Restoration Strategies
Regional Water Quality Plan

Prepared by

South Florida Water Management District

April 27, 2012

Final Version

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Acronyms and Abbreviations

ac-ft	acre-feet
cfs	cubic feet per second
DMSTA	Dynamic Model for Stormwater Treatment Areas
EAA	Everglades Agricultural Area
EAV	Emergent Aquatic Vegetation
EBWCD	East Beach Water Control District
EPA	Everglades Protection Area
ESWCD	East Shore Water Control District
FDEP	Florida Department of Environmental Protection
FEB	Flow Equalization Basin
MIA	Miami Canal
MDR	Model Design Report
NNRC	North New River Canal
ppb	parts per billion
SAV	Submerged Aquatic Vegetation
SFCD	South Florida Conservancy District
SFWMD	South Florida Water Management District
SFWMM	South Florida Water Management Model
SSDD	South Shore Drainage District
STA	Stormwater Treatment Area
TP	Total Phosphorus
USEPA	United States Environmental Protection Agency
WCA	Water Conservation Area
WQBEL	Water Quality Based Effluent Limit
WPB	West Palm Beach
WY	Water Year

1.0 Introduction

To address water quality concerns associated with existing flows to the Everglades Protection Area (EPA), the South Florida Water Management District (SFWMD or District), Florida Department of Environmental Protection (FDEP), and United States Environmental Protection Agency (USEPA) engaged in technical discussions starting in 2010. The primary objectives were to establish a Water Quality Based Effluent Limit (WQBEL) that would achieve compliance with the State of Florida's numeric phosphorus criterion in the EPA and to identify a suite of additional water quality projects to work in conjunction with the existing Everglades Stormwater Treatment Areas (STAs) to meet the WQBEL.

Based on the collaborative effort described above, a suite of projects have been identified that would achieve the WQBEL. This report describes those resulting projects and the evaluation tools and assumptions that were utilized in the technical evaluation.

The projects have been divided into three flow paths (Eastern, Central and Western), which are delineated by the source basins that are tributary to the existing Everglades STAs. The identified projects primarily consist of Flow Equalization Basins (FEBs), STA expansions, and associated infrastructure and conveyance improvements. The primary purpose of FEBs is to attenuate peak stormwater flows prior to delivery to STAs and provide dry season benefits, while the primary purpose of STAs is to utilize biological processes to reduce phosphorus concentrations in order to achieve the WQBEL. Each component listed in this document is a planning estimate of the project feature required in each flow path to meet the water quality standards for the EPA. The Eastern Flow Path contains STA-1E and STA-1W. The additional water quality projects for this flow path include an FEB in the S-5A Basin with approximately 45,000 acre-feet (ac-ft) of storage and an STA expansion of approximately 6,500 acres (5,900 acres of effective treatment area) that will operate in conjunction with STA-1W. The Central Flow Path contains STA-2, Compartment B and STA-3/4. The additional project is an FEB with approximately 54,000 ac-ft of storage that will attenuate peak flows to STA-3/4, and STA-2 and Compartment B. The Western Flow Path contains STA-5, Compartment C and STA-6. An FEB with approximately 11,000 ac-ft of storage and approximately 800 acres of effective treatment area (via internal earthwork) within STA-5 are being added to the Western Flow Path.

2.0 Evaluation Tools and Assumptions

2.1 Modeling Tools and Datasets

The Restoration Strategies Preliminary Plan used hydrologic and water quality models to evaluate regional alternatives. The focus of the modeling was to identify project features necessary to achieve the WQBEL.

2.1.1 South Florida Water Management Model

The South Florida Water Management Model (SFWMM or 2x2) is a regional, hydrologic model specifically developed and applied to simulate the unique hydrology of the south Florida system and its regional management. Use of the SFWMM in the Restoration Strategies planning effort involved application of the model to estimate the current volume and timing of surface water flows discharged from source basins contributing inflows to existing and additional project features described in this plan, with eventual discharge into the EPA. These modeled hydrologic estimates were processed for inclusion in the water quality modeling effort described in subsequent sections.

2.1.1.1 Description of Model

The SFWMM is a coupled surface water-groundwater model which incorporates overland flow, canal routing, unsaturated zone accounting and two-dimensional single layer aquifer flow. The model simulates the major components of the hydrologic cycle in south Florida including rainfall, evapotranspiration, infiltration, overland and groundwater flow, canal flow, canal groundwater seepage, levee seepage and groundwater pumping. The model has been exclusively developed for the south Florida region and has been calibrated and verified using water level and discharge measurements at hundreds of locations distributed throughout the region within the model boundaries. In addition to simulating the natural hydrology in south Florida, the model also simulates the management processes that satisfy policy-based rules (both existing and proposed) to meet flood control, water supply and environmental needs. It can incorporate current or proposed water management control structures and current or proposed operational rules. The SFWMM simulates hydrology on a daily basis using climatic data for the 1965-2005 period which includes many droughts and wet periods.

2.1.1.2 Description of Hydrologic Modeling Scenario

The SFWMM simulation of hydrology for this planning effort was the Restoration Strategies Baseline 2 scenario or RS_BASE2. A detailed description of the south Florida system-wide assumptions and projects that were incorporated into the RS_BASE2 scenario is found in the Model Documentation Report (MDR) attached in **Appendix A**.

The intent of the RS_BASE2 model scenario is to represent a projection of the south Florida system hydrology as it would be in the future condition (circa 2015-2020). This projection is dependent on several assumptions, including anticipated completion of current and planned projects, system operating protocols and projections of future consumptive use and environmental demands. Although the entire south Florida regional system is modeled by the SFWMM, the primary area of interest for the Restoration Strategies initiative is the basin hydrology in and in the vicinity of the Everglades Agricultural Area (EAA), specifically related to basins that contribute flow to Everglades STAs that discharge into the EPA.

2.1.1.3 Summary of Source Basin Hydrology

For the purposes of Restoration Strategies project planning, application of the SFWMM provides hydrologic estimates of the areas identified in **Figure 1**. For each basin, daily flow time series are provided from the RS_BASE2 model output. This dataset provides the basis for the generation of inputs to the DMSTA model by utilizing a method that is consistent with previous DMSTA modeling efforts (Gary Goforth, Inc., 2009a). During this process, some aspects of the SFWMM-estimated hydrology are recalculated or rescaled to more closely approximate observed historical data. The aggregated source basin volumes are provided in **Table 1**.

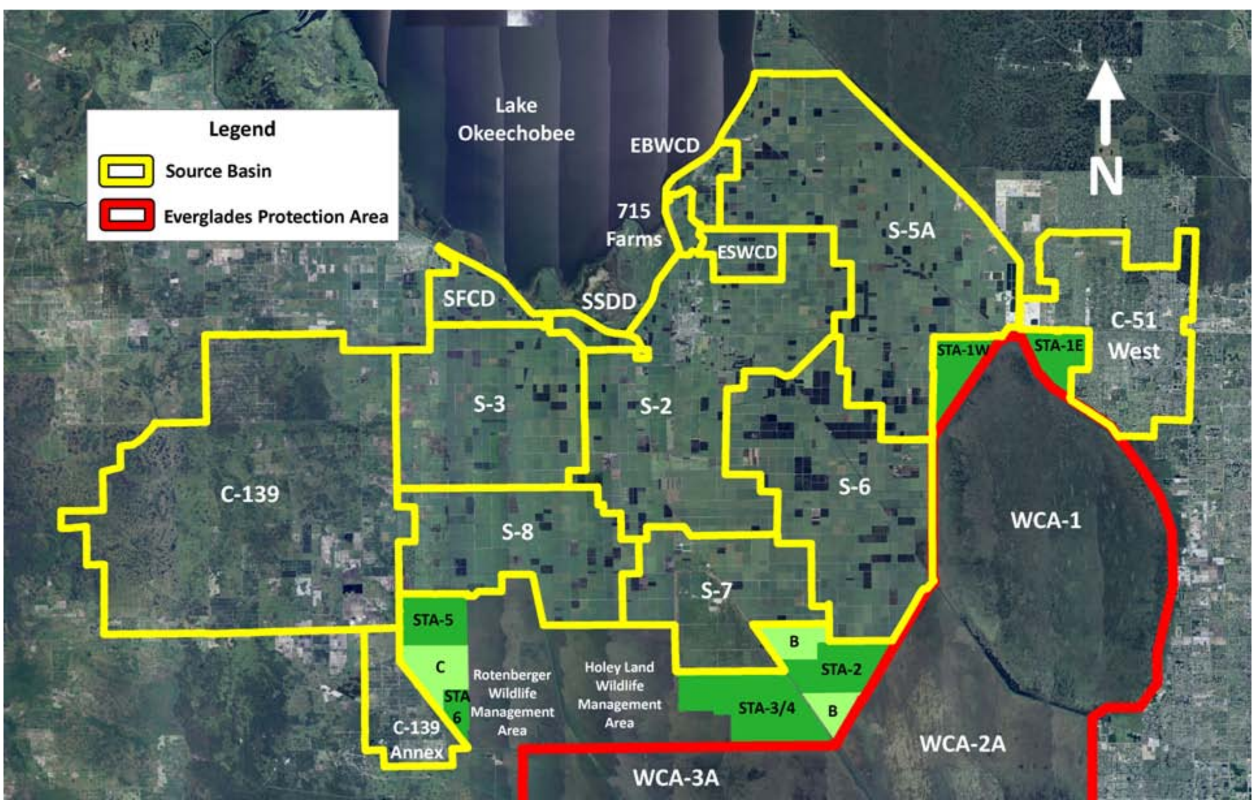

Figure 1. Potential Restoration Strategies Source Basins

Table 1. Restoration Strategies Source Basin Average Annual Volumes

Source Basin Name	Average Annual Flow (ac-ft)
C-51 West / L-8	169,700
West Palm Beach (S-5A)	293,500
Hillsboro (S-2/S-6)	181,400
North New River (S-2/S-7)	263,900
Miami Canal (S-3/S-8)	218,400
EBWCD	17,000
ESWCD & 715 Farms	22,700
SSDD	11,700
SFCD	19,100
C-139	202,400
C-139 Annex	0
Lake Okeechobee (Regulatory)	58,300
Lake Okeechobee (Urban Water Supply)	29,200
Total	1,487,300

Note: See Section 3.1.3.1 for an explanation of L-8 Basin flows

2.1.2 Dynamic Model for Stormwater Treatment Areas (DMSTA)

2.1.2.1 Description of Model

The Dynamic Model for Stormwater Treatment Areas (DMSTA) was developed for the U.S. Department of the Interior and the U.S. Army Corps of Engineers (Walker and Kadlec, 2005; http://wwwalker.net/dmsta/). DMSTA was developed and calibrated to information specific to south Florida and to predict phosphorus removal performance of Everglades STAs and storage reservoirs, and has been commonly used by both state and federal agencies for STA design and evaluation since 2001. The 2005 version of DMSTA was calibrated to data from 35 fully functional treatment cells with viable vegetation communities of various types. The model provides detailed output on the water and phosphorus balances of individual treatment cells and entire STAs, regional networks of STAs and storage reservoirs. Warning messages are generated in cases where simulated conditions exceed the calibration boundaries for phosphorus concentration, depth, dryout frequency, and/or flow velocities.

Model input requirements include daily values for flow, phosphorus concentration, rainfall, evapotranspiration (ET), depth (optional input or simulated value) and releases (optional input or simulated), treatment area configuration, cell size, flow path width, vegetation type, estimates of hydraulic mixing, outflow hydraulics, and seepage estimates. Phosphorus removal rates (settling rate; *K*) and other phosphorus cycling parameters can be either user-defined or calculated within DMSTA based on calibration data sets. DMSTA assumes that the specified vegetation types (emergent, submerged, periphyton) will be maintained in the long-term, but does not take into account areas subject to periodic disturbance such as hurricanes, droughts and other extreme conditions that are not reflected in the calibration datasets where vegetation management may be difficult.

DMSTA is the best available tool for simulating phosphorus removal performance of existing or planned storage reservoirs and STAs. DMSTA is configured to allow integration with the SFWMD's regional hydrologic models (SFWMD, 2005) and can be configured to simulate complex regional networks of STAs and reservoirs. DMSTA's spreadsheet interface and relatively limited input data requirements allows the development and evaluation of various STA designs (Walker and Kadlec, 2011).

2.1.2.2 Model Implementation

For this planning project, the District utilized DMSTA, Model Version 2c (Version Date: 7/29/2011) provided by Dr. William Walker, Jr. to predict long-term flow-weighted mean phosphorus concentrations. As part of the technical collaboration with SFWMD since 2010 related to this planning project, Dr. William Walker, Jr. developed an intuitive Everglades STA-specific regional design worksheet that works seamlessly with DMSTA. The regional design worksheet can quickly be modified by the user to develop scenarios and evaluate DMSTA simulation results. An example of this regional design worksheet is provided in **Appendix B**.

2.1.2.2.1 Model Assumptions

The DMSTA model and regional design worksheet require several parameters that specify both physical and operational characteristics of an STA or reservoir. Many of the DMSTA parameters used for this planning project are provided in **Appendix B**. In addition to specific input parameters required by the model, there are several overall planning-level assumptions that must be determined (prior to DMSTA modeling) in order to appropriately pre-process the data that is required by DMSTA. The following section describes the critical overall assumptions implemented during this planning project.

Effective Treatment Areas for Existing STAs

One of the model parameters required by DMSTA is the surface area of the treatment wetland, or effective treatment area. While various DMSTA modeling methodologies are appropriate for planning level projects, the District simulated each STA cell individually within DMSTA. For example, all eight (8) treatment cells at STA-1E were individually parameterized within DMSTA. In addition, the Compartment C treatment cells at STA-5/6 (Cells 5-4A and 5-5A) were both further disaggregated into three (3) individual treatment cells within DMSTA to represent the intermediate berms with multiple low level weirs, upstream collection canals, and downstream spreader canals that exist within both of these cells. **Table 2** provides an overview of effective treatment areas for existing Everglades STAs that was assumed for this planning project. The total project area (which includes inflow, outflow, seepage canals, and upland areas) for existing Everglades STAs is approximately 68,000 acres.

Table 2. Summary of Existing Everglades STA Effective Treatment Areas

Stormwater Treatment Area	Effective Treatment Area (acres)		
	Target Vegetation		Total
	EAV	SAV	
STA-1E	2,053	2,941	4,994
STA-1W	2,016	4,528	6,544
STA-2 (with Comp. B)	5,269	10,226	15,495
STA-3/4	7,941	8,386	16,327
STA-5/6 (with Comp. C)	7,776	5,909	13,685
All STAs	25,055	31,990	57,045

Source Basin Total Phosphorus Concentration Period of Record

For this planning project, it was assumed that the total phosphorus (TP) concentrations for the basins tributary to the Everglades STAs would be based on historical data obtained during the 10-year period of record, Water Years 2000-2009 (May 1, 2000 through April 30, 2009). This 10-year period of record is considered a reasonable representation of future anticipated conditions and is suited for use in long-term regional water quality planning efforts. It incorporates a range of hydrologic and meteorological conditions (i.e. it includes periods with both hurricanes and droughts). Historical daily flows and TP concentrations and loads, that were calculated using data collected via the District's hydrological monitoring network and water quality monitoring programs, were used to develop twelve (12) mean monthly TP concentration values for each source basin. Where data were available, mean monthly TP concentrations were also developed for water management or drainage districts established by Chapter 298, Florida Statutes (commonly referred to as 298 Districts). The method used to develop the mean monthly TP concentrations for this planning project is consistent with the methodology documented in the report entitled "Updated STA Phosphorus Projections For the 2015 Planning Period" (Gary Goforth, Inc., 2009a). **Table 3** provides the mean monthly TP concentrations for each of the source basins used for this planning project.

Table 3. Source Basin Mean Monthly Total Phosphorus Concentrations

Month	EAA WPB	S5A DIV	EBWCD	C51W	S361	L-8	EAA Hillsboro	EAA NNRC	EAA MIA	ESWCD & 715 Farms
January	116	208	233	94	57	140	70	130	69	64
February	197	296	292	116	53	93	128	132	163	107
March	205	170	366	117	81	141	106	105	70	99
April	160	178	384	195	60	127	130	132	119	121
May	175	116	183	152	72	125	118	139	115	80
June	175	377	329	151	68	91	85	85	85	106
July	126	103	358	139	75	81	91	75	78	123
August	172	303	427	153	94	116	136	81	68	122
September	177	217	445	181	92	119	144	116	85	156
October	166	188	479	273	68	117	130	105	66	224
November	167	79	352	151	52	77	67	46	98	167
December	128	119	221	123	90	121	63	104	54	65

Month	SSDD MIA	SSDD NNRC	SFCD	G136	C139S	Lake NNRC	Lake MIA	Lake WPB	Lake Hillsboro
January	114	71	90	49	80	147	165	258	147
February	130	108	94	472	81	122	176	174	122
March	145	117	94	51	112	158	118	229	158
April	163	97	107	86	165	158	157	240	158
May	136	97	116	43	128	131	120	157	131
June	131	74	115	315	328	144	138	167	144
July	123	60	101	284	269	93	89	174	93
August	141	98	111	233	255	93	151	204	93
September	123	89	114	227	285	115	148	139	115
October	137	97	112	191	233	125	164	145	125
November	135	121	125	128	197	170	148	213	170
December	113	71	80	91	139	164	127	245	164

Note: See Section 3.3.3 for information regarding specific assumptions that affect G136 and C139S TP concentrations.
See Section 3.1.3.1 for information regarding L-8 Basin flows

Lake Okeechobee Total Phosphorus Concentrations

In addition to stormwater runoff, the Everglades STAs also receive water from Lake Okeechobee. Both regulatory releases and urban water supply deliveries from Lake Okeechobee may be conveyed to the Everglades STAs. Due to the distance between Lake Okeechobee outlet structures and Everglades STA inlet structures, and the phosphorus dynamics that exist within the regional water management system, the TP concentrations of Lake Okeechobee water measured at lake outlet structures are 50-70 ppb higher than TP concentrations measured at STA inlet structures (using data from Water Years 2000-2009). For the purposes of this planning project, the TP concentrations as measured at Lake Okeechobee outlet structures were used for all Lake Okeechobee water simulated to be conveyed to the Everglades STAs.

STA Duty Cycle Factor

The STA duty cycle factor is intended to represent the portion of time that an STA is projected to be offline for major maintenance or rehabilitation activities. For example, a duty cycle factor of 0.95 corresponds to an STA being offline 5% of the time (i.e. 1 year offline within a 20 year period). DMSTA applies the duty cycle factor as a multiplier to the net phosphorus settling rate, which effectively reduces the simulated phosphorus removal performance for the entire period of simulation. For this planning project, a duty cycle factor of 0.95, which is consistent with the offline time documented for the existing Everglades STAs, was assumed for all existing and additional STAs.

Extreme Event Diversions

It was assumed that the SFWMM-simulated STA diversion flows (i.e. flows that were simulated not to be conveyed to the STAs by the SFWMM due to structural constraints or damaging (i.e. high) STA water depths) would be included in the inflow datasets used during the water quality focusedDMSTA modeling. However, since most STA inflow structures (and the STA wetlands themselves) are not designed to convey all flows that occur as a result of extreme storm events, such as those that may occur during hurricanes or other tropical events, it is recognized that STAs may not receive all source basin flows and that STA diversion flows will occur occasionally. The intent of STA diversion operations is to prevent or minimize damaging depth and flow conditions within the STAs, ensure the continued health of treatment vegetation and thus maintain phosphorus removal performance, and to ensure flood damage is minimized in the EPA tributary basins. Therefore, it is anticipated that extreme event diversions will be addressed through the STA permit and/or regulatory process.

