also based on 2030 projections of industrial use from the Water Supply Bureau. • Irrigation demands for the six irrigation land-use types are calculated internally by the model. • Seminole Hollywood Reservation demands are set forth under VI. C of the Tribal Rights Compact. Tribal sources of water supply include various bulk sale agreements with municipal service suppliers.
Canal Operations	• C&SF system and operating rules in effect in 2012 • Includes operations to meet control elevations in the primary coastal canals for the prevention of saltwater intrusion • Includes existing secondary drainage/water supply system • C-4 Flood Mitigation Project • Western C-4, S-380 structure retained open • C-11 Water Quality Treatment Critical Project (S-381 and S-9A) • S-25B and S-26 backflow pumps are not modeled since they are used very rarely during high tide conditions and the model uses a long-term average daily tidal boundary • Northwest Dade Lake Belt area assumes that the conditions caused by currently permitted mining exist and that the effects of any future mining are fully mitigated by industry • ACME Basin A flood control discharges are sent to C-51, west of the S-155A structure, to be pumped into STA-1E. ACME Basin B flood control discharges are sent to STA-1E through the S-319 structure

Feature	
	• Releases from WCA-3A to ENP and the South Dade Conveyance System (SDCS) will follow the Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 o Structures S-343A, S-343B, S-344 and S-12A are closed Nov. 1 to July 15 o Structure S-12B is closed Jan. 1 to July 15 • Water supply deliveries from regional system (from WCA3A: S-151/S-337) are used to maintain the L30 canal with a minimum seasonal level varying from 6.25 ft in the dry season to 5.2 ft. at the beginning of the wet season • G-211 / S338 operational refinements; use coastal canals to convey seepage toward Biscayne Bay during drier times.
Canal Configuration	• Canal configuration same as calibration except no L-67 Extension Canal and CERP & CEPP project modifications.
Lower East Coast Service Area Water Shortage Management	• Lower east coast water restriction zones and trigger cell locations are equivalent to SFWMM ECB implementation. An attempt was made to tie trigger cells with associated groundwater level gages to the extent possible. The Lower East Coast Subregional (LECsR) model is the source of this data. • Periods where the Lower East Coast is under water restriction due to low Lake Okeechobee stages were extracted from the corresponding RSMBN FWO simulation.

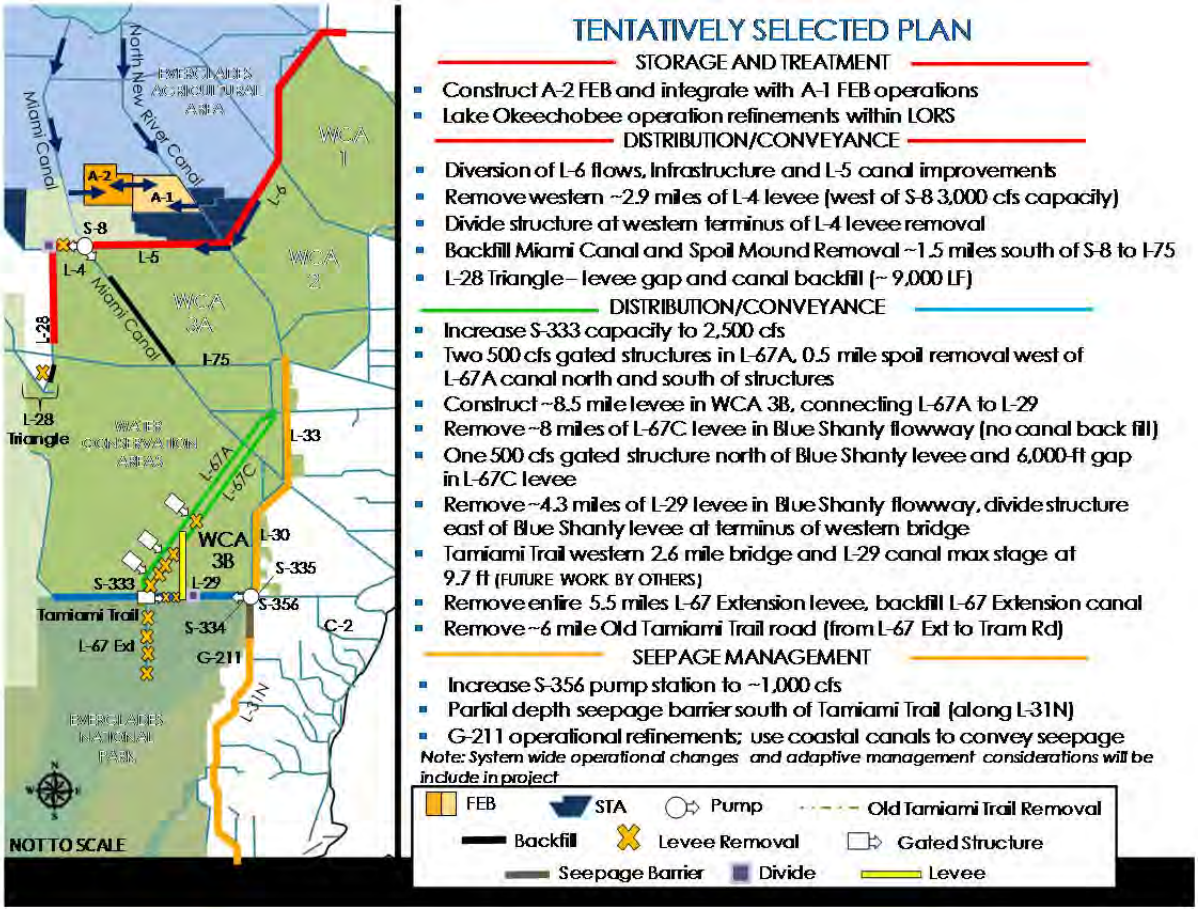


Fig. 1 CEPP ALT4R Features as defined by CEPP project team

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the northern boundary of the RSMGL model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Basins Model (RSMBN). The SFWMM was the source of the northern boundary groundwater/surface water flows, while the RSMBN was the source of the northern boundary structural flows.

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Glades-LECSA (RSMGL) Tentatively Selected Plan Other Water Related Needs Sensitivity Scenario (ALT4R1) Table of Assumptions

Feature	
Meteorological Data	• Rainfall file used: rain_v3.0_beta_tin_14_05.bin • Reference Evapotranspiration (RET) file used: RET_48_05_MULTIQUAD_v1.0.bin (ARCADIS, 2008)
Topography	• Same as calibration topographic data set except where reservoirs are introduced (STA1-E, C4 Impoundment and C-111 reservoirs). • United States Geological Survey (USGS) High-Accuracy Elevation Data Collection (HAEDC) for the Water Conservation Areas (1, 2A, 2B, 3A, and 3B), the Big Cypress National Preserve and Everglades National Park.
Tidal Data	• Tidal data from two primary (Naples and Virginia Key) and five secondary NOAA stations (Flamingo, Everglades, Palm Beach, Delray Beach and Hollywood Beach) were used to generate a historic record to be used as sea level boundary conditions for the entire simulation period.
Land Use and Land Cover	• Land Use and Land Cover Classification for the Lower East Coast urban areas (east of the Lower East Coast Flood Protection Levee) use 2008-2009 Land Use coverage as prepared by the SFWMD, consumptive use permits as of 2011 were used to update the land use in areas where it did not reflect the permit information. • Land Use and Land Cover Classification for the natural areas (west of the Lower East Coast Flood Protection Levee) is the same as the Calibration Land Use and Land Cover Classification for that area. Modified at locations where reservoirs are introduced (STA1-E, Site 1 Impoundment, Broward WPAs, C4 Impoundment, Lakebelt Lakes and C-111 Reservoirs).
Water Control Districts (WCDs)	• Water Control Districts in Palm Beach and Broward Counties and in the Western Basins assumed. • 8.5 SMA seepage canal is modeled as a WCD in ENP area.
Lake Belt Lakes	• Based on the permitted 2020 Lake Belt Lakes coverage obtained from USACE.
CERP Projects	• 1st Generation CERP – Site 1 Impoundment project is modeled as an above ground reservoir of area 1600 acres, with a maximum depth of 8 ft. • 2nd Generation CERP – Broward County Water Preserve Areas (WPAs) comprised of C-11 and C-9 impoundments were modeled as above ground reservoirs with areas 1221 and 1971 acres and maximum depths 4.3 and 4.0 ft. respectively. Operations refined in RSM model to closer represent project intent and outcomes.

Feature	
	• 2nd Generation CERP – C-111 Spreader Canal Project includes the Frog Pond Detention Area, which is modeled as an above ground impoundment with the S200 A, B and C pumps as inflow structures. In addition, the Aerojet canal is modeled with the inflow pumps S199 A, B and C. The S199 and S200 pumps are turned off based on the stage at the remote monitoring location EVER4 for the protection of the CSS Critical Habitat Unit 3. • 2nd Generation CERP – Biscayne Bay Coastal Wetlands project features were not modeled since these features along the coast in Miami-Dade County were not considered significant for CEPP. • Areal corrections were applied to the impoundment storages to account for the discrepancies of the areas in the model of the impoundments not matching the design areas.
Water Conservation Area 1 (Arthur R. Marshall Loxahatchee National Wildlife Refuge)	• Current C&SF Regulation Schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 14 ft. The bottom floor of the schedule (Zone C) is the area below 14 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow. • Structure S10E connecting LNWR to the northeastern portion of WCA-2A is no longer considered part of the simulated regional System
Water Conservation Area 2A & 2B	• Current C&SF regulation schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels in WCA-2A are less than minimum operating criteria of 10.5 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Water Conservation Area 3A & 3B	• Diversion of L-6 flows with additional 500 cfs structure and improvements to the L-5 canal • STA-3/4 outflows routed based on Rainfall Driven Operations (RDO) – a maximum of 2500 cfs is routed to S8 and G404, with the remainder being sent to S7 • Western L-4 levee degrade with 1.5 miles retained west of S8 (west of S-8 = 3,000 cfs capacity) • Miami Canal backfilled and spoil mound removed 1.5 miles south of S-8 to I-75 • Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 (USACE, 2012) • One 500 cfs gated structure in L-67A north of Blue Shanty levee (S345D) and associated gap in L-67C levee • Two 500 cfs gated structures in L-67A (S345F & S345G) discharging into Blue Shanty Flowway

Feature	
	• Environmental target deliveries through the S345s are determined through RDO and is spatially distributed as 40% to 345D, 35% to 345F and 25% to 345G • Blue Shanty Flowway assumed as follows: o Construction of ~8.5 mile levee in WCA 3B, connecting L-67A to L-29 o Removal of L-67C levee in Blue Shanty Flowway (no canal back fill) o Removal of L-29 levee in Blue Shanty Flowway. • Includes regulatory releases to tide through LEC canals. Documented in Water Control Plan (USACE, June 2002) • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 7.5 ft in WCA-3A, defined as when 3-69W marsh gauge falls below 7.5 ft or CA3 canal stage falls below 7.0 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Everglades Construction Project Stormwater Treatment Areas	• STA-1E: 5,132 acres total treatment area. • A uniform bottom elevation equal to the spatial average over the extent of STA-1E is assumed.
Everglades National Park	• Water deliveries to Everglades National Park are based upon Everglades Restoration Transition Plan (ERTP), with the WCA-3A Regulation Schedule including the lowered Zone A (compared to IOP) and extended Zones D and E1. The environmental component of the schedule is defined by RDO. If hydraulic capacity exists at the 345s, then flood control discharges are made into 3B instead of at the S12s. • S-333 capacity increased to 2,500 cfs • L29 Divide structure assumed and is operated to send water from L29W to L29E to equilibrate canals when L29E falls below 7 ft. • L29 canal can receive inflow up to 9.7 ft (applies to both E and W segments / i.e. S333 & S356) • G-3273 constraint for operation of S-333 assumed to be 9.5 ft, NGVD. • The one mile Tamiami Trail Bridge as per the 2008 Tamiami Trail Limited Reevaluation Report is modeled as a one mile weir. Located east of the L67 extension and west of the S334 structure. • Western 2.6 mile Tamiami Trail Bridge, modeled as a 2.6 mile long weir, and is located east of Osceola Camp and west of Frog City. • Tamiami Trail culverts east of the L67 Extension are simulated where the bridge is not located. • Removal of the entire 5.5 miles L-67 Extension levee, with backfill of L-67 Extension canal • S-355A & S-355B are operated.

Feature	
	• Capacity of S-356 pump increased to 1000 cfs. S-356 is operated to manage seepage. • Full construction of C-111 project reservoirs consistent with the as-built information from USACE plus addition of contract 8 and contract 9 features. A uniform bottom elevation equal to the spatial average over the extent of each reservoir is assumed. • 8.5 SMA project feature as per federally authorized Alternative 6D of the MWD/8.5 SMA Project (USACE, 2000 GRR); operations per 2011 Interim Operating Criteria (USACE, June 2011) including S-331 trigger shifted from Angel's well to LPG-2. Outflow assumed from 8.5 SMA detention cell to the C-111 North Detention Area. o An additional length of seepage canal is assumed in the model to allow water to be collected for S357 operation. • Partial depth, approximately 4 mile long seepage barrier south of Tamiami Trail (along L-31N)
Other Natural Areas	• Flows to Biscayne Bay are simulated through Snake Creek, North Bay, the Miami River, Central Bay and South Bay
Pumpage and Irrigation	• Public Water Supply pumpage for the Lower East Coast was updated using 2010 consumptive use permit information as documented in the C-51 Reservoir Feasibility Study; permits under 0.1 MGD were not included • Modeling of the TSP assumes an additional public water supply withdrawal of 18 MGD in Service Area 2 and 53 MGD in Service Area 3. • Residential Self Supported (RSS) pumpage are based on 2030 projections of residential population from the SFWMD Water Supply Bureau. • Industrial pumpage is also based on 2030 projections of industrial use from the Water Supply Bureau. • Irrigation demands for the six irrigation land-use types are calculated internally by the model. • Seminole Hollywood Reservation demands are set forth under VI. C of the Tribal Rights Compact. Tribal sources of water supply include various bulk sale agreements with municipal service suppliers.
Canal Operations	• C&SF system and operating rules in effect in 2012 • Includes operations to meet control elevations in the primary coastal canals for the prevention of saltwater intrusion • Includes existing secondary drainage/water supply system • C-4 Flood Mitigation Project • Western C-4, S-380 structure retained open • C-11 Water Quality Treatment Critical Project (S-381 and S-9A) • S-25B and S-26 backflow pumps are not modeled since they are used very rarely during high tide conditions and the model uses a long-term average daily tidal boundary • Northwest Dade Lake Belt area assumes that the conditions caused by currently permitted mining exist and that the effects of any future mining are fully mitigated by industry • ACME Basin A flood control discharges are sent to C-51, west of the S-155A structure, to be pumped into STA-1E. ACME Basin B

Feature	
	flood control discharges are sent to STA-1E through the S-319 structure • Releases from WCA-3A to ENP and the South Dade Conveyance System (SDCS) will follow the Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 o Structures S-343A, S-343B, S-344 and S-12A are closed Nov. 1 to July 15 o Structure S-12B is closed Jan. 1 to July 15 • Water supply deliveries from regional system (from WCA3A: S-151/S-337) are used to maintain the L30 canal with a minimum seasonal level varying from 6.25 ft in the dry season to 5.2 ft. at the beginning of the wet season • G-211 / S338 operational refinements; use coastal canals to convey seepage toward Biscayne Bay during drier times.
Canal Configuration	• Canal configuration same as calibration except no L-67 Extension Canal and CERP & CEPP project modifications.
Lower East Coast Service Area Water Shortage Management	• Lower east coast water restriction zones and trigger cell locations are equivalent to SFWMM ECB implementation. An attempt was made to tie trigger cells with associated groundwater level gages to the extent possible. The Lower East Coast Subregional (LECsR) model is the source of this data. • Periods where the Lower East Coast is under water restriction due to low Lake Okeechobee stages were extracted from the corresponding RSMBN FWO simulation.