Urban Water Supply Deliveries

For this planning project, urban water supply deliveries from Lake Okeechobee were simulated as being treated within the STAs. During the dry season when regional water availability is typically limited, and treatment of water supply deliveries would result in additional losses due to STA seepage, evapotranspiration, etc., flexibility will be required to operate the regional water management system to maximize efficiencies and help ensure water supply responsibilities are met. Therefore, it is anticipated that urban water supply deliveries will be addressed through the STA permit and/or regulatory process.

3.0 Projects

This section describes a suite of projects that have been discussed that would work in concert with existing Everglades STAs to attain the WQBEL. Numerous modeling simulations and conceptual engineering evaluations were conducted to analyze each flow path and identify the appropriate combination of features that are best suited to optimize performance, recognizing flow path specific TP concentrations, flows patterns, and existing STA performance. For convenience, descriptions of the various features are grouped into three flow paths, Eastern, Central and Western (**Figure 2**). **Appendix B** contains the DMSTA modeling sheets for the projects.

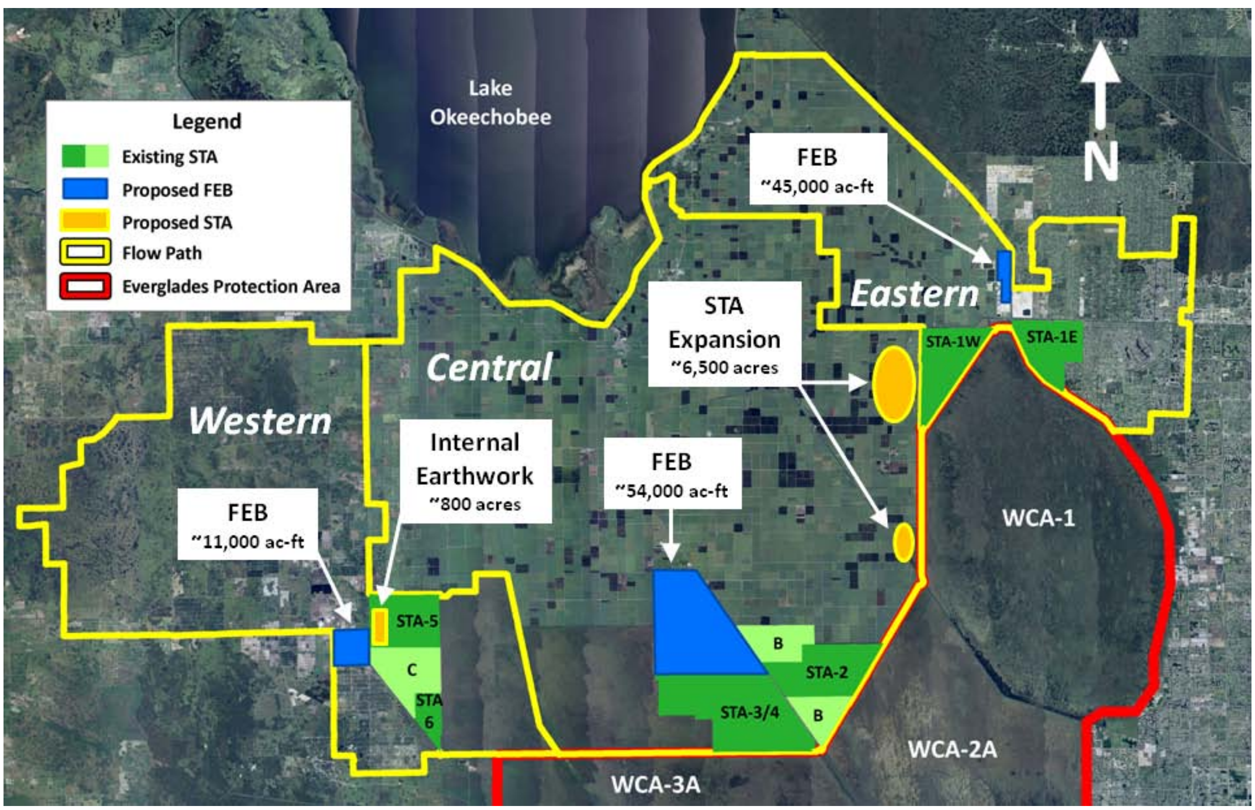

Figure 2. Restoration Strategies Flow Paths and Projects

Stormwater Treatment Areas – Description and Purpose

Stormwater Treatment Areas, or STAs, are large-scale freshwater wetlands constructed to remove phosphorus from urban and agricultural stormwater runoff prior to discharge to the Everglades. Phosphorus is removed from the water column through physical, chemical, and biological processes such as sedimentation, precipitation, plant growth, microbial activity and the accumulation of dead plant material that is converted to a layer of soil. A typical STA has multiple cells that are divided into several parallel treatment paths or flow ways. Water flows through these systems via water control structures, such as pump stations, gates, or culverts. The dominant plant communities in STAs are broadly classified as emergent aquatic vegetation (EAV) and submerged aquatic vegetation (SAV). Interspersed among this vegetation, where conditions are favorable, are floating aquatic vegetation and periphyton communities.

In contrast to conventional chemical treatment technologies which are designed to allow real time active control of treatment processes to provide technically reliable performance, STAs are cutting edge, biological systems which are more complex and reliant on multiple factors that are less controllable and subject to natural perturbations. STAs are considered the most cost-effective and environmentally preferred means of removing phosphorus from water prior to discharge to the Everglades (62-302.540, F.A.C.). Since 1994 the District spent approximately $70 million on Advanced Treatment Technology (ATT) and STA Optimization research. The District continues to apply science and engineering to optimize and enhance performance of the STAs to ensure that the best available science is being utilized to further reduce phosphorus concentrations in discharges to the Everglades. The Everglades STAs, varying in size and configuration, have been in operation in south Florida since 1993. The total area of Everglades STAs, including infrastructure components, is approximately 68,000 acres with approximately 57,000 acres of effective treatment area. To date, Everglades STAs have been successfully operated to prevent significant quantities of phosphorus from entering the Everglades.

Flow Equalization Basins – Description and Purpose

Wetlands, including Everglades STAs, are affected by a variety of factors including water depth, vegetation type, geometry, inflow water quality, hydraulic loading, and the intensity, duration and timing of flow events. Everglades STAs are typically subject to large and sustained flow pulses due to the hydrological and land use characteristics of south Florida. In general, if the volume of water that is displaced during flow pulses is large, detention time and phosphorus removal performance will likely be less than optimal. To assist the Committee on Independent Scientific Review of Everglades Restoration Progress, Kadlec (2011) prepared a draft document summarizing the effect of pulsing on wetlands and evaluating the potential improvements to wetland performance as flow pulses are reduced. Kadlec's analyses indicate that storage reservoirs operated to reduce pulse flows have the potential to significantly improve the performance of Everglades STAs (Kadlec, 2011). Recent DMSTA modeling evaluating the effect of FEBs operated to attenuate pulse flows to STAs demonstrated that an FEB can reduce the required STA expansion area by thousands of acres. Therefore, based on more than twenty years of STA operational experience, best professional judgment of District engineers and scientists, and the information summarized above, reducing flow pulses to Everglades STAs was considered a key objective of the water quality projects. Consequently, storage reservoirs or FEBs are included for all three project flow paths.

3.1 Eastern Flow Path

3.1.1 Project Description

The Eastern Flow Path consists primarily of the C-51 West and S-5A Basins. The flows from these drainage basins are currently routed to STA-1W and STA-1E for treatment prior to discharging into Water Conservation Area (WCA) 1 (**Figure 3**). The S-5A and S-319 Pump Stations will continue to provide the existing level of flood protection to the S-5A Basin and the C-51 West Basin.

The Eastern Flow Path projects are intended to manage basin runoff in a more advantageous manner, by reducing the impacts of storm event driven inflows on the STAs, as well as expanding the effective stormwater treatment area. This is accomplished by: redirecting a portion of the STA inflows to an approximately 45,000 ac-ft FEB located adjacent to the L-8 Canal, for flow attenuation, prior to conveyance to STAs for treatment; increasing the spatial extent of STA-1W by approximately 6,500 acres (5,900 acres of effective treatment area) for additional phosphorus treatment capacity; and modifying the system to allow utilization of the G-341 structure consistent with its design intent (**Figure 3**).

In the Eastern Flow Path, the primary projects include:

- Construction of an approximately 45,000 ac-ft FEB adjacent to the L-8 Canal to attenuate peak flows and optimize STA inflow rates.

- Construction of an approximate 6,500 acre STA expansion (targeting 5,900 acres of effective treatment area) in the vicinity of the STA-1W complex to provide additional treatment capacity for S-5A and C-51 West basin runoff.
    - o Exact location and sizing will be dependent on detailed design but will be sufficient to ensure the project performs consistent with the WQBEL.

- Conveyance improvements necessary to enable the G-341 structure to operate consistent with its design intent.

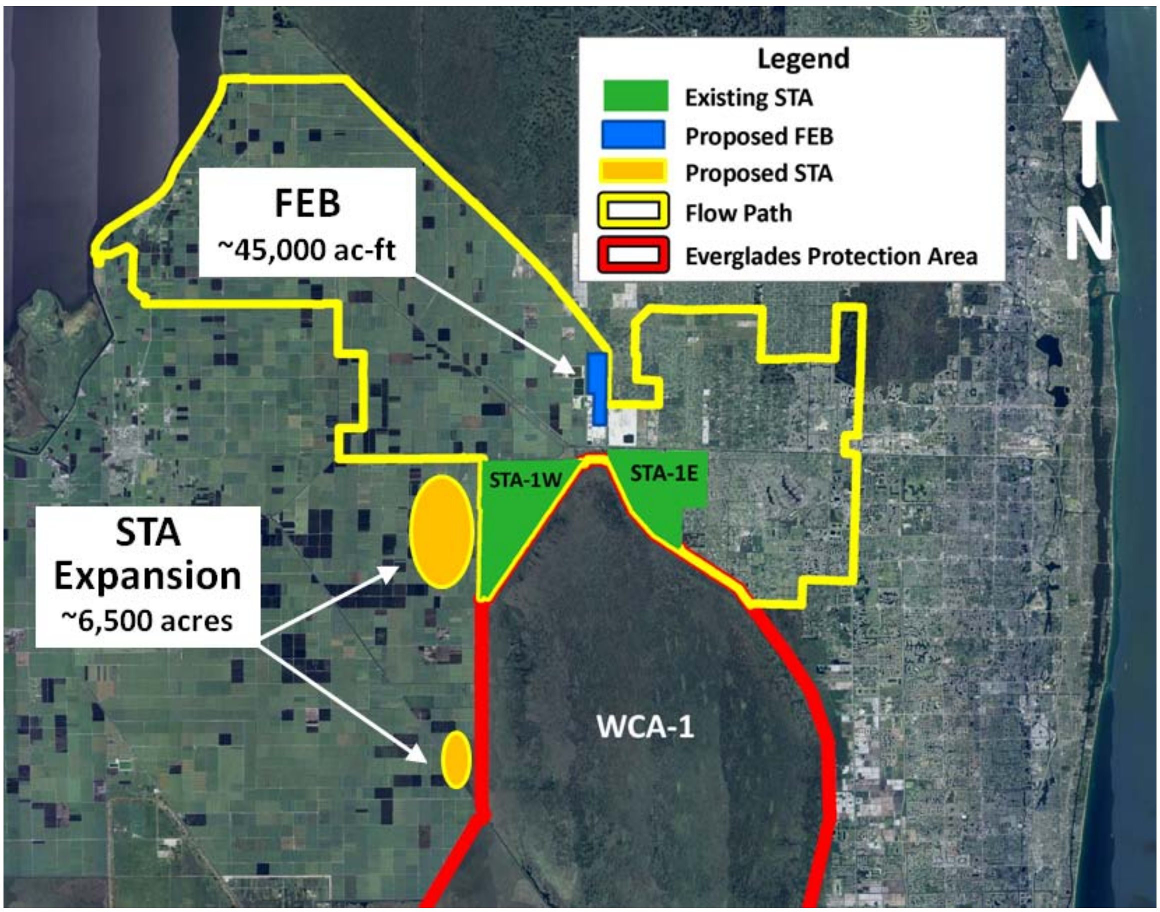

Figure 3. Eastern Flow Path Projects

3.1.2 Conceptual Engineering and Operations

- **S-319 Pump Station (Existing)**

The primary purpose of the S-319 Pump Station is to provide flood protection for the C-51 West Basin (**Figure 4**). The S-319 Pump Station, which has a design capacity of 3,980 cubic feet per second (cfs), conveys surface water runoff and other flows from the C-51 West Canal into the STA-1E East Distribution Cell.

In this plan, there is no change to the current use of the S-319 Pump Station and it will continue to be utilized for flood protection in the C-51 West Basin to move water from the C-51 West Canal to the STA-1E East Distribution Cell.

- **STA-1E Distribution Cell (Existing)**

The STA-1E Distribution Cell is divided into the East Distribution Cell and the West Distribution Cell by a north-south levee and structure S-375 (**Figure 4**). The primary purpose of these two cells is to distribute flows to the downstream treatment cells of STA-1E by conveyance of water east or west from the S-319 Pump Station. The S-375 structure serves to convey water from the East Distribution Cell into the West Distribution Cell where it can be conveyed either into the treatment cells for STA-1E or through G-311 to the STA-1 Inflow Basin.

The STA-1E Distribution Cell will continue to be utilized to provide an optimized amount of flow to STA-1E. Excess flows above the optimum flow will be redirected through the S-375 and G-311 structures to the STA-1 Inflow Basin.

- **STA 1 Inflow Basin (Existing)**

The STA-1 Inflow Basin provides the capability to convey flows from Pump Stations S-5A and S-319 to STA-1W, STA-1E and the future L-8 FEB (**Figure 4**). The STA-1 Inflow Basin is also able to receive flows from the L-8 Canal to STA-1E through G-311 or to STA-1W through G-302.

- **S-375 Structure (Existing)**

The S-375 structure has an approximate capacity of 1,580 cfs (**Figure 4**). During high flow events from the C-51 West Basin and at times when there is capacity for storage in the FEB or STA-1E is receiving optimal flows; water will be diverted through S-375 to the G-311 Structure. Due to current capacity constraints with the S-375 structure, an S-375 structure expansion or overflow weir will be required.

- **S-375 Structure Expansion (New)**

As part of the project, an additional structure will be constructed adjacent to the existing S-375 (**Figure 4**). The new structure will have an approximate design capacity of approximately 2,400 cfs to allow conveyance of full design flows from the S-319 Pump Station through use of both the S-375 structure and the new structure.

- **G-311 Structure (Existing)**

  The G-311 structure serves to deliver water between the STA-1 Inflow Basin and STA-1E West Distribution Cell (**Figure 4**). The G-311 structure has the capability to redirect flows from the S-319 Pump Station into the STA-1 Inflow Basin or direct flow from the STA-1 Inflow Basin to the STA-1E West Distribution Cell.

- **S-5A Pump Station (Existing)**

  S-5A Pump Station provides flood protection to upstream basins (**Figure 4**). The removal of stormwater runoff from the upstream basins has been, and will continue to be, the primary function of the S-5A Pump Station. The S-5A Pump Station has a design capacity of 4,800 cfs.

  In this plan there is no change to the current use of the S-5A Pump Station and it will continue to be utilized for flood protection to the S-5A Basin to move water from the L-12 Canal to the STA-1 Inflow Basin.

- **S-5AS Structure Automation (New)**

  The existing S-5AS structure is located at the southern termination of the existing L-8 Canal where it enters the STA-1 Inflow Basin (**Figure 4**). The two cable-operated vertical lift gates are locally controlled in accordance with operational criteria. S-5A Basin and C-51 West Basin runoff will be directed north through S-5AS to the L-8 FEB under this plan. With the implementation of this project, the use of the S-5AS structure will increase and therefore will require the structure to be automated.

- **L-8 Canal Divide Structure (New)**

  The current structures in the L-8 Canal are located at the junction of the M Canal at West Palm Beach's Control Pump Station #2 and S-76 located near Lake Okeechobee . In order to avoid impacts to surrounding lands, a new divide structure will be required within the L-8 Canal. The structure will be designed to allow current operational criteria for flows within the L-8 Canal with minimal head loss, while allowing stages within the southern L-8 Canal to be raised in order to hydraulically move water north from the STA-1 Inflow Basin to the new L-8 FEB. The structure will also be used to allow flows to be directed south from the L-8 FEB to the STA-1 Inflow Basin.

- **L-8 FEB (New)**

  The L-8 FEB is a 950-acre former rock mine in central Palm Beach County with unique geology (**Figure 4**). The project is capable of storing approximately 45,000 ac-ft of water to attenuate peak flows and optimize STA-1E and STA-1W inflow volumes. In order to fully utilize the L-8 FEB, additional project features are required. These projects include an inlet structure, discharge pump station, embankment protection measures and strategic dredging to fully interconnect the cells.

  In order to utilize the full storage capacity of the L-8 FEB for flow attenuation of water redirected from the STA-1 Inflow basin, the new inlet structure will have a capacity of 3,000 cfs and will be able to fill the reservoir to its intended maximum operational pool stage of +16.5 NAVD (+18.0 NGVD).

  The discharge pump station will have a capacity of approximately 450 cfs for delivery of flows from the L-8 FEB to the STA-1 Inflow Basin. The discharge pump station will be able to draw the FEB down to an elevation of -37.0 NAVD (-35.5 NGVD), which is approximately 5 feet above the bottom of the reservoir.

  The District is currently in the process of solicitation for a Design/Build contractor to complete design and construction on the project. This consists of hiring a firm to construct the inlet structure and outflow pump station, revetment protection features for the surrounding levees, and final configuration of the flow path within the reservoir itself.

  Over the years as the site has been mined, the mining developer was required to keep the process water on site. This consists of recycling the water within the pits used for dredging the lower portion of the reservoir. This process water was deposited in the southern cell for settling of fine particles (rock flour), prior to reusing the water in the dredging of the other cells. In addition, as material was removed for further processing and eventual disposal to contracting firms for building infrastructure, the material required washing. The same water utilized for dredging was also utilized for washing the rock obtained from the reservoir. This wash water was also then placed in the southern cell for settling out fine particles.

  Over the many years it took to excavate and clean the rock material from the reservoir, an elevated chloride level was created in the process water. Since the District received ownership of the reservoir, the reservoir has been used to a very limited degree to supplement environmental deliveries to the Loxahatchee River and water supply in drought years. Each time the reservoir use has been monitored, and although the overall volume of water exchanged within the reservoir has been limited, there has been a substantial decrease in the chlorides in the cells that are fully interconnected. However, the two most southerly cells still have a limited hydrologic connection to the remaining cells and therefore still have higher chloride concentrations.

The above Design/Build contract will create additional connections between the cells (including the two most southerly cells) and will create a configuration that maximizes the exchange of water between cells. In addition, the Design/Build contract will include a requirement for the contractor to empty the reservoir to the expected low operational level and to refill the reservoir with surface water runoff, before the District accepts the completed project. This will allow the District to begin operations of the FEB's enhanced delivery system to the existing STAs at completion with water discharged from the reservoir meeting Class III water quality requirements.