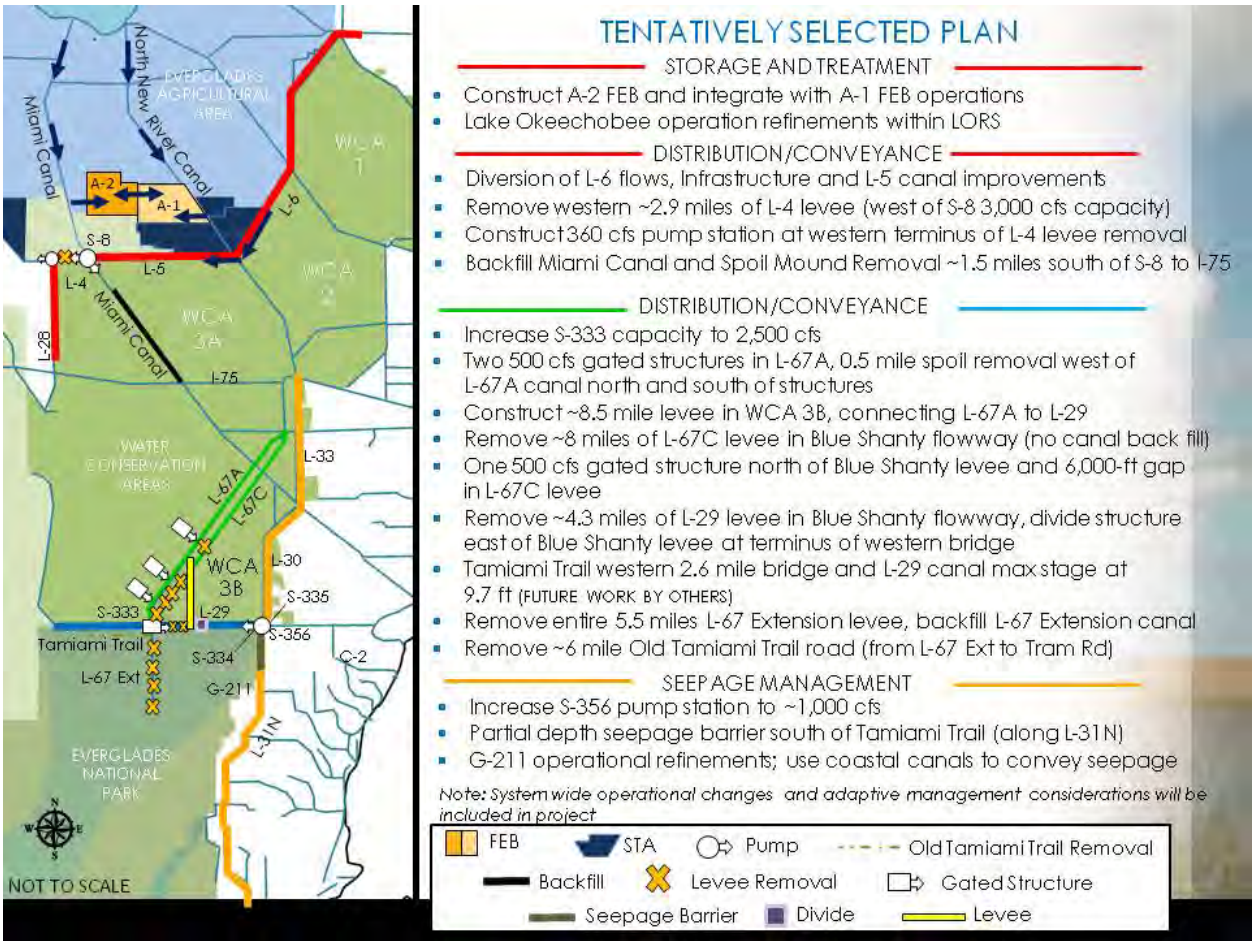


Fig. 1 CEPP ALT4R2 Features as defined by CEPP project team

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the northern boundary of the RSMGL model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Basins Model (RSMBN). The SFWMM was the source of the northern boundary groundwater/surface water flows, while the RSMBN was the source of the northern boundary structural flows.

Hydrologic and Environmental Systems Modeling & Interagency Modeling Center

Regional Simulation Model Glades-LECSA (RSMGL)
Updated Tentatively Selected Plan (ALT4R2)
Table of Assumptions

Feature	
Meteorological Data	• Rainfall file used: rain_v3.0_beta_tin_14_05.bin • Reference Evapotranspiration (RET) file used: RET_48_05_MULTIQUAD_v1.0.bin (ARCADIS, 2008)
Topography	• Same as calibration topographic data set except where reservoirs are introduced (STA1-E, C4 Impoundment and C-111 reservoirs). • United States Geological Survey (USGS) High-Accuracy Elevation Data Collection (HAEDC) for the Water Conservation Areas (1, 2A, 2B, 3A, and 3B), the Big Cypress National Preserve and Everglades National Park.
Tidal Data	• Tidal data from two primary (Naples and Virginia Key) and five secondary NOAA stations (Flamingo, Everglades, Palm Beach, Delray Beach and Hollywood Beach) were used to generate a historic record to be used as sea level boundary conditions for the entire simulation period.
Land Use and Land Cover	• Land Use and Land Cover Classification for the Lower East Coast urban areas (east of the Lower East Coast Flood Protection Levee) use 2008-2009 Land Use coverage as prepared by the SFWMD, consumptive use permits as of 2011 were used to update the land use in areas where it did not reflect the permit information. • Land Use and Land Cover Classification for the natural areas (west of the Lower East Coast Flood Protection Levee) is the same as the Calibration Land Use and Land Cover Classification for that area. Modified at locations where reservoirs are introduced (STA1-E, Site 1 Impoundment, Broward WPAs, C4 Impoundment, Lakebelt Lakes and C-111 Reservoirs).
Water Control Districts (WCDs)	• Water Control Districts in Palm Beach and Broward Counties and in the Western Basins assumed. • 8.5 SMA seepage canal is modeled as a WCD in ENP area.
Lake Belt Lakes	• Based on the permitted 2020 Lake Belt Lakes coverage obtained from USACE.
CERP Projects	• 1st Generation CERP – Site 1 Impoundment project is modeled as an above ground reservoir of area 1600 acres, with a maximum depth of 8 ft. • 2nd Generation CERP – Broward County Water Preserve Areas (WPAs) comprised of C-11 and C-9 impoundments were modeled as above ground reservoirs with areas 1221 and 1971 acres and maximum depths 4.3 and 4.0 ft. respectively. Operations refined in RSM model to closer represent project intent and outcomes.

Feature	
	• 2nd Generation CERP – C-111 Spreader Canal Project includes the Frog Pond Detention Area, which is modeled as an above ground impoundment with the S200 A, B and C pumps as inflow structures. In addition, the Aerojet canal is modeled with the inflow pumps S199 A, B and C. The S199 and S200 pumps are turned off based on the stage at the remote monitoring location EVER4 for the protection of the CSS Critical Habitat Unit 3. • 2nd Generation CERP – Biscayne Bay Coastal Wetlands project features were not modeled since these features along the coast in Miami-Dade County were not considered significant for CEPP. • Areal corrections were applied to the impoundment storages to account for the discrepancies of the areas in the model of the impoundments not matching the design areas.
Water Conservation Area 1 (Arthur R. Marshall Loxahatchee National Wildlife Refuge)	• Current C&SF Regulation Schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 14 ft. The bottom floor of the schedule (Zone C) is the area below 14 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow. • Structure S10E connecting LNWR to the northeastern portion of WCA-2A is no longer considered part of the simulated regional System
Water Conservation Area 2A & 2B	• Current C&SF regulation schedule. Includes regulatory releases to tide through LEC canals • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 10.5 ft in WCA-2A, defined as when WCA2-U1 marsh gauge falls below 10.5 ft or L38 canal stage falls below 10.0 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Water Conservation Area 3A & 3B	• Diversion of L-6 flows with additional 500 cfs structure and improvements to the L-5 canal • STA-3/4 outflows routed based on Rainfall Driven Operations (RDO) – a maximum of 2500 cfs is routed to S8 and G404, with the remainder being sent to S7 • Western L-4 levee degrade with 1.5 miles retained west of S8 (west of S-8 = 3,000 cfs capacity) • Miami Canal backfilled and spoil mound removed 1.5 miles south of S-8 to I-75 • Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 (USACE, 2012) • One 500 cfs gated structure in L-67A north of Blue Shanty levee (S345D) and associated gap in L-67C levee

Feature	
	• Two 500 cfs gated structures in L-67A (S345F & S345G) discharging into Blue Shanty Flowway • Environmental target deliveries through the S345s are determined through RDO and is spatially distributed as 40% to 345D, 35% to 345F and 25% to 345G • Blue Shanty Flowway assumed as follows: o Construction of ~8.5 mile levee in WCA 3B, connecting L-67A to L-29 o Removal of L-67C levee in Blue Shanty Flowway (no canal back fill) o Removal of L-29 levee in Blue Shanty Flowway. • Includes regulatory releases to tide through LEC canals. Documented in Water Control Plan (USACE, June 2002) • No net outflow to maintain minimum stages in the LEC Service Area canals (salinity control), if water levels are less than minimum operating criteria of 7.5 ft in WCA-3A, defined as when 3-69W marsh gauge falls below 7.5 ft or CA3 canal stage falls below 7.0 ft. Any water supply releases below the floor will be matched by an equivalent volume of inflow.
Everglades Construction Project Stormwater Treatment Areas	• STA-1E: 5,132 acres total treatment area. • A uniform bottom elevation equal to the spatial average over the extent of STA-1E is assumed.
Everglades National Park	• Water deliveries to Everglades National Park are based upon Everglades Restoration Transition Plan (ERTP), with the WCA-3A Regulation Schedule including the lowered Zone A (compared to IOP) and extended Zones D and E1. The environmental component of the schedule is defined by RDO. If hydraulic capacity exists at the 345s, then flood control discharges are made into 3B instead of at the S12s. • S-333 capacity increased to 2,500 cfs • L29 Divide structure assumed and is operated to send water from L29W to L29E to equilibrate canals when L29E falls below 7 ft. • L29 canal can receive inflow up to 9.7 ft (applies to both E and W segments / i.e. S333 & S356 as well as S345F & S345G structure on Blue Shanty Flowway) • G-3273 constraint for operation of S-333 assumed to be 9.5 ft, NGVD. • The one mile Tamiami Trail Bridge as per the 2008 Tamiami Trail Limited Reevaluation Report is modeled as a one mile weir. Located east of the L67 extension and west of the S334 structure. • Western 2.6 mile Tamiami Trail Bridge, modeled as a 2.6 mile long weir, and is located east of Osceola Camp and west of Frog City. • Tamiami Trail culverts east of the L67 Extension are simulated where the bridge is not located.

Feature	
	• Removal of the entire 5.5 miles L-67 Extension levee, with backfill of L-67 Extension canal • S-355A & S-355B are operated. • Capacity of S-356 pump increased to 1000 cfs. S-356 is operated to manage seepage. • Full construction of C-111 project reservoirs consistent with the as-built information from USACE plus addition of contract 8 and contract 9 features. A uniform bottom elevation equal to the spatial average over the extent of each reservoir is assumed. • 8.5 SMA project feature as per federally authorized Alternative 6D of the MWD/8.5 SMA Project (USACE, 2000 GRR); operations per 2011 Interim Operating Criteria (USACE, June 2011) including S-331 trigger shifted from Angel's well to LPG-2. Outflow assumed from 8.5 SMA detention cell to the C-111 North Detention Area. o An additional length of seepage canal is assumed in the model to allow water to be collected for S357 operation. • Partial depth, approximately 4 mile long seepage barrier south of Tamiami Trail (along L-31N)
Other Natural Areas	• Flows to Biscayne Bay are simulated through Snake Creek, North Bay, the Miami River, Central Bay and South Bay
Pumpage and Irrigation	• Public Water Supply pumpage for the Lower East Coast was updated using 2010 consumptive use permit information as documented in the C-51 Reservoir Feasibility Study; permits under 0.1 MGD were not included • Modeling of the TSP assumes an additional public water supply withdrawal of 12 MGD in Service Area 2 and 5 MGD in Service Area 3. • Residential Self Supported (RSS) pumpage are based on 2030 projections of residential population from the SFWMD Water Supply Bureau. • Industrial pumpage is also based on 2030 projections of industrial use from the Water Supply Bureau. • Irrigation demands for the six irrigation land-use types are calculated internally by the model. • Seminole Hollywood Reservation demands are set forth under VI. C of the Tribal Rights Compact. Tribal sources of water supply include various bulk sale agreements with municipal service suppliers.
Canal Operations	• C&SF system and operating rules in effect in 2012 • Includes operations to meet control elevations in the primary coastal canals for the prevention of saltwater intrusion • Includes existing secondary drainage/water supply system • C-4 Flood Mitigation Project • Western C-4, S-380 structure retained open • C-11 Water Quality Treatment Critical Project (S-381 and S-9A) • S-25B and S-26 backflow pumps are not modeled since they are used very rarely during high tide conditions and the model uses a long-term average daily tidal boundary

Feature	
	• Northwest Dade Lake Belt area assumes that the conditions caused by currently permitted mining exist and that the effects of any future mining are fully mitigated by industry • ACME Basin A flood control discharges are sent to C-51, west of the S-155A structure, to be pumped into STA-1E. ACME Basin B flood control discharges are sent to STA-1E through the S-319 structure • Releases from WCA-3A to ENP and the South Dade Conveyance System (SDCS) will follow the Everglades Restoration Transition Plan (ERTP) regulation schedule for WCA-3A, as per SFWMM modeled alternative 9E1 o Structures S-343A, S-343B, S-344 and S-12A are closed Nov. 1 to July 15 o Structure S-12B is closed Jan. 1 to July 15 • Water supply deliveries from regional system (from WCA3A: S-151/S-337) are used to maintain the L30 canal with a minimum seasonal level varying from 6.25 ft in the dry season to 5.2 ft. at the beginning of the wet season • G-211 / S338 operational refinements; use coastal canals to convey seepage toward Biscayne Bay during drier times.
Canal Configuration	• Canal configuration same as calibration except no L-67 Extension Canal and CERP & CEPP project modifications.
Lower East Coast Service Area Water Shortage Management	• Lower east coast water restriction zones and trigger cell locations are equivalent to SFWMM ECB implementation. An attempt was made to tie trigger cells with associated groundwater level gages to the extent possible. The Lower East Coast Subregional (LECsR) model is the source of this data. • Periods where the Lower East Coast is under water restriction due to low Lake Okeechobee stages were extracted from the corresponding RSMBN FWO simulation.