- **G-302 Structure (Existing)**

  Inflow structure G-302 is located at the head of the Inflow Canal for STA-1W (**Figure 4**). Structure G-302 provides flows from STA-1 Inflow Basin to STA-1W. During the design of the expansion of STA-1W, an analysis will be performed to determine if there is a need to expand this structure or install additional structures. This determination is dependent on the final design of the expansion and potential changes to STA-1W.

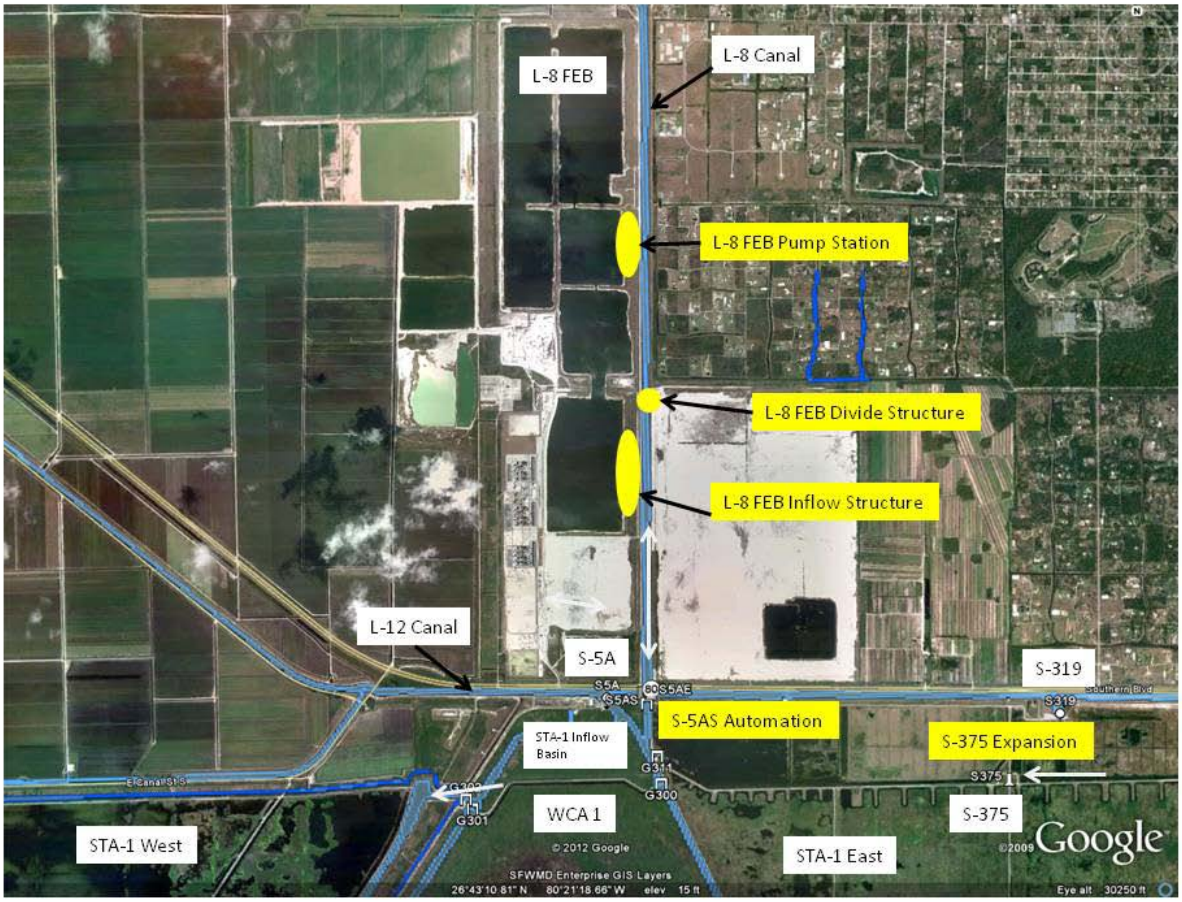

Figure 4. L-8 FEB and STA-1 Conceptual Design

- **STA-1 West Expanded (New)**

  STA-1W Expanded (STA-1WEX) is a combination of the existing STA-1W footprint and the additional treatment area required (**Figure 5**). For the purpose of this section, the STA-1WEX project will consist of all features necessary to make the Eastern Flow Path projects perform consistent with the WQBEL. An approximately 6,500 acre STA expansion (5,900 acres of effective treatment area) is included as a new project for the Eastern Flow Path. At the current time, the final footprint of the expansion has not been established. However, a conceptual alternative for potentially available land is generally described below. Upon actual identification of the lands available for the project, multiple conceptual designs will be required to determine the most cost effective treatment layout to meet the requirements of the WQBEL.

The conceptual design described below is one of many options that could be considered depending on hydraulics and available land. This may consist of modifications to the physical configuration or operational protocols of the existing STA-1W as well as the design of the new treatment areas. In any case, the final design will incorporate the best available information to ensure appropriate vegetation partitioning and water depths.

- **STA-1W (Existing)**

  The current design of STA-1W was constrained by the available land and the need to maximize treatment areas while maintaining the necessary hydraulics to move the water through the system for both treatment and flood control purposes (**Figure 5**). In the new project design, the existing footprint will be evaluated to determine if the area can be utilized more effectively. The evaluation will consider the vegetation distribution across cells and whether reorientation of flow paths would be beneficial if adjacent land is available for the STA expansion.

- **4700 Acre STA Expansion (New)**

  For the purpose of this conceptual design, it is assumed that 4,700 acres of land contiguous with the existing STA-1W footprint is available (**Figure 5**). Further, it is assumed that the 4,700 acres does not contain any major infrastructure that would need to be avoided or incorporated into the design of the STA expansion. In this conceptual design, it is assumed that the new cells would be operated in coordination with STA-1W and therefore would be designed in series with the existing cells. As stated above, upon final identification of the lands, further investigations will be required.

  This project will consist of a new pump station (approximately 2,280 cfs) that would be located in the vicinity of the existing STA-1W Discharge Canal. The new pump station would have approximately 75% capacity of G-310 to pump the outflow of the existing STA-1W footprint to a new distribution canal at the front end of the 4,700 acre STA. The 4,700 acres would be subdivided with appropriate inflow structures, distribution and collection canals into 3 cells. Outflow from these SAV cells would be collected and delivered to WCA-1 through the existing G-310 pump station.

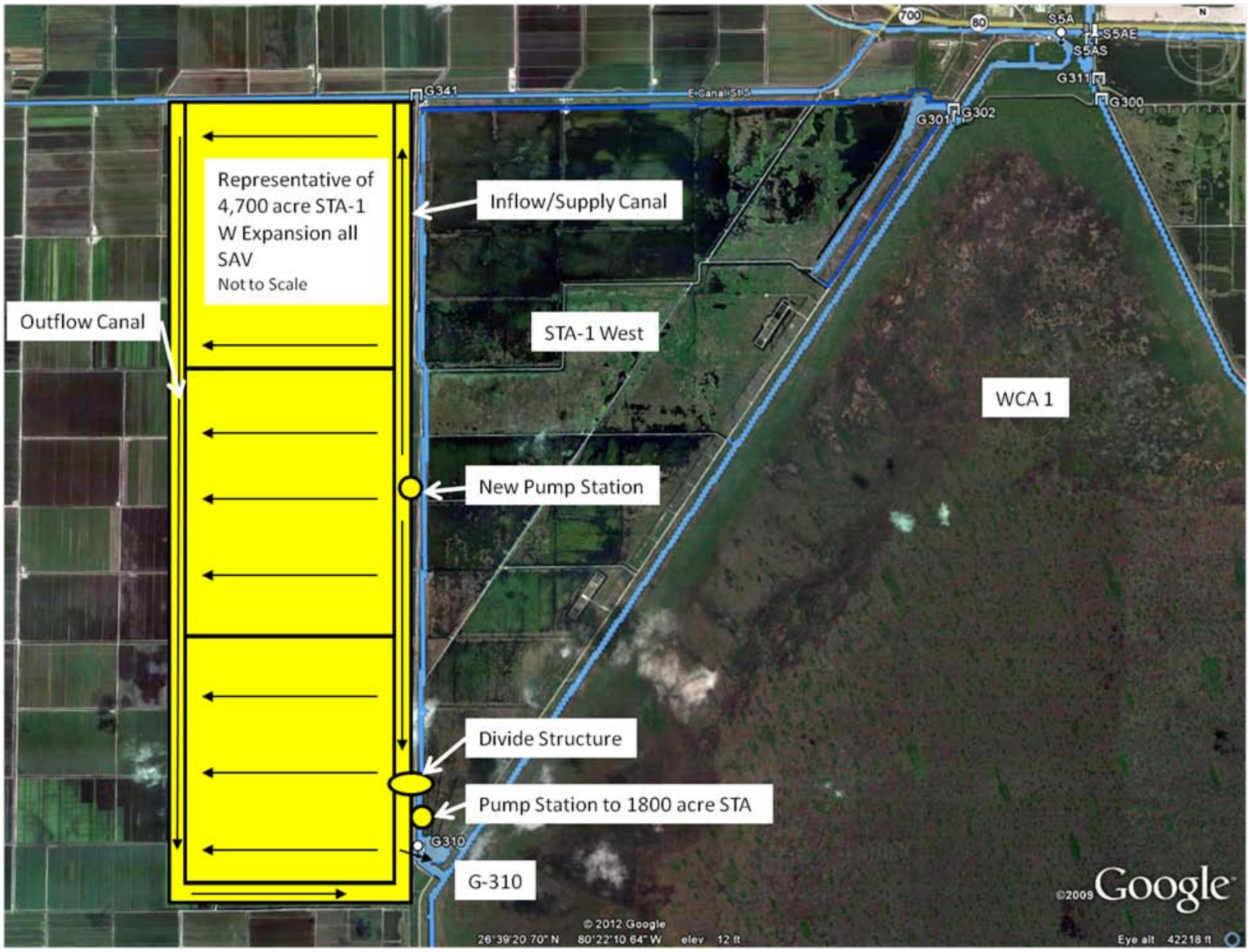

Figure 5. 4,700 STA-1 West Expansion Conceptual Design

- **1,800 Acre STA Expansion (New)**

  This conceptual project assumes 1,800 acres of land located southwest of the existing STA-1W, in the vicinity of the property called the Snail Farm, is available (**Figure 6**). Further, it is assumed there are no major infrastructure limitations within the new acreage. In determining the use of 1,800 acres that are not contiguous with the existing STA-1W, it will be assumed that the new STA cells are developed in series with the existing cells. As stated above, upon final identification of the lands, further investigations will be required.

  This project will consist of a new pump station (approximately 760 cfs) that would be located near G-310 and the existing STA-1W discharge canal. The new pump station would have approximately 25% capacity of G-310 to pump the outflow of the existing STA-1W footprint to a new conveyance and distribution canal at the front end of the 1,800 acre STA. The one cell SAV treatment area would contain the appropriate inflow/outflow structures, distribution and collection canals. Outflow would be collected by a new pump station and discharge at a new location into the WCA-1 canal near the S-6 pump station.

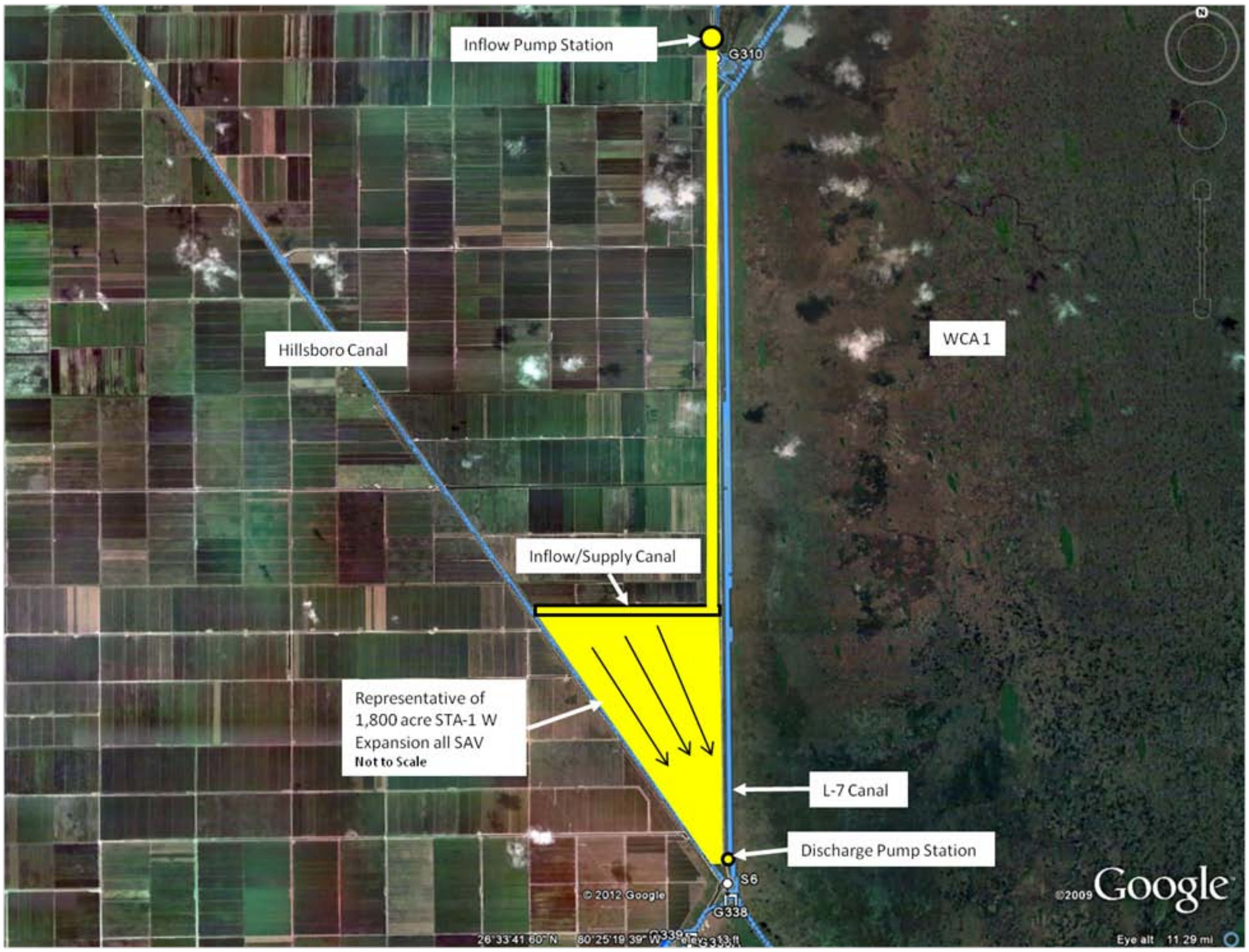

Figure 6. 1,800 STA-1 West Expansion Conceptual Design

- **G-341 Related Improvements**

This structure is located in the Ocean Canal between the S-5A Basin and the S-2/S-6 Basins (**Figure 7**). The original design intent was to divert up to a maximum of 600 cfs from the intermediate reach between S5AX and G-341 to the west. Due to various constraints, the full intent of the structure's design has not been able to be implemented. There are multiple methods that will need to be analyzed to identify the most cost effective measures available to fully implement the designed operations for the G-341 structure. During the project design phase, multiple conceptual designs will be developed and analyzed. These alternatives could include operational changes to the Central and Southern Florida Flood Control Project or an alternative delivery path. One such path looked at in previous studies is enlargement of the Cross Canal and delivery of waters down the North New River Canal for delivery to STA 2, STA 3/4 or the EAA FEB. One conceptual option is described below**.**

Confluence of Ocean and Hillsboro Canal

The current interface of flows from the Ocean canal into the Hillsboro Canal is in the shape of a “T” and was originally designed to move the water both north and south in the Hillsboro Canal. Due to this “T” configuration, there is significant hydraulic loss when moving water south (**Figure 7**). As a result in the reduction in back pumping to Lake Okeechobee, this Project will require the flows from the Ocean canal to be routed south to STA 2. The canal will be reconstructed with a revised connection to allow reduction in head losses. As part of the project, the canal will be reshaped and a new bridge will be required.

- **Dredging of Hillsboro Canal**

  In order to operate G-341 per the design intent, there is a need to move more water to the Central Flow Path than the original design anticipated (**Figure 7**). In order to move this additional water south, a hydraulic analysis will be required on the Hillsboro canal to determine if additional dredging will be required.

- **Additional Capacity at S-6 Pump Station**

  In order to operate G-341 per the design intent, there is a need to move more water to the Central Flow Path than the original design anticipated. In order to move this additional water to the Central Flow Path by the Hillsboro canal, the S-6 Pump Station will require 600-1,000 cfs of additional capacity. This increased capacity can be achieved through modification of the existing pump station or adding an additional station adjacent to the existing one.