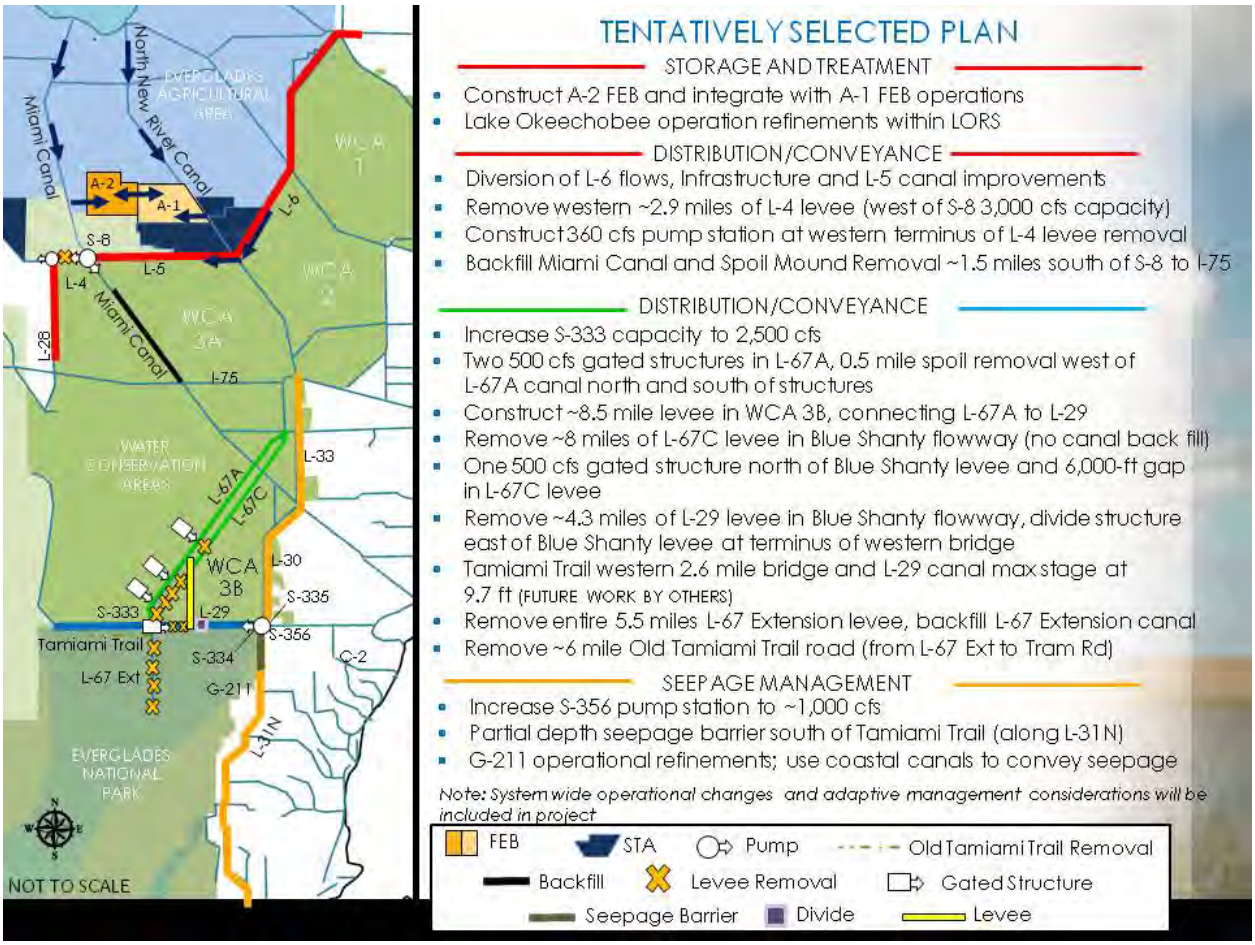


Fig. 1 CEPP ALT4R2 Features as defined by CEPP project team

Notes:

- The RSM is a robust and complex regional scale model. Due to the scale of the model, it is frequently necessary to implement abstractions of system infrastructure and operations that will, in general, mimic the intent and result of the desired project features while not matching the exact mechanism by which these results would be obtained in the real world. Additionally, it is sometimes necessary to work within established paradigms and foundations within the model code (e.g. use available input-driven options to represent more complex project operations).
- The boundary conditions along the northern boundary of the RSMGL model were provided from either the South Florida Water Management Model (SFWMM) or the RSM Basins Model (RSMBN). The SFWMM was the source of the northern boundary groundwater/surface water flows, while the RSMBN was the source of the northern boundary structural flows.

Appendix B – LORS08 Operations Schedule

The LORS08 schedule used for operation of Lake Okeechobee in the CEPP baselines was modified as shown in **Figure B.1** for use in the TSP. **Figures B.2 and B.3** show the pulse releases from Lake Okeechobee into the Caloosahatchee and St. Lucie Estuary, respectively.

Details of the TSP model implementation of the schedule can be found in **Figures B.4, B.5 and B.6. Figure B.4** lists the range of values used to classify the tributary hydrologic conditions. **Figure B.5** lists the range of values used to classify the net inflow seasonal outlook. **Figure B.6** lists the range of values used to classify the net inflow multi-seasonal outlook.

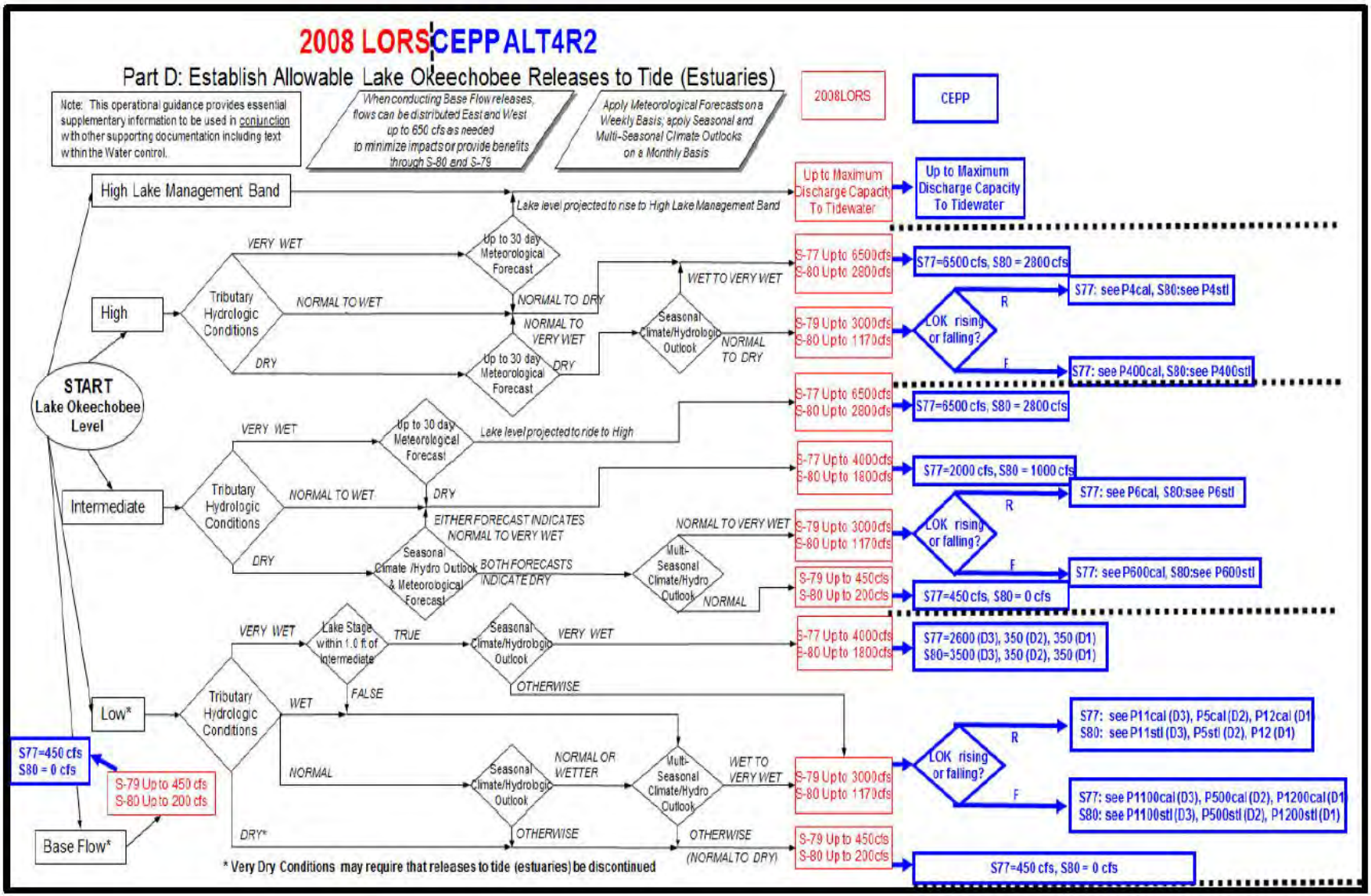


Figure B.1. LORS08 operations schedule, with CEPP TSP modifications as modeled shown in blue.

	High		Intermediate		Low					
zone	A	A	B	B	D3	D3	D2	D2	D1	D1
	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling
Day of Pulse	P4cal	P400cal	P6cal	P600cal	P11cal	P1100cal	P5cal	P500cal	P12cal	P1200cal
1	500	125	840	504	125	125	850	850	504	504
2	1,375	343.75	1,920	1,152	344	344	2,200	2,200	1,152	1,152
3	1,625	406.25	2,220	1,332	406	406	2,600	2,600	1,332	1,332
4	1,250	312.50	1,680	1,008	313.50	313.50	2,000	2,000	1,008	1,008
5	1,000	250	1,440	864	250	250	1,600	1,600	864	864
6	750	187.50	1,140	684	188.50	188.50	1,200	1,200	684	684
7	500	125	960	576	125	125	850	850	576	576
8	250	62.50	720	432	62.50	62.50	500	500	432	432
9	125	31.25	540	324	31.25	31.25	350	350	324	324
10	125	31.25	540	324	31.25	31.25	350	350	324	324
Average Flow (cfs)	750	187.5	1200	720	187.7	187.7	1250	1250	720	720
Volume (ac-ft)	14,873	3,718	23,796	14,278	3,722	3,722	24,788	24,788	14,278	14,278
†equivalent depth (ft)	0.03	0.01	0.05	0.03	0.01	0.01	0.05	0.05	0.03	0.03
† : Volume to depth Conversion based on average Lake surface area of 467,000 acres.										

Figure B.2. Pulse releases (as a function of lake level) from Lake Okeechobee into Caloosahatchee Estuary in cubic feet per second (cfs).

	High		Intermediate		Low					
zone	A	A	B	B	D3	D3	D2	D2	D1	D1
	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling	R=Rising	F=Falling
Day of Pulse	P4stl	P400stl	P6stl	P600stl	P11stl	P1100stl	P5stl	P500stl	P12stl	P1200stl
1	450	112.50	720	432	112.50	112.50	750	750	432	432
2	600	150	960	576	150	150	1,000	1,000	576	576
3	525	131.25	840	504	131.25	131.25	900	900	504	504
4	375	93.75	600	360	93.75	93.75	600	600	360	360
5	250	62.50	420	252	62.50	62.50	450	450	252	252
6	225	56.25	360	216	56.25	56.25	350	350	216	216
7	150	37.50	240	144	37.50	37.50	250	250	144	144
8	150	37.50	240	144	37.50	37.50	250	250	144	144
9	100	25	0	0	25	25	200	200	0	0
10	100	25	0	0	25	25	0	0	0	0
Average Flow (cfs)	292.5	73.1	438.0	262.8	73.1	73.1	475.0	475.0	262.8	262.8
Volume (ac-ft)	5,800	1,450	8,686	5,211	1,450	1,450	9,419	9,419	5,211	5,211
†equivalent depth (ft)	0.01	0.00	0.02	0.01	0.00	0.00	0.02	0.02	0.01	0.01
† : Volume to depth Conversion based on average Lake surface area of 467,000 acres.										

Figure B.3. Pulse releases (as a function of lake level) from Lake Okeechobee into St. Lucie Estuary in cubic feet per second (cfs).

LORS2008

Classification of Lake Okeechobee Tributary Hydrologic Conditions

Palmer Index Class Limits	2-wk Mean LO Inflow Class Limit	Tributary Hydrologic Classification*
> 3.0	>= 6000 cfs	Very Wet
1.5 to 2.99	2500 - 5999 cfs	Wet
-1.49 to 1.49	500 - 2499 cfs	Near Normal
-2.99 to -1.5	-5000 - 500 cfs	Dry
-3.0 or less	< -5000 cfs	Very Dry

*use the wettest of the two indicators

CEPP-RSMBN

Classification of Lake Okeechobee Tributary Hydrologic Conditions

Palmer Index Class Limits	2-wk Mean LO Inflow Class Limit	Tributary Hydrologic Classification*
> 3.3	>= 8700 cfs	Very Wet
0.01 to 3.29	1000 - 8699 cfs	Wet
-0.49 to 0.0	500 - 999 cfs	Near Normal
-2.99 to -0.50	-5000 - 500 cfs	Dry
-3.0 or less	< -5000 cfs	Very Dry

*use the wettest of the two indicators

Figure B.4. LORS08 and CEPP TSP modified Tributary Hydrologic Conditions Classifications.

LORS2008

Classification of Lake Okeechobee Net Inflow Seasonal Outlook**

Lake Net Inflow Prediction (million acre-feet) (Does not include ET)	Equivalent Depth (feet)	Lake Okeechobee Net Inflow Seasonal Outlook
> 0.93	> 2.0	Very Wet
0.71 to 0.93	1.51 to 2.0	Wet
0.35 to 0.70	0.75 to 1.5	Normal
< 0.35	< 0.75	Dry

**volume-depth conversion based on average lake surface area of 467,000 acres.

CEPP-RSMBN

Classification of Lake Okeechobee Net Inflow Seasonal Outlook**

Lake Net Inflow Prediction (million acre-feet) (Does include ET)	Equivalent Depth (feet)	Lake Okeechobee Net Inflow Seasonal Outlook
> 1.43	> 3.06	Very Wet
0.91 to 1.43	1.93 to 3.06	Wet
0.46 to 0.90	0.98 to 1.92	Normal
< 0.46	< 0.98	Dry

**volume-depth conversion based on average lake surface area of 467,000 acres.

Figure B.5. LORS08 and CEPP TSP modified Seasonal Outlook Classifications.