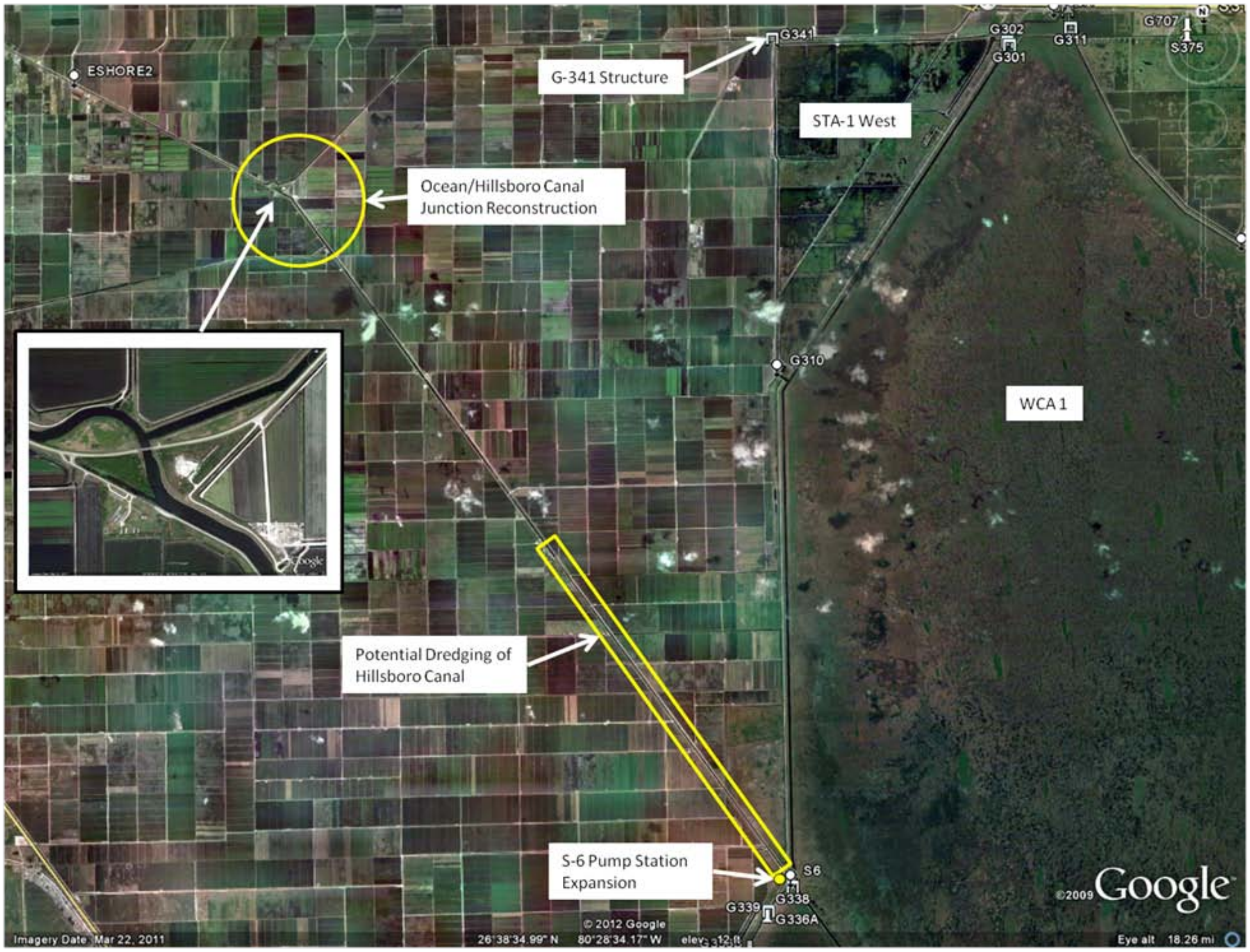

Figure 7. G-341 Related Improvements Conceptual Design

3.1.3 Model Assumptions and Results Specific to the Eastern Flow Path

3.1.3.1 L-8 Basin Runoff

Runoff from the L-8 Basin is currently conveyed to multiple locations, including STA-1E, STA-1W, the Arthur R. Marshall Loxahatchee National Wildlife Refuge, the C-51 West Canal and the Lake Worth Lagoon. As part of the Comprehensive Everglades Restoration Plan (CERP), the U.S. Army Corps of Engineers and the District are underway with the planning, design and construction of projects that will divert a substantial portion of L-8 Basin runoff from its current locations to the Loxahatchee River. However, it is anticipated that a portion of L-8 Basin runoff will continue to be conveyed as it is today. For this planning project, it was assumed that an average annual volume of approximately 41,000 ac-ft of L-8 Basin runoff would be included in the potential volume of runoff that could be conveyed to STA-1E, STA-1W and the

Eastern Flow Path water quality projects. In addition, it was assumed that an equivalent volume of runoff (a mixture of L-8 and C-51 West Basin runoff) would be conveyed east by the C-51 Canal via S-155A, as described in the STA-1E Operation Plan (Gary Goforth, Inc., 2009b).

3.1.3.2 Flow Equalization Basin Operations and Performance

In the DMSTA modeling, no phosphorus removal was assumed for the Eastern Flow Path FEB. However, to maximize the treatment efficiency of the Eastern Flow Path STAs, enhanced FEB operations and release protocols were implemented. The enhanced FEB operations attenuate the impact of peak flows and loads on STAs during wet seasons, attempt to provide optimal inflows to the STAs, and reduce the frequency and severity of dryout conditions in the STA during dry seasons. Simulation results indicate that FEBs with enhanced operations improve STA phosphorus removal efficiency and provide a more robust system capable of accommodating highly variable hydrologic and phosphorus loading conditions.

3.1.3.3 STA Expansion Area

The STA expansion area for the Eastern Flow Path was assumed to have approximately 5,900 acres of effective treatment area (6,500 total acres) and to operate in concert with STA-1W. Together, STA-1W and the Eastern Flow Path STA expansion are assumed to be composed of approximately 25 percent emergent aquatic vegetation and 75 percent submerged aquatic vegetation.

3.1.3.4 Summary of Eastern Flow Path Flows and Total Phosphorus Loads and Concentrations

To simulate Eastern Flow Path scenarios with DMSTA, the SFWMM-simulated source basin daily flows are combined with the corresponding mean monthly TP concentrations. The overall model assumptions described above are then incorporated, which result in a daily flows and TP concentrations for the Eastern Flow Path that are compatible with DMSTA. **Table 4** provides a summary of the average annual flows and TP loads and concentrations for each source basin that result from this process.

Table 4. Average Annual Flows and Total Phosphorus Loads and Concentrations for the Eastern Flow Path

Source Basin	Flow (ac-ft per year)	Total Phosphorus Load (metric tons per year)	Total Phosphorus Concentration (ppb)
S-5A	233,700	47.5	165
EBWCD	17,000	7.8	370
C-51 West	141,500	28.2	163
C-51 West (via S361)	9,700	0.9	73
L-8	18,500	2.5	110
Lake Okeechobee (Urban Water Supply via S352)	1,900	0.4	176
Total	422,300	87.3	168

DMSTA Modeling Results

Based on the DMSTA modeling results (Appendix B), the long-term flow-weighted mean outflow TP concentration for this flow path is 11.1 ppb. Due to the uncertainty associated with DMSTA simulated low level annual concentrations, annual values less than 12 ppb were replaced with a value of 12 ppb. When implementing a minimum annual TP concentration of 12.0 ppb, the long-term flow-weighted mean outflow TP concentration is 12.8 ppb.

3.1.4 Safety Factors

For the purpose of this plan, safety factors are modeling assumptions or activities that provide greater assurances that the TP WQBEL can be achieved. The safety factors in the eastern flow path are:

<u>Sub-Regional Source Control</u>

The modeling inflow datasets in the Eastern Flow Path did not assume additional TP concentration reductions above the TP load reduction already being achieved in accordance with the current BMP regulatory program in the S-5A basin. As part of the Restoration Strategies Water Quality Planning effort, the District proposes to build upon the success of the existing BMP Regulatory Program by focusing on areas and projects with the greatest potential to further improve water quality. The District’s goal is to design projects to increase retention/detention of TP above what is currently required at the basin-ID level in strategic onsite locations or through sub-regional source control projects in series with the onsite BMPs to further reduce TP loads to the STAs.

The S-5A Sub-basin within the EAA Basin was selected as a priority sub-basin based on the inflow concentrations from Lake Okeechobee into the S-5A, the water quality of the farms discharging within the S-5A, the potential to affect the inflow to the STAs, and potential positive impact to the Refuge. Conceptual projects within the S-5A Sub-basin were considered based on a combination of factors, including water quality of farm discharges, proximity and potential impact to the STA, and having willing participants.

Three conceptual projects and area locations have been identified for sub-regional source controls projects, the Southeast cluster (collective of five separate basin ID's), East Beach Water Control District (298 District) and a District lease property. Collectively, the three project locations contribute an annual average of 24.78 metric tons (WY2006 – 2011) of phosphorus which is 37.4% of the basin load into STA-1E/1W. It is anticipated that these projects have the potential to reduce this load which would be an additional reduction in phosphorus from entering the STA-1E/1W complex that was not taken into account in the model inflow datasets.

Extreme Event Diversions

It was assumed that all SFWMM-simulated STA diversion flows would be treated by the STAs in the water quality-focused DMSTA modeling. However, it is recognized that there are structural and other constraints that will require STA diversions to occur. Therefore, since the water quality modeling assumes all flows will be treated, the predicted model performance could be considered conservative.

FEB Phosphorus Treatment Performance

The DMSTA modeling for the FEB assumed no phosphorus reduction. However based on the hydraulic residence time in the FEB, some level of phosphorus reduction is expected.

Internal Improvements to STAs

Internal improvements within the STAs, to address short circuiting, vegetation, topographic, and other issues, will continue to be implemented and are expected to further improve treatment performance. This improvement in performance is not accounted for in the DMSTA modeling, therefore current modeled treatment performance is conservative.

3.2 Central Flow Path

3.2.1 Project Description

The Central Flow Path consists of the S-2, S-3, S-6, S-7 and S-8 Drainage Basins. The Hillsboro, North New River and Miami Canals route flows from these basins to STA-2, Compartment B and STA-3/4. STA-2, Compartment B and STA-3/4 treat the water for phosphorus prior to discharging into WCA-2A and WCA-3A. The projects listed below will continue to provide the existing flood protection to the various basins through the G-370, G-372, S-6, G-434 and G-435 pump stations.

The Central Flow Path projects are intended to manage basin runoff in a more advantageous manner, by reducing the impacts of storm event driven inflows on the STAs. This is accomplished by redirecting a portion of the STA inflows to an approximately 54,000 ac-ft FEB located north of STA-3/4, for flow attenuation, prior to discharge to STAs for treatment (**Figure 8**). No additional infrastructure within STA-2 and Compartment B is anticipated to be required to accommodate inflows from the FEB. A further evaluation will be done during detailed design.

In the Central Flow Path, the primary project includes:

- Completion of construction of an approximately 54,000 ac-ft FEB adjacent to the North New River Canal and north of STA-3/4 to attenuate peak flows and optimize STA inflows to STA-3/4 and Compartment B.

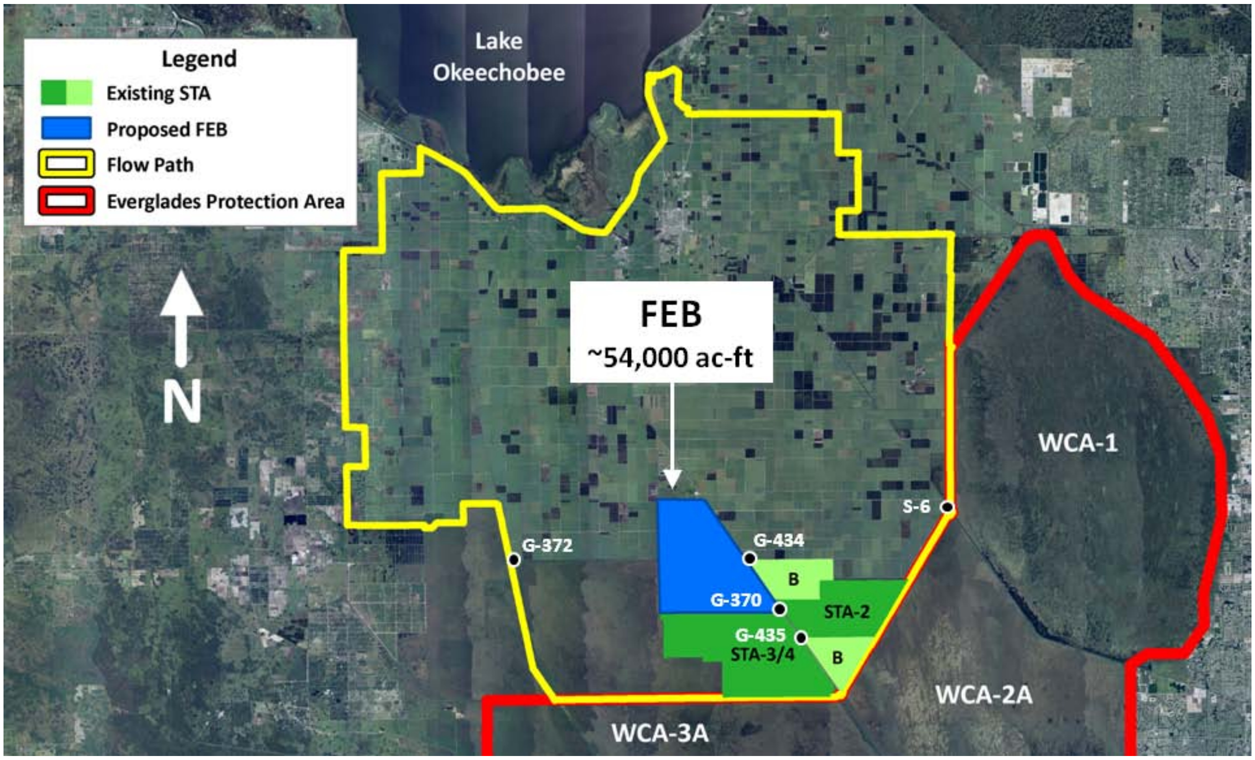

Figure 8. Central Flow Path Projects

3.2.2 Conceptual Engineering and Operations

- **S-6 Pump Station (Existing)**

  The primary purpose of the S-6 Pump Station is for flood protection of the upstream S-6/S-2 Basins. The S-6 Pump Station, which has a design capacity of 2,925 cfs, conveys surface waters into STA-2 and Compartment B North.

  In this plan, there is no change to the current use of the S-6 Pump Station other than modifications listed in the Eastern Flow Path. It will continue to be utilized for flood protection in the S-6 Basin to move water from the Hillsboro Canal to STA-2 and Compartment B North.

- **G-434 Pump Station (Existing)**

  The purpose of the G-434 Pump Station is to convey stormwater to Compartment B North for the treatment of phosphorus prior to discharge to WCA-2A. The G-434 Pump Station has a design capacity of 1,120 cfs.

  In this plan, G-434 will continue to be utilized to convey stormwater runoff from the North New River Canal at an optimized rate when there is capacity in Compartment

B North. In combination, with the development of the EAA A-1 FEB (EAA FEB), G-434 will also convey flows from the EAA FEB to Compartment B North when required.

- **G-435 Pump Station (Existing)**

  The purpose of the G-435 Pump Station is to convey stormwater to Compartment B South for the treatment of phosphorus prior to discharge to WCA-2A. The G-435 Pump Station has a design capacity of 480 cfs.

  In this plan, G-435 will continue to be utilized to convey stormwater runoff from the North New River Canal at an optimized rate when there is capacity in Compartment B South. In addition, with the development of the EAA FEB, G-435 will also convey discharges from the EAA FEB to Compartment B South when required.

- **G-370 Pump Station (Existing)**

  The purpose of the G-370 Pump Station is flood protection, primarily for the upstream S-7/S-2 Basins (**Figure 9**). The G-370 Pump Station original design capacity was 2,170 cfs, however, the actual constructed capacity is 2,775 cfs. G-370 conveys surface waters from the North New River Canal into STA 3/4.

  In this plan, the flood control aspects of G-370 will be maintained. However, the pump station will be utilized for deliveries both to STA-3/4 and to the EAA FEB. It is also anticipated that the seepage control pumps installed in G-370 will be utilized by the EAA FEB to protect surrounding infrastructure from the higher stages developed in the EAA FEB.

- **G-370 Inflow Basin to EAA FEB (New)**

  Currently, G-370 discharges into the STA 3/4 inflow/supply canal. To redirect the flows to the EAA FEB, an inflow basin will be constructed for the EAA FEB (**Figure 9**). The G-370 inflow basin will be similar to the STA-1 Inflow Basin.

  Downstream from the G-370 Pump Station, a gated structure will be constructed in the STA-3/4 inflow/supply canal. The purpose of this structure will be to allow discharge from G-370 to flow into STA-3/4 at its optimized rate. The capacity of the gated structure will be sized to allow full flood control operation requirements when the EAA FEB is at maximum stage.

  The inflow basin will also have a gate on the South side and a weir on the North side to allow approximately 2,775 cfs flow from G-370 to the EAA FEB inflow channel.

The southern structure is utilized to control flows when there is a desire to split flows between the EAA FEB and STA-3/4 or when the EAA FEB is not available. The north weir is utilized to prevent flows from the EAA FEB inflow channel flowing back into the inflow basin when it is in use for discharging from the EAA FEB to the North New River.

Two additional structures, approximately 2,000 cfs each are located on the east and west side of the inflow basin to allow discharges from the EAA FEB into the North New River Canal.

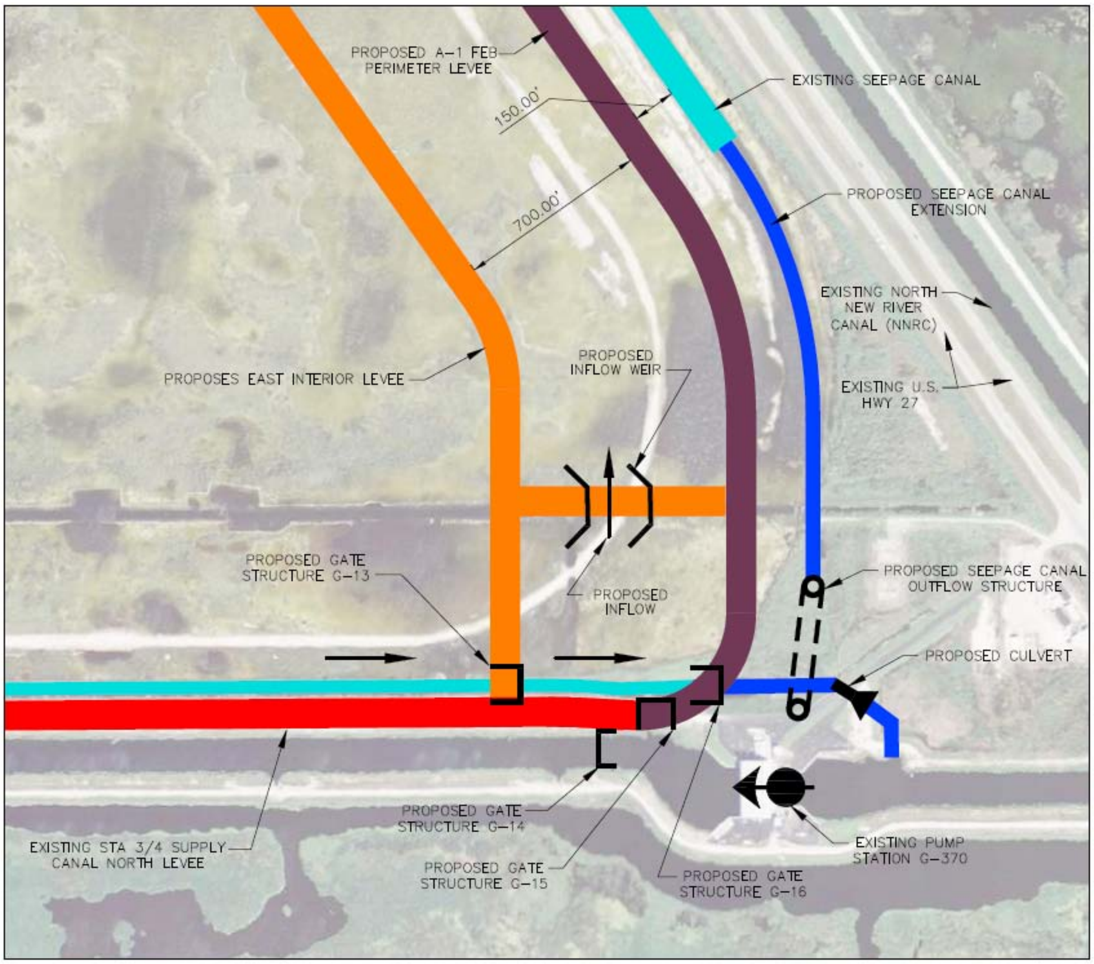

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Figure 9. EAA A-1 FEB G-370 Inflow/Discharge Structure

- **G-372 Pump Station (Existing)**

  The primary purpose of the G-372 Pump Station is for flood protection to the upstream S-8 Basin (**Figure 10**). The G-372 Pump Station, which has a design capacity of 3,700 cfs, conveys surface waters from the Miami Canal into STA-3/4.

  In this plan, the flood control aspects of G-372 will be maintained. However, the pump station will be utilized for deliveries both to STA-3/4 and to the EAA FEB.