LORS2008

Classification of Lake Okeechobee Net Inflow Multi-Seasonal Outlook**

Lake Net Inflow Prediction (million acre-feet) (Does not include ET)	Equivalent Depth (feet)	Lake Okeechobee Net Inflow Multi-Seasonal Outlook
> 2.0	> 4.3	Very Wet
1.18 to 2.0	2.51 to 4.3	Wet
0.5 to 1.17	1.1 to 2.5	Normal
< 0.5	< 1.1	Dry

**volume-depth conversion based on average lake surface area of 467,000 acres.

CEPP-RSMBN

Classification of Lake Okeechobee Net Inflow Multi-Seasonal Outlook**

Lake Net Inflow Prediction (million acre-feet) (Does include ET)	Equivalent Depth (feet)	Lake Okeechobee Net Inflow Multi-Seasonal Outlook
> 2.0	> 4.3	Very Wet
1.18 to 2.0	2.51 to 4.3	Wet
0.6 to 1.17	1.3 to 2.5	Normal
< 0.6	< 1.3	Dry

**volume-depth conversion based on average lake surface area of 467,000 acres.

Figure B.6. LORS08 and CEPP TSP modified Multi-Seasonal Outlook Classifications.

Appendix C – Structure Operations in South Miami-Dade County for CEPP TSP Scenarios

In **Table C.1**, the list of structures is color-coded in three groupings:

green	Structures on the L-67, L-28, and L-29 canals. Structures included are S-345, S-349, S-344, S-343A-B, S-12A-D, S-333, S-334, S-355, and S-356
blue	Structures on the L-30 and part of the L-31 canals Structures included are S-337, S-151, S-335, S-338, G-211, S-173 & S-331P (COMBQ), S-176 and S-174
yellow	Structures on part of the L-31 canal and L-31W and C-111 canals Structures included are S-332A-D, S-357, S-332, S-175, S-200, S-199, S-177, S-18C, S-197 and S-332E

Table C.1 includes alternatives ALT4R and ALT4R2.

Table C.1. Alternatives (ALT4R, ALT4R2)

Canal	Structure	**ALT4R (RSMGL)**	**ALT4R2 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-67	S-345*	S345D, S345F & S345G 3 gated spillway at L-67A Design Q= 500 cfs each flood control only	S345D, S345F & S345G 3 gated spillway at L-67A Design Q= 500 cfs each flood control only
	S-349*	Non-existent	Non-existent
L-28	S-344*	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15 2)flood control only	Special code Design Q=250 cfs 1) Closed Nov 1- Jul 15 2)flood control only
	S-343A-B*	Special code 1) Closed Nov 1- Jul15 2) flood control only 3)S343A&B- Design Q= 200 cfs each	Special code 1) Closed Nov 1- Jul15 2) flood control only 3)S343A&B- Design Q= 200 cfs each
L-29	S-12A-D*	per ERTP S12A closed Nov 1 to Jul 31; S12B closed Jan 1 to Jul 31; S12C no closure dates. S12D no closure dates. Special code 1) S12s = 8000 cfs per structure. 2) Each structure modeled individually. 3) Each Structure is a spillway 4) Flood Control only	per ERTP S12A closed Nov 1 to Jul 31; S12B closed Jan 1 to Jul 31; S12C no closure dates. S12D no closure dates. Special code 1) S12s = 8000 cfs per structure. 2) Each structure modeled individually. 3) Each Structure is a spillway 4) Flood Control only
	S-333*	Special code (S333 has higher priority over S12s) 1) L-29 canal max stage of 9.7 Wet/Dry 2) Design Q=2500 cfs 3) G-3273 stage constraint of 9.5 4) Flood Control only	Special code (S333 has higher priority over S12s) 1) L-29 canal max stage of 9.7 Wet/Dry 2) Design Q=2500 cfs 3) G-3273 stage constraint of 9.5 4) Flood Control only
	S-334	Non-existent No IOP wraparound operations. So, no flow through S334	Non-existent No IOP wraparound operations. So, no flow through S334
	S-355*	Special code 1) S355 A and B Modeled Design Q = 1000 cfs each, 2) L-29 Max stage of 9.7 3) Flood control only 4)G-3273 stage constraint of 9.5	Special code 1) S355 A and B Modeled Design Q = 1000 cfs each, 2) L-29 Max stage of 9.7 3) Flood control only 4)G-3273 stage constraint of 9.5
	S-356*	**6.0/5.5** open/closed wet season **6.0/5.8** open/closed dry season 1) Design Q = 1000 cfs 2) Flood control only	**6.0/5.5** open/closed wet season **6.0/5.8** open/closed dry season 1) Design Q = 1000 cfs 2) Flood control only

Canal	Structure	**ALT4R (RSMGL)**	**ALT4R2 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-30	S337	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)	1) Water Supply / Flood Control 2) Design Q=1100 cfs (discharge coef = 1053 cfs in msestruc*.xml)
		mse_unit inlet L30; L30 maintLevel from rc id=993110 maintLevel(01 Nov-31 May=6.45. 01 Jun-31 Oct =5.4) L30 resLevel from rc id = 993111 resLevel(01 Nov-31 May=6.25. 01 Jun-31 Oct=5.2) mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_ALT4R.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml	mse_unit inlet L30; L30 maintLevel from rc id=993110 maintLevel(01 Nov-31 May=6.45. 01 Jun-31 Oct =5.4) L30 resLevel from rc id = 993111 resLevel(01 Nov-31 May=6.25. 01 Jun-31 Oct=5.2) mse_unit outlet C-304; C304 localLevel=99.0 S337_HWi & S337TWi (input variable for WCA3A_WCA3B_regulatory in Special_Assessors_ALT4R.so) S337_FracGO & S337_FracGo_high & S337_FracGo_low variable output maxfracS12s xml
	S-151*	Flow target based on WCA-3A regulation schedule	Flow target based on WCA-3A regulation schedule
	S-335	**7.6/ 7.4** open/closed wet &dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 maintLevel from rc ID 993110 maintLevel(01 Nov-31 May=6.45. 01 Jun-31 Oct=5.4) L30 resLevel from rc ID=993111 resLevel(01 Nov-31 May=6.25. 01 Jun-31 Oct=5.2) mse_unit inlet for L31NC; localLevel=99.0	**7.6/ 7.4** open/closed wet &dry season 1) Water Supply / Flood Control 2) Design Q=1170 (discharge coef. = 1468 cfs in msestruc*.xml) 3) twHeadLimit name "S335 twHeadLimit" = 6.0 mse_unit outlet for L30; L30 maintLevel from rc ID 993110 maintLevel(01 Nov-31 May=6.45. 01 Jun-31 Oct=5.4) L30 resLevel from rc ID=993111 resLevel(01 Nov-31 May=6.25. 01 Jun-31 Oct=5.2) mse_unit inlet for L31NC; localLevel=99.0

Canal	Structure	**ALT4R (RSMGL)**	**ALT4R2 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N	S-338	**5.8 / 5.5** open/closed wet season **5.7 / 5.5** open/closed dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0	**5.8 / 5.5** open/closed wet season **5.7 / 5.5** open/closed dry season 1) Water Supply / Flood Control 2) Design Q=305 (discharge coef. = 393 cfs in msestruc*xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for C1; C1 maintLevel=3.0
	G-211	**6.0 / 5.7** open/closed wet season **5.8 / 5.5** open/closed dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply / Flood Control 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N; L31N localLevel=99.0	**6.0 / 5.7** open/closed wet season **5.8 / 5.5** open/closed dry season twHeadLimit name "G211 twHeadLimit" = 5.3 1) Water Supply / Flood Control 2) Design Q=1100 (discharge coef. = 943 cfs in msestruc*.xml) mse_unit outlet for L31NC; L31NC localLevel=99.0 mse_unit inlet for L31N; L31N localLevel=99.0
	S-173 & S-331P (COMBQ) *	1) Water Supply / Flood Control 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.	1) Water Supply / Flood Control 2) Design Q=1161 (special code Special_Assessors_ECB_2010-11.so) mse_unit outlet for L31N; localLevel = 99.0 mse_unit inlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit inlet for L31S; "L31S res" resLevel = 3.5 mse_unit outlet for L31N; mse_unit "L31N local" localLevel = 99.0 S331_TW_lim = 6.0 Operations defined in S331_ECB_2010-11.cc: S331_HW_levels = 4.0 4.5 5.0 5.5 (LPG2 stage criteria) S331 OPERATING CRITERIA: “Discharges through S-331 can be made if the S-331 tailwater stage is below 6.0 feet and the S-176 headwater stage is below 5.5 feet. If either of those water levels of S-331 and S-176 were exceeded, discharges at S-331 would be terminated until the S-176 headwater recedes to 5.0 feet." S176_Cond is dependent on S331_TW and S176_HW -> true if either stage prohibits S331 releases.