- **G 372 Inflow to EAA FEB (New)**

  Currently, G-372 discharges into the STA-3/4 inflow/supply canal (**Figure 10**). To redirect the flows to the EAA FEB, two structures are needed.

  Downstream from the G-372 Pump Station, a gated structure will be constructed in the STA-3/4 inflow/supply canal. The purpose of this structure is to allow discharge from G-372 to flow into STA-3/4 at its optimized rate. When the FEB is full and a flood event is occurring, the in stream gate to STA 3/4 must pass all flows to STA 3/4. Usually this gate is closed or partially closed to direct flow to the FEB. The capacity of the gated structure will be sized to allow full flood control operation requirements when the EAA FEB is at maximum stage.

  An additional structure of approximately 3,700 cfs will be constructed on the eastern edge of the STA-3/4 inflow/supply canal to allow discharge of flows from G-372 to the inflow channel of the EAA FEB.

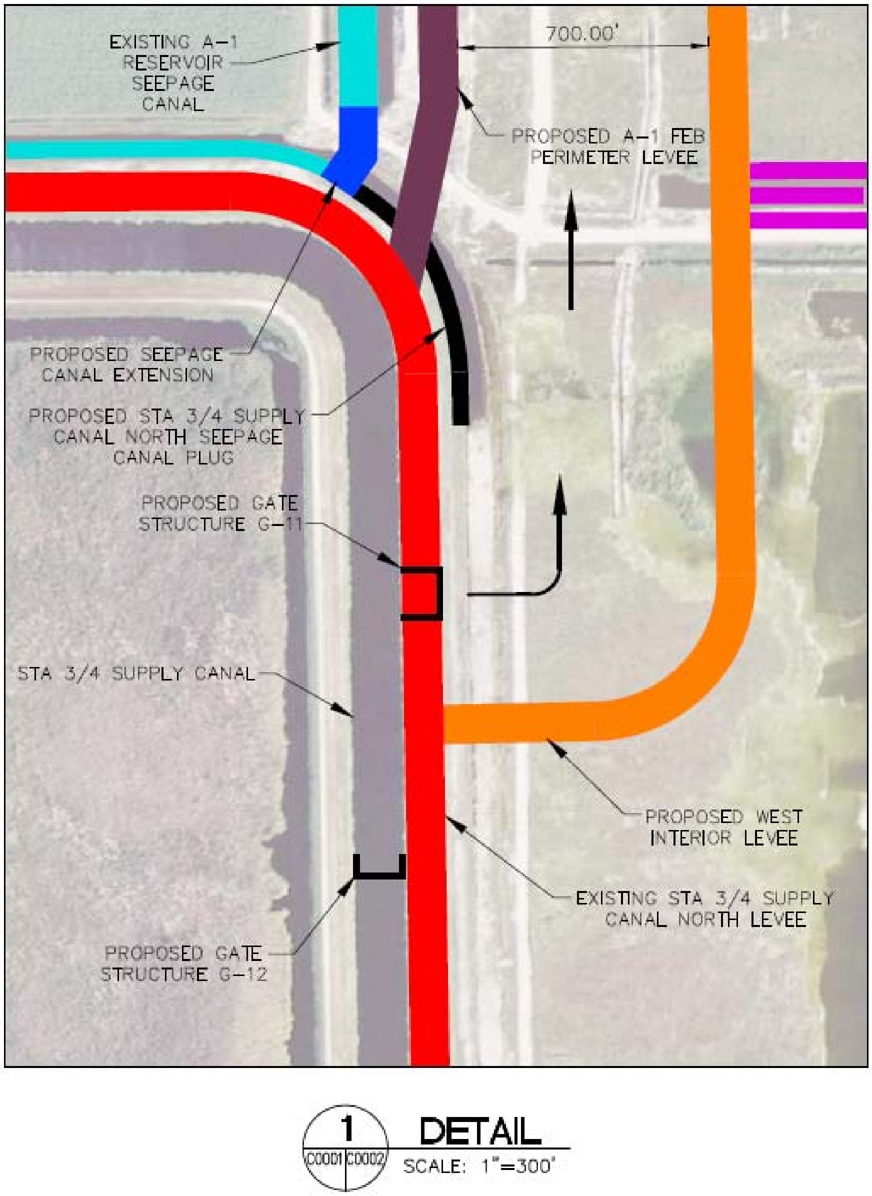

Figure 10. EAA A-1 FEB G-372 Inflow Structure

- **EAA A-1 Flow Equalization Basin (New)**

  In the Central Flow Path, an approximate 54,000 ac-ft FEB upstream of STA-3/4, STA-2, and Compartment B is included to attenuate peak flows and optimize STA inflow volumes (**Figure 11**). The EAA FEB primarily delivers water to STA-3/4 with a designated percentage of flows going to STA-2 and Compartment B. Inflows to the EAA FEB will be from the North New River Canal and Miami Canal through the G-

370 and G-372 pump stations, respectively. Discharges from the EAA FEB will be via gravity through two gated outflow structures into the G-370 inflow canal. A majority of the flows (80%) will be pumped back through the G-370 and into STA-3/4 inflow/supply canal for treatment. The remaining flows (20%) will be conveyed to STA-2 and Compartment B North via the G-434 pump station and to Compartment B South via the G-435 pump station.

The EAA FEB is to be constructed utilizing the materials and features developed during the start of construction of the EAA A-1 Reservoir. As part of the reservoir project there were 1,200 foot wide areas scraped down to the cap rock along the perimeter of the site in preparation for constructing the embankment. With the maximum storage height being limited in the EAA FEB, the embankment foot print becomes much smaller. By utilizing the available scraped down area as a flow path, it has been determined, based on preliminary hydraulic analyses, that the existing pump stations G-370 and G-372 currently have the capability to deliver flows to the north end of the FEB.

After flows are delivered to the north end of the EAA FEB, the water will be spread utilizing the northern scraped area to enable sheet flow from north to south within the facility. Also, as additional hydraulic modeling is being developed, investigation is ongoing to determine if the existing infrastructure can be utilized to create a serpentine flow path through the site to minimize short circuiting and maximize hydraulic residence time. These conditions are expected to support vegetation that will aid in the uptake of phosphorus within the FEB.

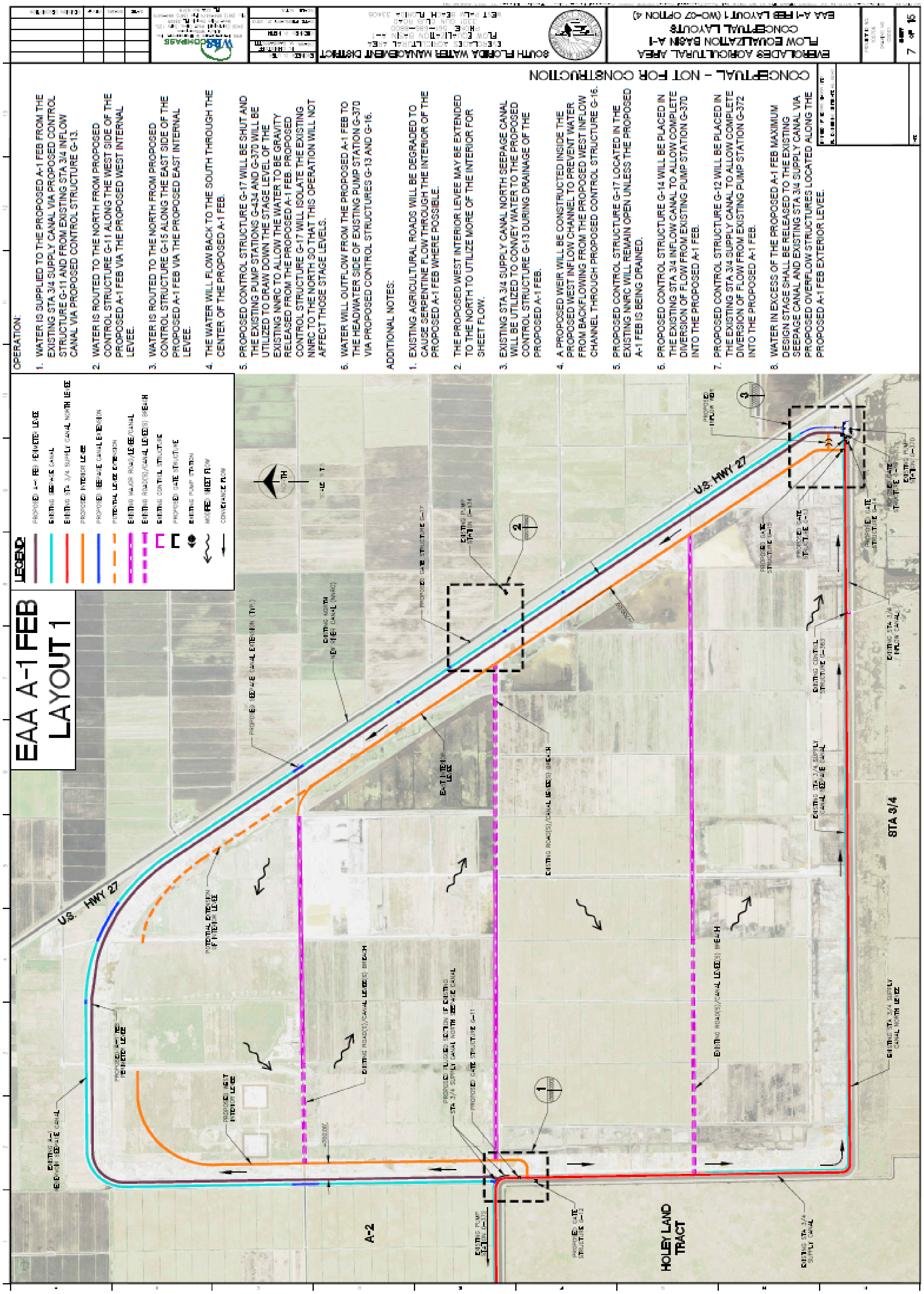

Figure 11. EAA A1 FEB Conceptual Design

- **North New River Canal Divide Structure (New)**

  The current structures in the North New River Canal are G-371, located south of G-370 near S-7, and S-351, located at Lake Okeechobee. In order to avoid impacts to surrounding lands, a new divide structure will be required within the North New River Canal. The structure will be designed to allow current operational criteria for flows within the North New River Canal with minimal head loss.

  The purpose of the new structure is to allow stages within the North New River Canal to be lowered without impacting upstream users in order to hydraulically move the water from the EAA FEB to the existing G-370, G-434 and G-435 pump stations.

3.2.3 Model Assumptions and Results Specific to the Central Flow Path

3.2.3.1 Flow Equalization Basin Operations and Performance

In the DMSTA modeling, the phosphorus removal performance of the Central Flow Path FEB was assumed to be consistent with emergent aquatic vegetation. FEB discharges were simulated using DMSTA's default outlet hydraulic algorithms to simulate conditions typically encountered in wetland cells or shallow reservoirs.

3.2.3.2 Summary of Central Flow Path Flows and Total Phosphorus Loads and Concentrations

To simulate Central Flow Path scenarios with DMSTA, the SFWMM-simulated source basin daily flows are combined with the corresponding mean monthly TP concentrations. The overall model assumptions described above are then incorporated, which results in a daily flows and TP concentrations for the Central Flow Path that are compatible with DMSTA. **Table 5** provides a summary of the average annual flows and TP loads and concentrations for each source basin that result from this process.

Table 5. Average Annual Flows and Total Phosphorus Loads and Concentrations for the Central Flow Path

Source Basin	Flow (ac-ft per year)	Total Phosphorus Load (metric tons per year)	Total Phosphorus Concentration (ppb)
S-5A	59,800	15.7	213
S-6	181,400	24.8	111
S-7	263,900	31.9	98
S-8	218,400	22.5	83
ESWCD & 715 Farms	22,700	3.7	132
SFCD	19,100	2.5	108
SSDD	11,700	1.7	116
C-139 (via G136)	14,700	2.8	154
Lake Okeechobee (Regulatory Releases)	58,300	10.4	145
Lake Okeechobee (Urban Water Supply via S351 and S354)	27,300	4.6	138
Total	877,300	120.6	111

Note: The C-139 values above include reductions of TP concentrations due to C-139 Basin Rule

DMSTA Modeling Results

Based on the DMSTA modeling results, the long-term flow-weighted mean outflow TP concentration for this flow path is 12.4 ppb. Due to the uncertainty associated with DMSTA simulated low level annual concentrations, annual values less than 12 ppb were replaced with a value of 12 ppb. When implementing a minimum annual TP concentration of 12.0 ppb, the long-term flow-weighted mean outflow TP concentration is 13.0 ppb.

3.2.4 Safety factors

For the purpose of this plan, safety factors are modeling assumptions or activities that provide greater assurances that the TP WQBEL can be achieved. The safety factors in the central flow path are:

Lake Okeechobee Total Phosphorus Concentrations

For this planning effort, the mean monthly total TP concentrations assumed for STA inflows from Lake Okeechobee were calculated based on TP concentrations measured at Lake outlet structures. In comparison, TP concentrations measured at STA inflow structures are 50 – 70 ppb lower for the period of record WY2000 – WY2009.

Extreme Event Diversions

It was assumed that all SFWMM-simulated STA diversion flows would be treated by the STAs in the water quality-focused DMSTA modeling. However, it is recognized that there are structural and other constraints that will require STA diversions to occur. Therefore, since the water quality modeling assumes all flows will be treated, the predicted model performance could be considered conservative.

Internal Improvements to STAs

Internal improvements within the STAs, to address short circuiting, vegetation, topographic, and other issues, will continue to be implemented and are expected to further improve treatment performance. This improvement in performance is not accounted for in the DMSTA modeling, therefore current modeled treatment performance is conservative.

Footprint of the EAA FEB

The DMSTA modeling assumed the EAA FEB was approximately 13,500 acres. In re-utilizing the site previously designed and partially constructed as a deep storage reservoir (EAA Reservoir), there is approximately 15,000 acres of useable FEB area inside the proposed embankments. As it is more cost effective to construct on the entire 15,000 acre site, the FEB will be approximately 15,000 acres which is up to 1,500 acres larger than what was assumed in the modeling.

3.3 Western Flow Path

3.3.1 Project Description

The Western Flow Path consists of the C-139 Basin. STA-5, Compartment C and STA-6 treat the water for phosphorus prior to discharging into the L-4 canal and ultimately into WCA-3A. The projects listed below will continue to provide existing flood protection to the C-139 Basin through the existing STAs, G-407 gravity structure and G-508 Pump Station.

The Western Flow Path projects are intended to manage basin runoff in a more advantageous manner, by reducing the impacts of storm event driven inflows on the STAs, as well as expanding the effective stormwater treatment area. This is accomplished by: redirecting a portion of the STA inflows to an approximately 11,000 ac-ft FEB located South of Deer Fence canal and west of STA-5 Flowway 3, for flow attenuation, prior to discharge to STAs for treatment, and by increasing the effective treatment area within the Western Flow Path (**Figure 12**).

Projects in the Western Flow Path primarily consist of:

- Construction of an approximately 11,000 ac-ft FEB adjacent to the Deer Fence Canal and West of STA-5 Flowway 3 to attenuate peak flows and optimize STA inflow volumes.

- Construction of internal earthwork improvements resulting in approximately 800 additional acres of effective treatment area in STA-5 Cells 2A and 3A.

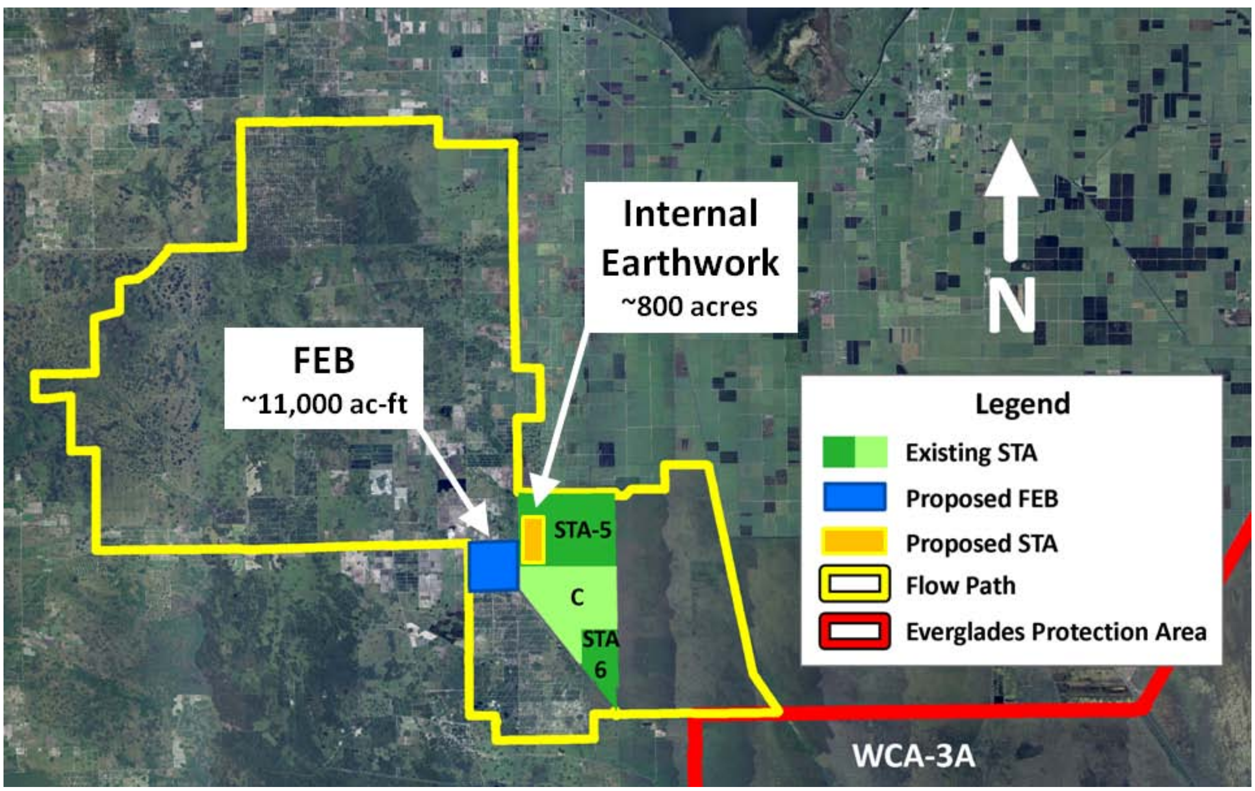

Figure 12. Western Flow Path Projects

3.3.2 Conceptual Engineering and Operations

- **G-508 Pump Station (Existing)**

  The primary purpose of the G-508 Pump Station is to provide flood protection for the upstream C-139 Basin (**Figure 13**). The G-508 Pump Station, which has a design capacity of 2,080 cfs, conveys surface waters from the C-139 Basin into STA-5 Flowway 3, Compartment C and STA-6.

In this plan, G-508 will continue to be utilized to deliver stormwater runoff from the C-139 Basin at an optimized rate when there is capacity in the STAs. In addition, with the development of the C-139 FEB, G-508 will also be used to convey the discharges from the C-139 FEB and deliver the water to the STAs when required.

- **Deer Fence Canal Dredging (New)**

  The new pump station for the C-139 FEB is sized for delivering approximately 1,000 cfs inflows to the C-139 FEB (**Figure 13**). In order to move this additional water from the L-2 Canal to the new pump station, a hydraulic analysis will be conducted during detailed design to determine if additional dredging will be required.

- **C-139 FEB Pump Station (New)**

  Construction of a new pump station will be required on the northwest corner of the C-139 FEB (**Figure 13**). The pump station will have a capacity of approximately 1,000 cfs capable of lifting water from the Deer Fence Canal and distributing in the C-139 FEB distribution canal.

- **C-139 Flow Equalization Basin (New)**

  Construction of the approximately 11,000 ac-ft C-139 FEB is included on the north end of the C-139 Annex property up to 2,800 acres depending on final investigation of the site and detailed design (**Figure 13**). The site has a significant variation in topography as well as some areas that may need to be avoided or may require engineering solutions. Upon obtaining detailed survey information, the final configuration will be selected. The C-139 FEB will be designed and operated to perform consistent with the WQBEL.

  The conceptual design assumes the new C-139 Pump Station will distribute the water along the western edge of the site to develop sheet flow from the west to the east. Where the topography starts to fall moving from west to east across the site, an interim embankment would be placed to develop two zones within the FEB. The first zone would occupy the majority of the site and would focus on maintaining appropriate vegetation to provide attenuation of stormwater inflows and provide phosphorus treatment. The second zone, which would be considerably smaller (approximately 400 acres) would be entirely for storage with treatment expectation similar to a reservoir. The project will also allow seepage to assist in maintaining natural restoration of the southern portion of the property.

- **C-139 FEB Discharge Structures (New)**

  The C-139 FEB discharge structures will consist of gated structures to the Deer Fence Canal (**Figure 13**). Through distribution of the flows to the Deer Fence canal, the G-508 pump station will be able to distribute the flows to the STAs.

  Additional hydraulic modeling will be conducted during detailed design to determine if the stages developed in the deep portion of the FEB can be leveraged to allow gravity flow to the STAs through an additional structure in the L-3 canal just south of G-406.

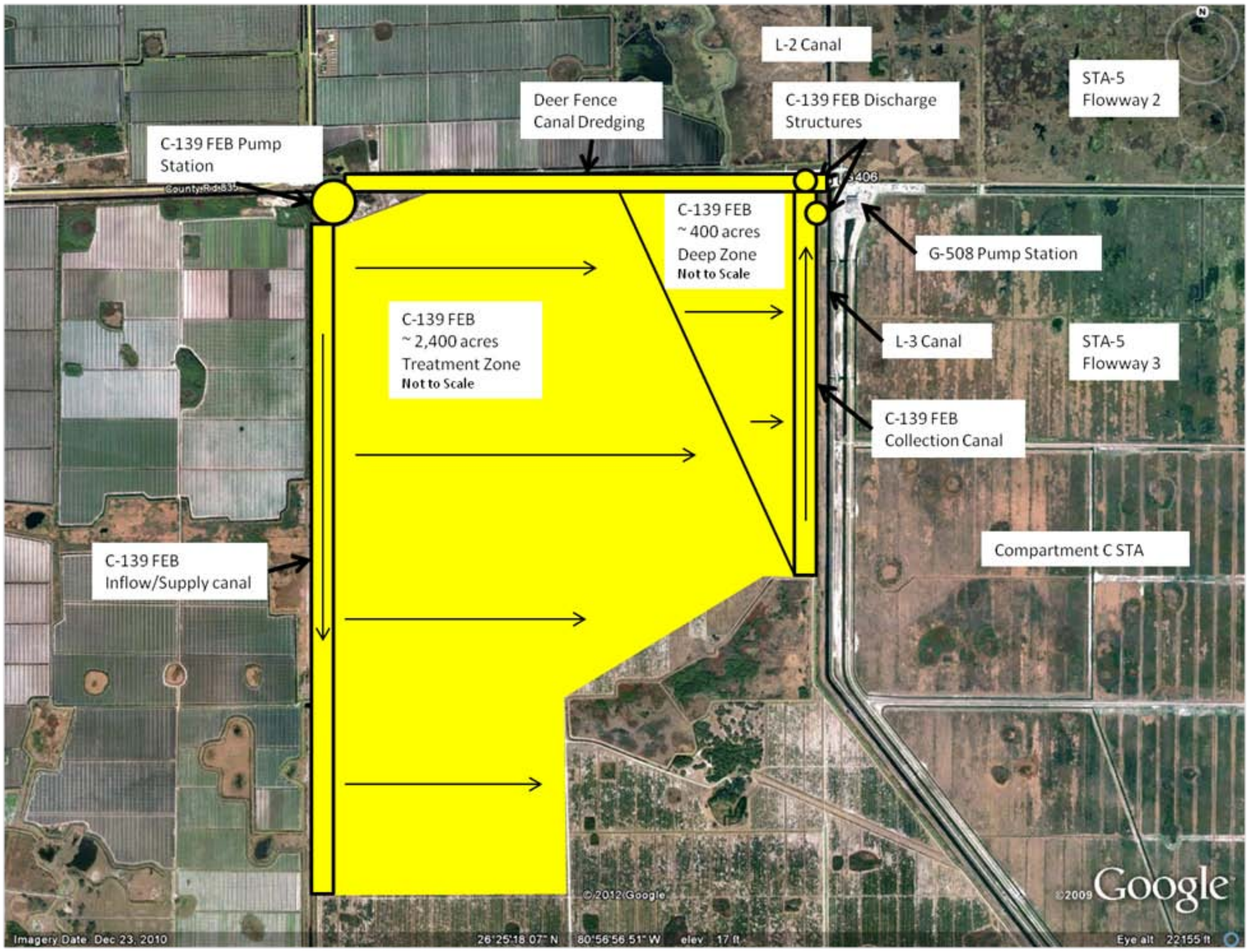

Figure 13. C-139 FEB Conceptual Plan

- **STA-5 Internal Earthwork**

  Construction of STA-5 consists of internal earthwork improvement to cells 2A and 3A (**Figure 14**). The western side of the STA-5 Flowway 2 and STA-5 Flowway 3 adjacent to the L-2 and L-3 canals currently are at an elevation that prevents routine inundation and therefore inhibits the expansion of emergent wetland vegetation. As a result, these areas have previously been considered “non-effective treatment areas”. This project will conduct the earthwork necessary to lower the high-elevation areas down to approximately match the ground elevation of the adjacent effective treatment area to the east and to fill in remnant ditches that cause short-circuiting, thereby increasing the effective treatment area by approximately 800 acres.

Figure 14. STA-5 Internal Earthwork

3.3.3 Model Assumptions and Results Specific to the Western Flow Path

3.3.3.1 DMSTA Calibration Dataset for SAV Cells

Unlike all other SAV cells simulated by DMSTA for this planning effort, the SAV cells of STA-5, STA-6 and Compartment C, utilized DMSTA's pre-existent wetland calibration dataset (PEW_3) instead of the submerged aquatic vegetation calibration dataset (SAV_3).

3.3.3.2 Flow Equalization Basin Operations and Performance

In the DMSTA modeling, the phosphorus removal performance of the Western Flow Path FEB was assumed to be consistent with emergent aquatic vegetation for approximately 85 percent of the area and consistent with a reservoir for approximately 15 percent of the area. This areal allocation results in a net phosphorus settling rate of 15.1 meters per year. In addition, to maximize the treatment efficiency of the Western Flow Path STAs, enhanced FEB operations and release protocols were implemented. The enhanced FEB operations attenuate the impact of peak flows and loads on STAs during wet seasons, attempt to provide optimal inflows to the STAs, and reduce the frequency and severity of dryout conditions in the STAs during dry seasons. Simulation results indicate that FEBs with enhanced operations improve STA phosphorus removal efficiency and provide a more robust system capable of accommodating highly variable hydrologic and phosphorus loading conditions.

3.3.3.3 C-139 Basin Rule

The Everglades Forever Act mandates that the TP load from the C-139 Basin not exceed the phosphorus load during an established historic period, adjusted for rainfall. Chapter 40E-63, Florida Administrative Code, establishes a rainfall adjusted methodology for an annual performance assessment to determine whether the C-139 Basin is achieving the mandate. Using mean monthly TP concentrations observed from the C-139 Basin southern discharge during Water Years 2000-2009 and simulated discharge flow volumes, the period of simulation average annual TP load from the C-139 Basin is estimated to be approximately 58.9 metric tons per year. Therefore, in order to simulate STA inflows with future achievement of mandated historical loads from the C-139 Basin, the concentration dataset was scaled down by approximately 35 percent (to replicate a historical period load of 38.15 metric tons per year). As previously mentioned, WY2000-2009 mean monthly TP concentrations when combined with SFWMD-simulated flows may result in higher TP loads from the C-139 Basin than is currently being observed.

Furthermore, the assumption that the historical period loads will be achieved is justified by the C-139 Basin Rule's recently improved BMP implementation requirements and specific actions necessary if the basin is determined to not meet those levels into the future.

3.3.3.4 C-139 Annex

The objective of C-139 Annex restoration plan is to restore the historic Everglades hydrologic conditions to the greatest extent possible. The project will improve water quality in the Everglades by restoring primarily wetland and associated upland habitat values, diversity, and function while eliminating all agricultural runoff from the site. Approximately 10,000 acres of cultivated area on the site will be restored to a wetland community. Approximately 3,400 acres of undeveloped areas, including tree islands, upland hardwood hammocks, wet prairies and cypress hardwood hammocks will receive hydrologic enhancements as a result of the project. As a result of the restoration plan, the C-139 Annex is not considered a source basin to the STAs in this planning process as flows will continue south.

3.3.3.5 Summary of Western Flow Path Flows and Total Phosphorus Loads and Concentrations

To simulate Western Flow Path scenarios with DMSTA, the SFWMM-simulated source basin daily flows are combined with the corresponding mean monthly TP concentrations. The overall model assumptions described above are then incorporated, which results in a daily flows and TP concentrations for the Western Flow Path that are compatible with DMSTA. **Table 6** provides a summary of the average annual flows and TP loads and concentrations for each source basin that result from this process.

Table 6. Average Annual Flows and Total Phosphorus Loads and Concentrations for the Western Flow Path

Source Basin	Flow (ac-ft per year)	Total Phosphorus Load (metric tons per year)	Total Phosphorus Concentration (ppb)
C-139	187,700	35.4	153
Lake Okeechobee (supplemental water to maintain STA vegetation)	9,900	1.8	147
Total	197,600	37.3	153

Note: The C-139 values above include reductions of TP concentrations due to C-139 Basin Rule

DMSTA Modeling Results

Based on the DMSTA modeling results, the long-term flow-weighted mean outflow TP concentration for this flow path is 11.8 ppb. Due to the uncertainty associated with DMSTA simulated low level annual concentrations, annual values less than 12 ppb were replaced with a value of 12 ppb. When implementing a minimum annual TP concentration of 12.0 ppb, the long-term flow-weighted mean outflow TP concentration is 13.1 ppb.

3.3.4 Safety factors

For the purpose of this plan, safety factors are modeling assumptions or activities that provide greater assurances that the TP WQBEL can be achieved. The safety factors in the western flow path are:

<u>Current vs. Future Performance of STA-5</u>

Historically, STA-5 performance has not equaled that of the other STAs. Experience in operating this STA has indicated poor performance is primarily driven by TP over-loading, short circuiting within the treatment cells, and problems related to dryout. However since 2009, STA-5 performance as a whole has improved, which is believed to be due to internal improvements that were made to STA-5 Cell 1A, reductions in hydraulic and TP loading, decreases in soil phosphorus flux and TP inflow concentrations, and vegetation establishment throughout the STA (Pietro 2011, SFWMD 2012).

In addition to the recent performance improvements, it is anticipated that additional improvements in performance will occur as a result of future projects including: additional internal earthwork that will be conducted to increase effective treatment area and reduce short circuiting (in addition to Compartment C); the recently revised C-139 Basin Rule which will further reduce inflow TP concentrations and loads; and the upstream FEB which will assist in reducing dryout and phosphorus loading/concentrations.

Additionally, there have been concerns that low Calcium (Ca) levels in STA-5 have reduced treatment performance; however, based on an internal analysis of factors affecting treatment performance, and conclusions of Gu et al. (2005); Ca does not seem to be limiting TP reduction in STA-5.

<u>Lake Okeechobee Total Phosphorus Concentrations</u>

For this planning effort, the mean monthly total TP concentrations assumed for STA inflows from Lake Okeechobee were calculated based on TP concentrations measured at Lake outlet structures. In comparison, TP concentrations measured at STA inflow structures are 50 – 70 ppb lower for the period of record WY2000 – WY2009.

Extreme Event Diversions

It was assumed that all SFWMM-simulated STA diversion flows would be treated by the STAs in the water quality-focused DMSTA modeling. However, it is recognized that there are structural and other constraints that will require STA diversions to occur. Therefore, since the water quality modeling assumes all flows will be treated, the predicted model performance could be considered conservative.

Internal Improvements to STAs

Internal improvements within the STAs, to address short circuiting, vegetation, topographic, and other issues, will continue to be implemented and are expected to further improve treatment performance. This improvement in performance is not accounted for in the DMSTA modeling, therefore current modeled treatment performance is conservative.

4.0 Science Plan

A science plan will be developed and implemented to investigate critical factors that influence phosphorus treatment performance. The science plan will be developed in coordination with key state and federal agencies and experts and will be designed to increase the understanding of factors that affect treatment performance; in particular factors that affect performance at low phosphorus concentrations (<20 ppb TP). These investigations could include, but are not limited to: effects of microbial activity, phosphorus flux, inflow volumes and timing, inflow phosphorus loading rate and concentrations on phosphorus outflow, phosphorus removal by specific vegetation speciation, and the stability of accreted phosphorus. Results from these studies will be used to inform design and operations of treatment projects which will ultimately improve capabilities to manage for achievement of the WQBEL. Results from these studies will be summarized and reported as part of the annual report (South Florida Environmental Report).

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Appendix A

Modeling Design Report

RS_Base 2

Model Documentation Report

South Florida Water Management Model
Restoration Strategies Baseline 2

September 27, 2011

1.0 Overview

Identification

This report documents assumptions and decisions made in the development of the Restoration Strategies Baseline 2 (RS_BASE2) scenario using the South Florida Water Management Model (SFWMM or 2x2). This work was completed by the Hydrologic & Environmental Systems Modeling section at the South Florida Water Management District (SFWMD) under the auspices of Model Request Form (MRF) 5041 (included as Attachment B) in support of the SFWMD Restoration Strategies initiative.

Scope and Objectives

The intent of the RS_BASE2 model run is to represent a projection of the south Florida system hydrology as it would be in the future (circa 2015-2020). This projection is dependent on several assumptions, including anticipated completion of current and planned projects, system operating protocols and projections of future consumptive use and environmental demands. Although the entire south Florida regional system is modeled by the SFWMM, the primary area of interest for the Restoration Strategies initiative focuses on basin hydrology in and in the vicinity of the Everglades Agricultural Area (EAA), specifically related to any basins that contribute flow to Stormwater Treatment Areas (STAs) that discharge into the Everglades Protection Area.

Throughout the development of the RS_BASE2 scenario, the modeling and project teams determined the appropriate modeling techniques to be used given the scale and previous formulation of the model and consistent with a reasonable use of the regional SFWMM tool as determined by best professional judgment and established peer review findings (Bras 2005).

Intended Use of Results

The simulation of the RS_BASE2 is required for production of time-series data of flows representative of basin hydrology in and in the vicinity of the EAA. These flows are utilized in subsequent modeling performed using the Dynamic Model for Stormwater Treatment Areas (DMSTA), and its pre-processing tools, in order to assess sizing and operations of proposed project features in support of the SFWMD Restoration Strategies project.

2.0 Basis

Assumptions, Considerations and Constraints

The RS_BASE2 scenario was developed using the Restoration Strategies Baseline (RS_BASE) scenario from May 2010 as a starting point. The RS_BASE scenario was utilized by the Environmental Protection Agency in development of the Amended Determination. The current modeling of RS_BASE2 retains a number of assumptions carried over from the previous scenario including the following key points:

- The RS_BASE and RS_BASE2 runs are generally representative of a future (circa 2015-2020) condition including assumed build-out of projects not currently operating and utilizing future projected consumptive use demands.
- The implementation of STAs in the vicinity of the EAA in the RS_BASE and RS_BASE2 are based on the assumptions of the Long Term Plan for Achieving Water Quality Goals (LTP) objectives for the year 2015 as identified in the EAA Regional Feasibility Study (SFWMD 2005b), without the EAA Conveyance and Regional Treatment (ECART) project.
- The SFWMD Expedited Projects (formerly known as Acceler8) are included with the exception of the Everglades Agricultural Area (EAA-A1) Reservoir.
- Lake Okeechobee is managed with the 2008 Lake Okeechobee Regulation Schedule (LORS08) and Lake Okeechobee Water Shortage Management (LOWSM) operations (F.A.C. 2001 & F.A.C. 2007).
- Tamiami Trail culverts east of the L-67 Extension are explicitly modeled.

In addition to those assumptions already addressed, the RS_BASE2 makes the following refinements to the RS_BASE scenario:

- Updated modeling of the C51 canal and the Lake Worth Drainage District consistent with improvements to SFWMM modeling made in the C51 Reservoir feasibility study.
- Updated representation of the Loxahatchee River Watershed Restoration Project, consistent with project planning circa May 2011 under the Comprehensive Everglades Restoration Project (CERP).
- Improved simulation of 298 District routing to more closely represent observed trends in outflow (e.g. more flow directed south rather than to Lake Okeechobee).
- Improved simulation of Western Basin (C-139 and C-139 Annex) hydrology.

The primary constraints developed by the project team were as follows:

- Modeling done by the U.S. Army Corps of Engineers (USACE 2007 & USACE 2008) in support of development of the LORS08 regulation schedule assumed a limit on Lake Okeechobee releases to the STAs of 60,000 ac-ft per year. In order to be consistent with this modeling the same constraint was followed in this model run.
- Inflow volumes to downstream STAs in the vicinity of the EAA were not constrained despite known limitations of these facilities in providing treatment to volumes of water beyond their design capacities. Although high-level planning constraints are frequently considered in the SFWMM related to long-term STA flow loading, in the case of this modeling exercise, these constraints were not applied. It is anticipated that follow-up DMSTA modeling would identify additional projects to aid in the attainment of water quality objectives.

See Attachment A - Table of Assumptions for a comprehensive listing of SFWMM assumptions.

Model Limitations

The SFWMM 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).

3.0 Simulation

Modeling Tools Used

- South Florida Water Management Model Version 6.5.1r954 (Linux)
    - o SFWMD network model executable location: /nw/oom/sfwmm/workdirs/wca1/models/sfwmm/src_rev954/wmm.exe

Model Set Up

Source run for this scenario (input from which modifications were initiated) = RS_BASE
SFWMD network model output location for source run:
/nw/oomdata_ws/sfwmm/workdirs/wca1/models/sfwmm/RSBase_V6.0_052510_out

Model Input Additions/Modifications

A number of updated assumptions were included in the RS_BASE2 scenario relative to the RS_BASE as listed below. The narrative description below is not intended to be comprehensive of all SFWMM changes, but rather to convey the intent of the modifications. A comparison of SFWMM input sets can be made to identify the complete list of changes required to represent the intended revisions.