Canal	Structure	**ALT4R (RSMGL)**	**ALT4R2 (RSMGL)**
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations
L-31N (cont)	S-173 & S-331P (COMBQ) * (cont)	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations	S331 High Range: If the water level at LPG2 well is < 5.5 ft, S331 HW will have no limit. S331 Intermediate Range: If the level at LPG2 well is > or = 5.5 and < 6.0 ft, the average daily water level upstream of the S-331 will be maintained between 5.0 ft., and 4.5 ft if permitted by d/s conditions. S331 Low Range: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. S331 Low Range Adjustment: If the level at LPG2 well is > or = 6.0 ft and S-357 constraints are not limiting the ability of maintaining C-357 avg daily WL below 6.2 ft, the average daily water level upstream of S-331 will be maintained between 4.5 ft. and 4.0 ft if permitted by d/s conditions. Use previous day LPG2 stage, S331_TW and S176_HW, C-357 WL for current day operations
	S-176	**5.0 / 4.75** open/closed wet season **5.1 / 4.8** open/closed dry season 1) Water Supply / Flood Control 2) design Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)	**5.0 / 4.75** open/closed wet season **5.1 / 4.8** open/closed dry season 1) Water Supply / Flood Control 2) design Q = 1100 cfs (discharge coef. = 1135 cfs in msestruc*.xml) mse_unit outlet for L31S; "L31S maint" maintLevel = 4.0 mse_unit outlet for L31S; "L31S res" resLevel = 3.5 mse_unit inlet for C111; maintenance level and reserve level determined in high_rf_events assessor S176_HW_levels 5.0 5.5 (input variable for S331 ops in Special_Assessors_ECB_2010-11.so)
	S-174*	S174 not in model; canal is blocked near structure	S174 not in model; canal is blocked near structure

Canal	Structure	ALT4R (RSMGL)		ALT4R2 (RSMGL)	
		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations		Open/Close (ft NGVD) (Optimum stage ft NGVD) Wet Season/Dry Season Normal FC Operations	
L-31N (cont)	S-332A, B,C,D (pumps)	S332A Non-Existent S332B1 4.7/4.5 S332B2 5.0/4.7 S332BN1 4.7/4.5 S332B2 5.0/4.7 S332C1 4.7/4.5 S332C2 5.0/4.7 S332D1 4.65/4.50 S332D2 4.85/4.65	S332A Non-Existent S332B1 4.7/4.5 S332B2 5.0/4.7 S332BN1 4.7/4.5 S332B2 5.0/4.7 S332C1 4.7/4.5 S332C2 5.0/4.7 S332D1 4.65/4.50 S332D2 4.85/4.65	S332A Non-Existent S332B1 4.7/4.5 S332B2 5.0/4.7 S332BN1 4.7/4.5 S332B2 5.0/4.7 S332C1 4.7/4.5 S332C2 5.0/4.7 S332D1 4.65/4.50 S332D2 4.85/4.65	S332A Non-Existent S332B1 4.7/4.5 S332B2 5.0/4.7 S332BN1 4.7/4.5 S332B2 5.0/4.7 S332C1 4.7/4.5 S332C2 5.0/4.7 S332D1 4.65/4.50 S332D2 4.85/4.65
		S332B1=125 cfs S332B2=125 cfs S332BN1 =125cfs S332BN2=125 cfs S332C1 = 250 cfs S332C2=250 cfs S332D1 = 250 cfs S332D2 = 250 cfs Jul15-Nov30, 75cfs Dec 1-Jan31, 0cfs Feb 1-Jul14 All Flood Control		S332B1=125 cfs S332B2=125 cfs S332BN1 =125cfs S332BN2=125 cfs S332C1 = 250 cfs S332C2=250 cfs S332D1 = 250 cfs S332D2 = 250 cfs Jul15-Nov30, 75cfs Dec 1-Jan31, 0cfs Feb 1-Jul14 All Flood Control	
	S-357 (pump)	S357A (5.7' Nov 1-May31, 5.2' Jun1-Oct31)/(5.4' Nov 1-May31, 4.9' Jun1-Oct31) S357B (6.0' Nov 1-May31, 5.5' Jun1-Oct31)/(5.7' Nov 1-May31, 5.2' Jun1-Oct31) S357A = 250 cfs S357B = 250 cfs		S357A (5.7' Nov 1-May31, 5.2' Jun1-Oct31)/(5.4' Nov 1-May31, 4.9' Jun1-Oct31) S357B (6.0' Nov 1-May31, 5.5' Jun1-Oct31)/(5.7' Nov 1-May31, 5.2' Jun1-Oct31) S357A = 250 cfs S357B = 250 cfs	
L-31W	S-332 (pumps)*	Non-existent		Non-existent	
	S-175	Non-existent		Non-existent	
C-111	S-200	S-200A=75cfs; **3.6 / 3.4** S-200B=75cfs; **3.7 / 3.4** S-200C=75cfs; **3.8 / 3.4**		S-200A=75cfs; **3.6 / 3.4** S-200B=75cfs; **3.7 / 3.4** S-200C=75cfs; **3.8 / 3.4**	
	S-199	S-200A=75cfs; **3.8 / 3.6** S-200B=75cfs; **3.9 / 3.6** S-200C=75cfs; **4.0 / 3.6**		S-200A=75cfs; **3.8 / 3.6** S-200B=75cfs; **3.9 / 3.6** S-200C=75cfs; **4.0 / 3.6**	
	S-177	**4.2 / 3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.		**4.2 / 3.6** (*Open/Close determined in high rainfall event Special Code.) 1) Water Supply & Flood Control Spillway w/1 gate Design Q = 2900 cfs.	
	S-18C	**2.6 / 2.3** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.		**2.6 / 2.3** open/closed wet & dry season 1) Water Supply & Flood control Spillway w/2 gates Design Q=3200 cfs.	
	S-197*	****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.		****Same as IOP,See Note 1) S197 ops see below **** 2) Flood control only 13 Culverts w/gates Design Q=6000 cfs.	
	S-332E (pump)	Non-existent		Non-existent	

* SFWMM uses special code. Open/Close may or may not be used in operations.

**** S-197 Ops: Open 3 gates if S-177 full open & S-177>4.1 ft or S-18C> 2.8 ft
Open 7 gates if S-177 > 4.2 ft for 24 hrs or S-18C > 3.1 ft
Open 13 gates if S-177 > 4.3 ft or S-18C > 3.3 ft
Close when all the conditions below are met

1) S-176 < 5.2 ft and S-177 < 4.2 ft
2) Storm moved away from basin
3) After 1 and 2 are met, keep the number of S-197 culverts open necessary only to match residual flow through S-176