- C51 canal and the Lake Worth Drainage District (LWDD) modifications: As part of the SFWMD C51 Reservoir feasibility study, a thorough review of SFWMM assumptions in the C51 and LWDD basins was conducted. SFWMM outputs were compared to historical data and several meetings were held with LWDD staff to crosswalk structures and operational intent from the field to the model. Ultimately, updates were made to the model code and inputs to allow for a more accurate representation of the C51 and LWDD basins (SFWMD 2011a & SFWMD 2011b). For the purposes of Restoration Strategies initiative, the primary change of interest relates to the SFWMM tag “M1Q”. This tag represents outflows from Royal Palm Beach to the C51 Canal. In previous modeling efforts, as a simplifying assumption, this structure had been assumed to discharge downstream of S-155A (the structure dividing the C51 East and C51 West basins) although in the field its outfall is located upstream of S-155A. This assumption was made due to the fact that the operational intent of SFWMD water managers is to immediately discharge outflow from Royal Palm Beach through S-155A to tide. In the

RS_BASE2 and in subsequent modeling, M1Q is now assumed to discharge into C51W and then be passed on through S-155A as would be observed in the field. This change in output also necessitated updates to the DMSTA processing to account for the new routing location in determination of C51 East and C51 West basin runoff. Additionally, it should be noted that a flow divide in the Palm Beach Chain of Lakes south of the S155 structure is now assumed which limits the amount of water available to the S155 location and better distributes flows to S40 and S41. This assumption will reduce the amount of water considered to be part of the C51 East basin.

- Loxahatchee River Watershed Protection Project: In order to better represent the expected outcomes of this CERP initiative, the SFWMM was updated with several operational and structural input and code changes in the North Palm Beach planning area. The overall goal was to represent the project features consistent with the provisional Tentatively Selected Plan 5B scenario modeled with the NPB MODFLOW model (Kuebler 2010). A schematic representation of these features in shown in Figure 3-1. Again, from the Restoration Strategies perspective, the changes of interest involve an anticipated reduction in M1Q flows (due to redirection of Indian Trails runoff) and an expected increase in L8 basin runoff to the south via S5A resulting from wet season drawdown of the L8 Reservoir.

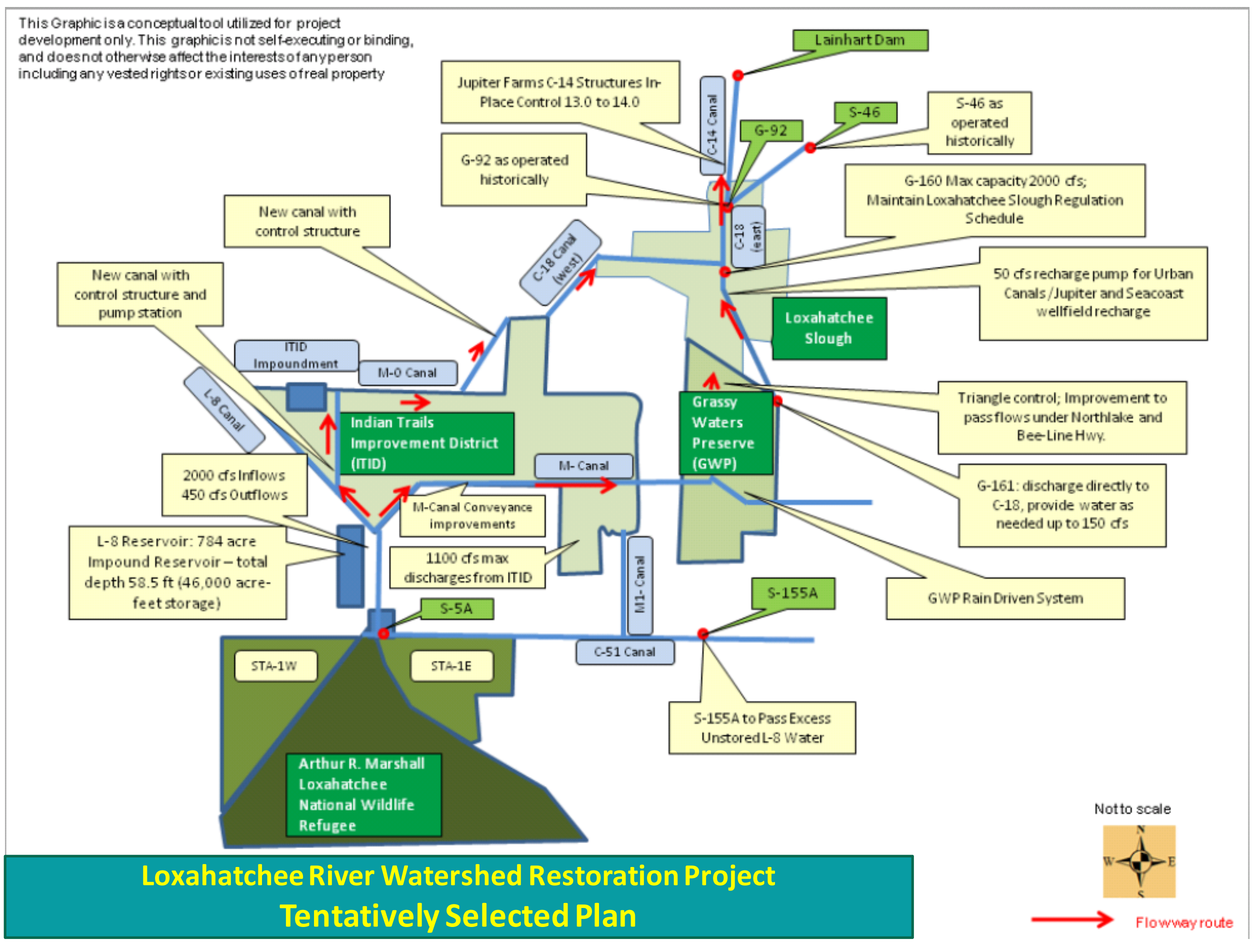

Figure 3-1

- 298 Districts: In the development of RS_BASE2 scenario, an attempt was made to better simulate the flow volumes that the various 298 Districts within the EAA route south toward the STAs. Previous modeling with DMSTA had relied on the methodology outlined in Goforth 2009 to estimate these basin contributions by pro-rating relative to adjacent basins. Iterative testing with the SFWMM indicated limited potential for the model to represent some 298 Districts adequately while others were left to be estimated using the rescaling methodology. Outcomes of the effort are identified in Table 3-1 below for each 298 District.

Table 3-1 – 298 District Hydrology Estimation for DMSTA Using RS_BASE2

298 District	Hydrology Estimate
East Beach WCD	SFWMM
East Shore WCD and 715 Farms	Goforth Method
South Shore Drainage District	SFWMM
South Florida Conservancy District	Goforth Method

- Western Basin (C-139 and C-139 Annex) hydrology: As part of the preparation for the C-139 Basin Feasibility Study, the SFWMD modeling group has developed a Regional Simulation Model (RSM) implementation for the C-139 and C-139 Annex basins (Flaig 2011). This physically based model has been calibrated to historical data for recent periods from 2000 through 2009 and is deemed to be an improvement over the hydrology estimates previously made for these basins that utilized statistical regression approaches. The SFWMM accepts estimates of C-139 and C-139 Annex hydrology as boundary conditions and then routes the resulting flows through the EAA, STAs or into the Everglades Protection Area. Difference between the updated potential inflows in the RS_BASE2 and those in the previous RS_BASE are shown in Table 3-1.

Table 3-2 – Comparison of Previous SFWMM Boundary Condition (BS) and RSM-C139 Model

G136 Flows

Source	Avg. Annual (kac-ft)	Peak flow (cfs)
Previous SFWMM BC	14.1	731
RSM - C139	18.1	425

Potential STA5 Inflows

Source	Avg. Annual (kac-ft)	Peak flow (cfs)
Previous SFWMM BC	177.4	4302
RSM - C139	190.3	2406

C139 Annex Flows

Source	Avg. Annual (kac-ft)	Peak flow (cfs)
Previous SFWMM BC	15.9	430
RSM - C139	46.3	535

Total (no Lake water supply, not accounting for G136 to STA34)

Source	Avg. Annual (kac-ft)
Previous SFWMM BC	207.4
RSM - C139	254.7

4.0 Results

Identification of Simulation

SFWMD network model output location for RS_BASE2 scenario:
/nw/oomdata_ws/sfwmm/workdirs/wca1/models/sfwmm/RSBase2_V6.5.1r954_081811_out

Project Specific Results

The primary objective of the modeling effort was to develop an updated set of flows representing hydrology in and in the vicinity of the EAA for the purposes of providing inputs to the DMSTA model. This objective has been met and summary results are provided on the average annual basis in three forms. Table 4.1 below shows a high-level summary of the flow volumes represented in the RS_BASE and RS_BASE2 scenarios for primary inflow source basins. This table includes some post-processed outcomes or rescaling of SFWMM hydrology (e.g. 298 districts) consistent with methodologies previously utilized in STA design efforts and in the Amended Determination modeling (Goforth 2009). Table 4.2 illustrates the summarized SFWMM flows for source basins as seen by the DMSTA model (including rescaling). A complete listing of all SFWMM tags (without rescaling modifications) used in DMSTA processing is included in Attachment C.

As can be observed in the tables, the anticipated affects of the updated assumptions outlined in Section 3 of this report are observed in the modeling outcomes. In particular, the following key flow observations can be made:

- Consistent with the updates to the C51 and LWDD basins, a reduction in C51 East basin volume is observed. Additionally, the S155A structure increased substantially from 25,000 ac-ft average annual in the RS_BASE to 108,600 ac-ft, average annual in the RS_BASE2 as a result of the updated M1Q routing.
- L8 Basin outflows through S5A increase from 25,000 ac-ft, average annual in the RS_BASE to 48,900 ac-ft, average annual in the RS_BASE2. This is consistent with the expected outcomes of Loxahatchee River Watershed Restoration Project.
- 298 District average annual outflows are more consistent with the historically observed volumes in the 2009 Goforth report in the RS_BASE2 compared to the RS_BASE.
- Total basin inflows to STAs 5 & 6 (STA5IQ +STA6IQ) increase from 204,400 ac-ft, average annual in the RS_BASE to 238,800 ac-ft, average annual in the RS_BASE2. This is consistent with the updated RSM-C139 hydrology assumed as a western basin boundary condition to the SFWMM.

Table 4-1 - Detailed Summary of Source Basin Volumes
(Includes adjustments to SFWMM output hydrology)

Source Basin Name	Average Annual Flow (ac-ft)
C-51 West	169,700
L8 Runoff South	48,900
West Palm Beach (S5A)	293,500
Hillsboro (S-2/S-6)	181,400
North New River (S-2/S-7)	263,900
Miami Canal (S-3/S-8)	218,400
EBWCD	17,000
ESWCD & 715 Farms	22,700
SSDD	11,700
SFCD (S-236)	19,100
C-139	202,400
C-139 Annex	52,000
Lake Okeechobee (Regulatory)	58,300
Lake Okeechobee (Urban Water Supply)	29,200

Table 4-2 - Summarized Flows for Source Basins Used by the DMSTA Model
(Includes adjustments to SFWMM output hydrology)

DMSTA Source	RS_BASE	RS_BASE2	ABS % Diff
S5A Runoff	296,372	293,533	1.0%
S5A Runoff to STA2	60,074	59,839	0.4%
S5A Runoff to WPB	236,298	233,695	1.1%
S361	9,685	9,684	0.0%
C51W_EX_S361	159,686	159,978	0.2%
L8 Runoff South	25,022	48,938	95.6%
C51E_Runoff	202,767	185,250	8.6%
S6 Runoff	181,280	181,359	0.0%
S6 Runoff to STA2	181,280	181,359	0.0%
S7_Runoff	263,712	263,857	0.1%
S7 to STA34	121,503	121,569	0.1%
S7_To_STA2b	142,209	142,288	0.1%
S8 Runoff	219,341	218,440	0.4%
S8 Runoff to STA34	219,341	218,440	0.4%
C139_L3	176,376	186,683	5.8%
C139_G136 to STA5	3,377	987	70.8%
C139_G136 to STA34	12,089	14,684	21.5%
C139_Annex	21,251	52,070	145.0%
EBWCD to WPB	24,088	17,041	29.3%
SSDD to NNR	5,852	4,208	28.1%
SFCD to MC	19,131	19,070	0.3%
ESWCD & 715 to Hills	30,408	22,747	25.2%
SSDD to MC	6,212	7,456	20.0%
LAKE_WS_STA6	6,818	0	100.0%
LAKE_WS_S354	19,644	21,537	9.6%
LAKE_WS_S351	6,186	5,726	7.4%
LAKE_WS_S352	2,327	1,894	18.6%
LAKE_REG_S354	58,547	58,295	0.4%
S4	38,225	38,225	0.0%

Regional-Level Results

A general overview of the modeling from a system performance perspective supports the following observations (Note that in the associated performance measure graphics, the identifiers “RSB1” and “RSB2” are used for the RS_BASE and RS_BASE2, respectively):

- Lake Okeechobee and the Northern Estuaries: Performance between the RS_BASE and RS_BASE2 scenarios is very comparable for Lake Okeechobee and for flows to the Caloosahatchee and St. Lucie Estuaries. The modeling constraint to send less than 60 kac-ft per year in Lake O. regulatory discharge south was honored. A subset of representative northern system performance measures are provided in Figures 4-1 through 4-2.
- Everglades Protection Area: In general, there is slightly more flow entering and passing through the Everglades system in the RS_BASE2 as compared to the RS_BASE. This is primarily a result of additional water entering the system from the C-139 and C-139 Annex due to the updated RSM-C139 modeling boundary conditions. This additional flow affects inundation patterns and hydroperiods throughout the system. A subset of representative Everglades performance measures are provided in Figures 4-3 through 4-5.
- Water Supply: Lake Okeechobee Service Area and Lower East Coast water shortage cutbacks (both frequency and magnitude) are very similar for the RS_BASE and RS_BASE2 scenarios, with the exception of increased frequency of cutbacks in Lower East Coast Service Area 2 in the RS_BASE2. A subset of representative water supply performance measures are provided in Figures 4-6 through 4-7.
- The specific intent of the project changes associated with the C51 review and Loxahatchee River project were observed in the model. These include changes in flows to Lake Worth Lagoon, different utilization of the L8 Reservoir and improved environmental performance in Grassy Waters Preserve (WPBCAT site) and the Loxahatchee Slough. A subset of representative water supply performance measures are provided in Figures 4-8 through 4-11.

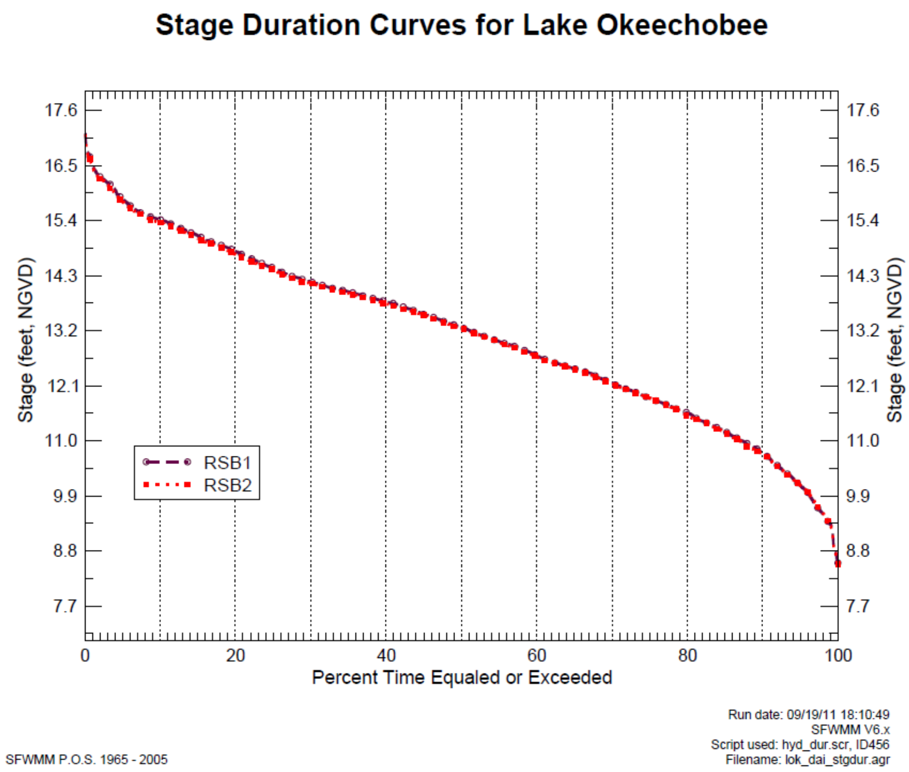

Figure 4-1

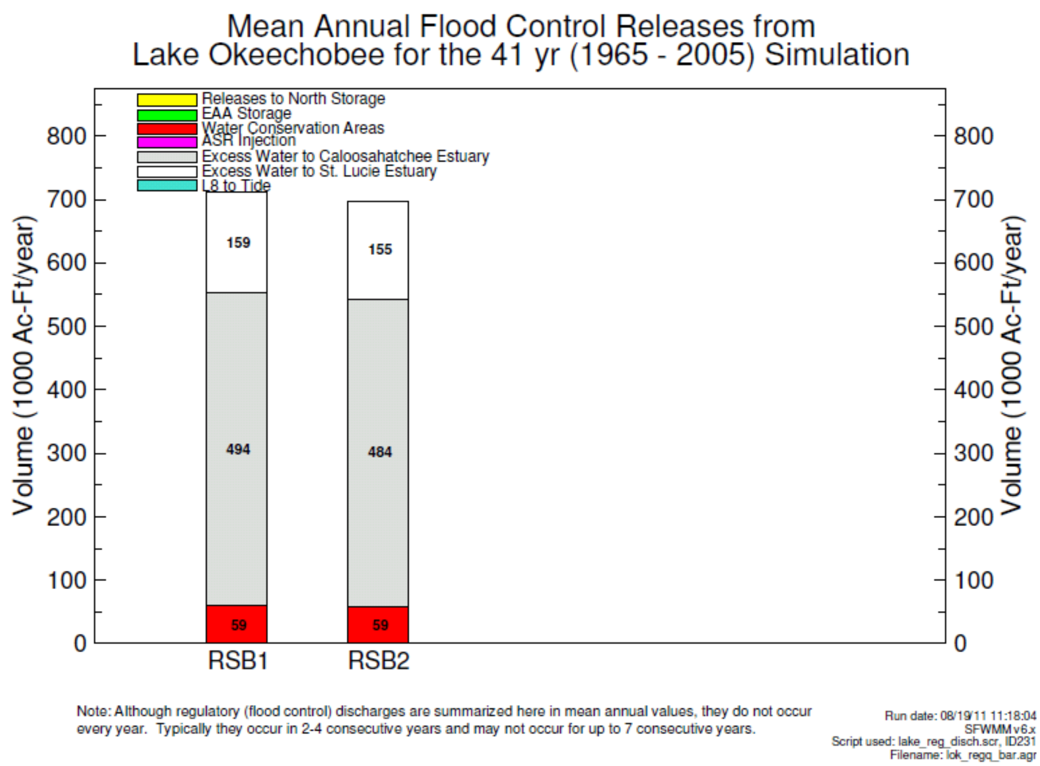

Figure 4-2

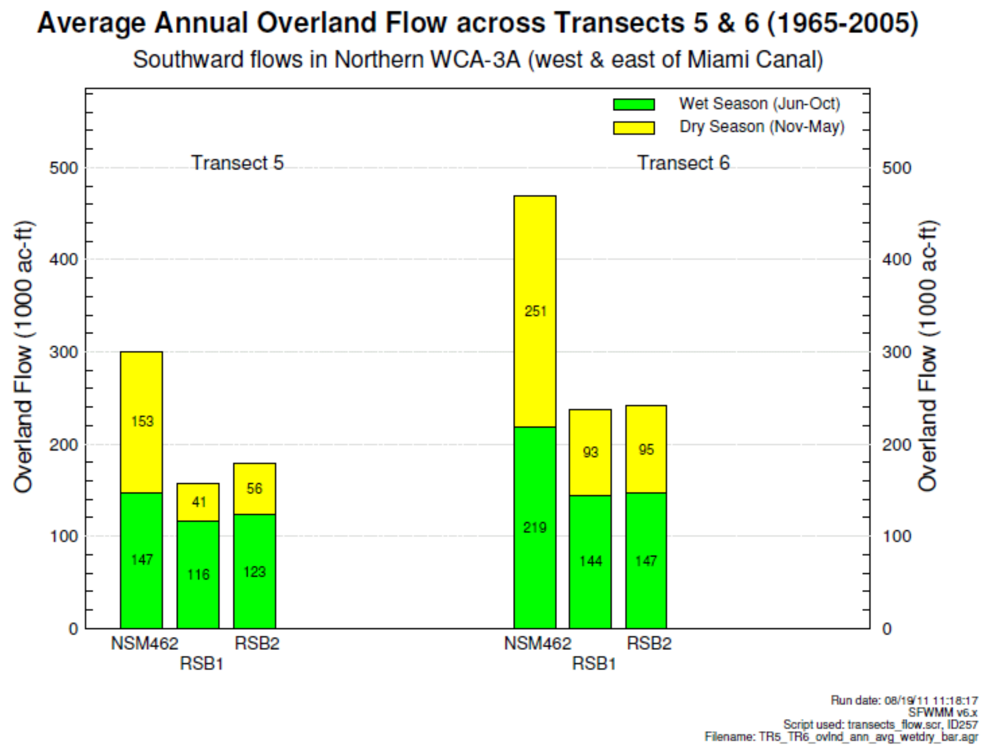

Figure 4-3

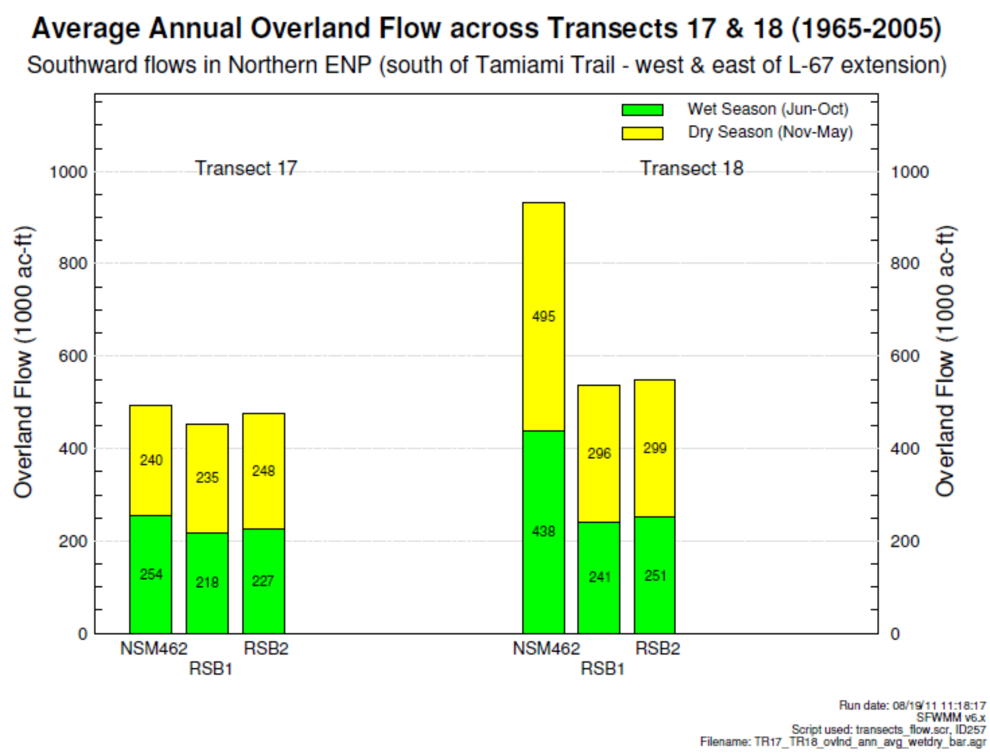

Figure 4-4

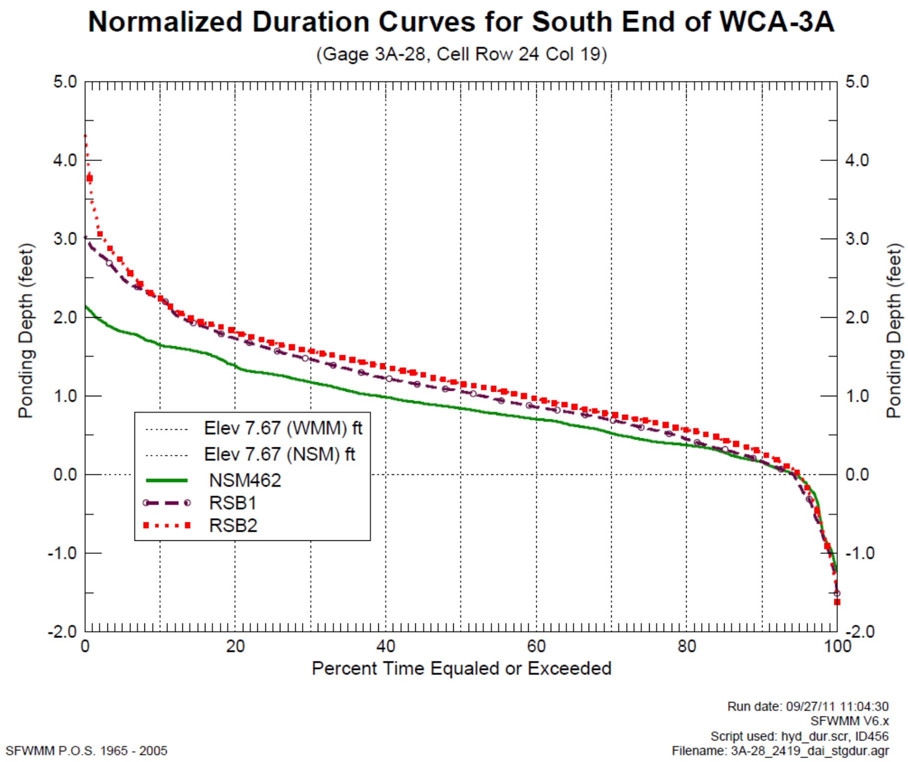

Figure 4-5

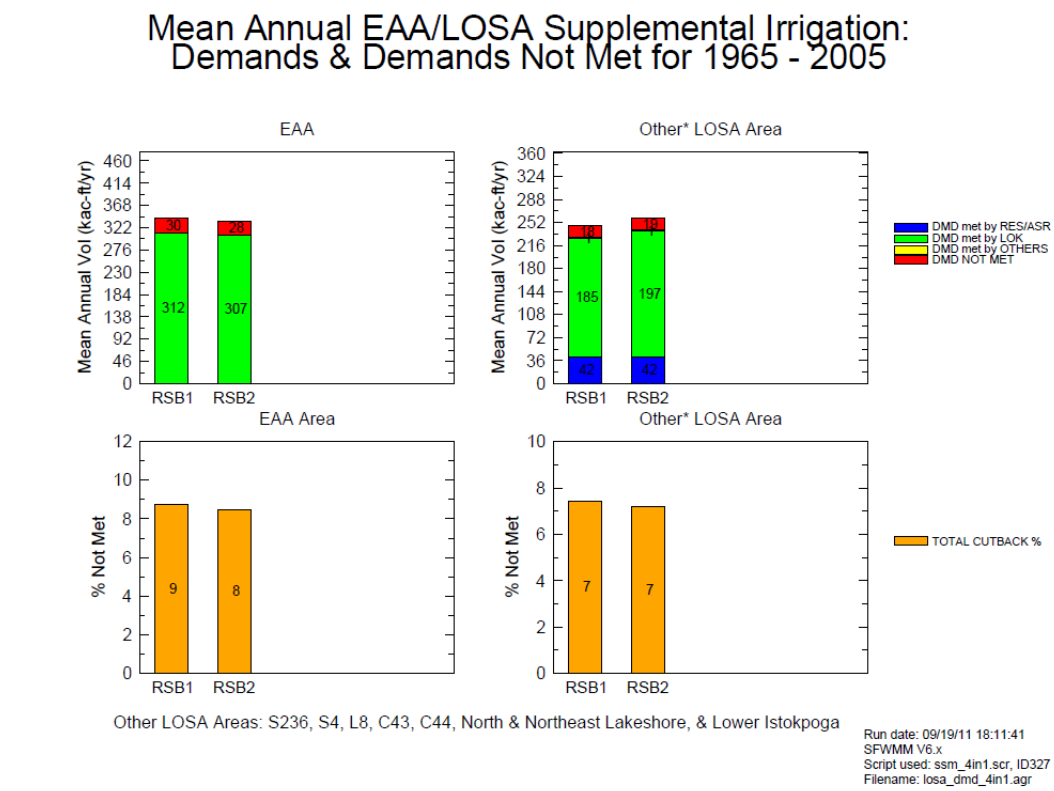

Figure 4-6

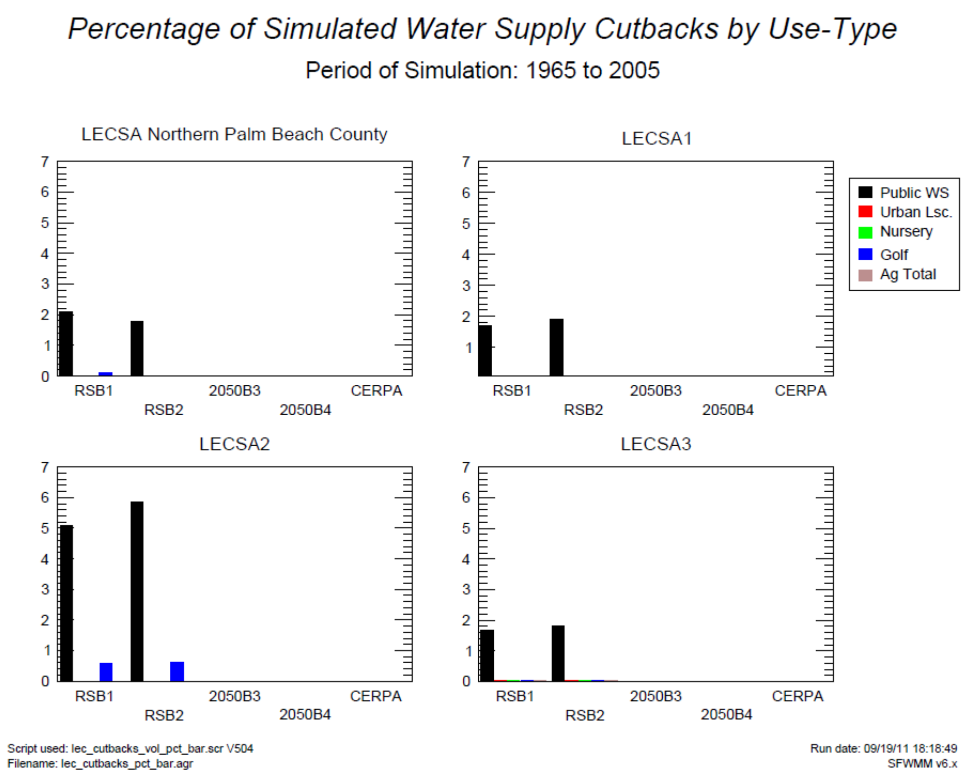

Figure 4-7

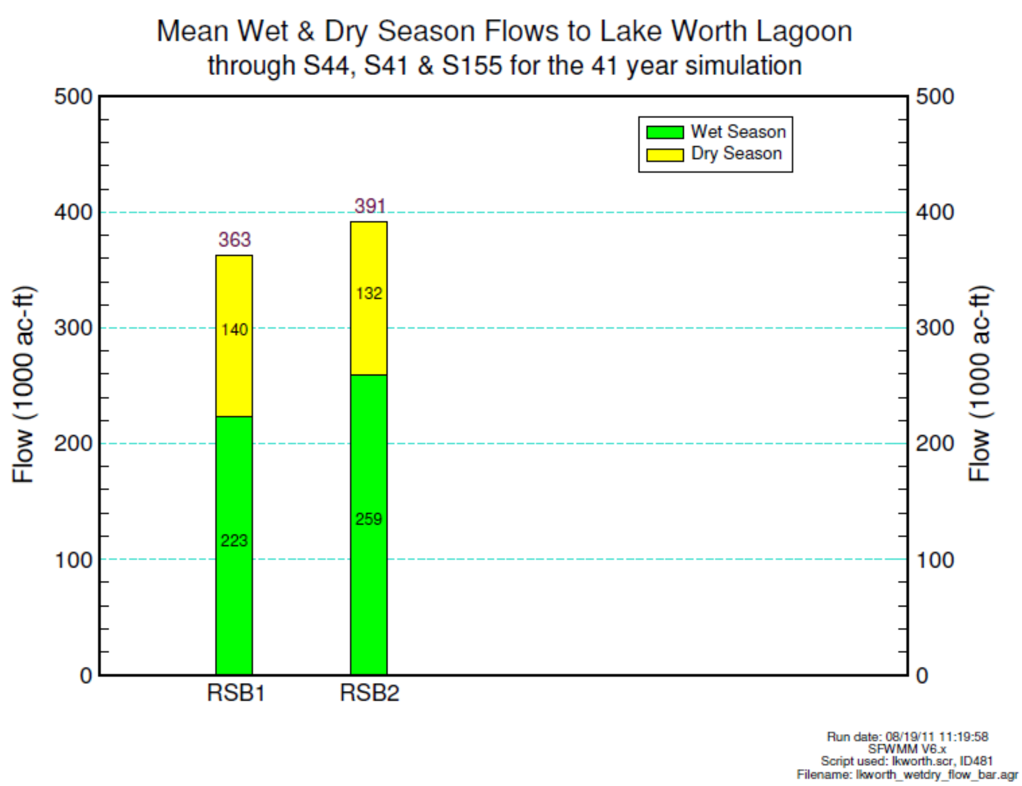

Figure 4-8

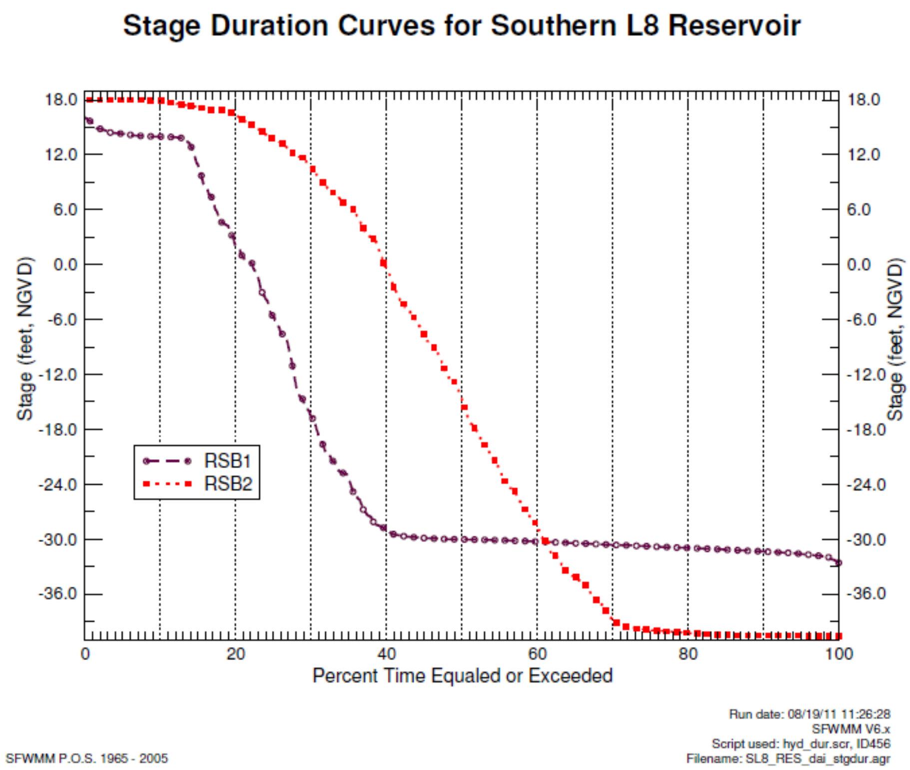

Figure 4-9

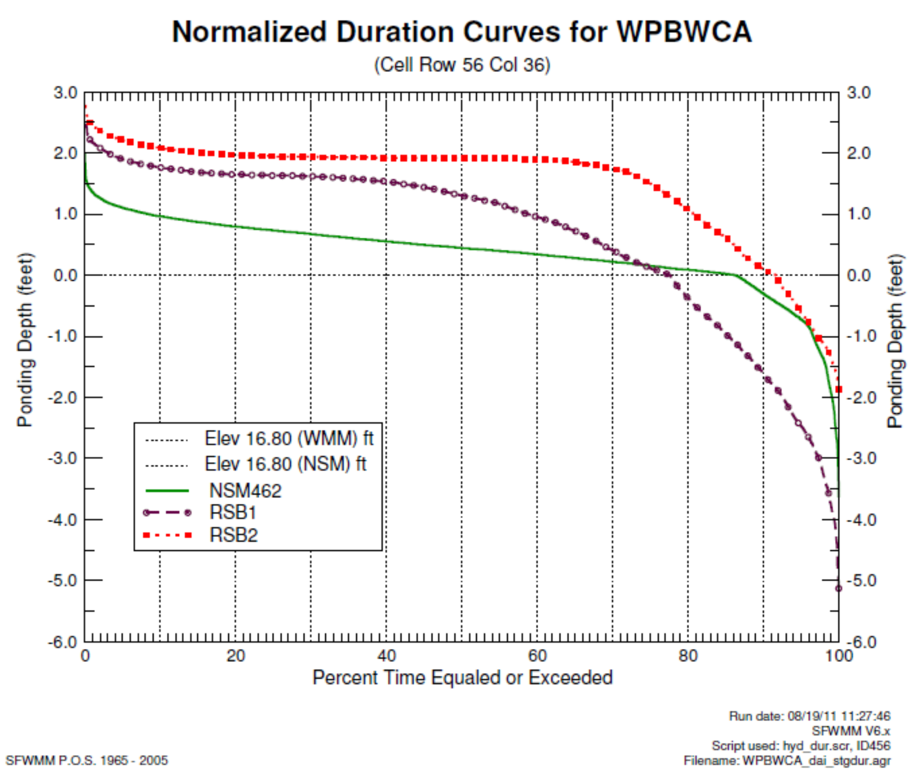

Figure 4-10

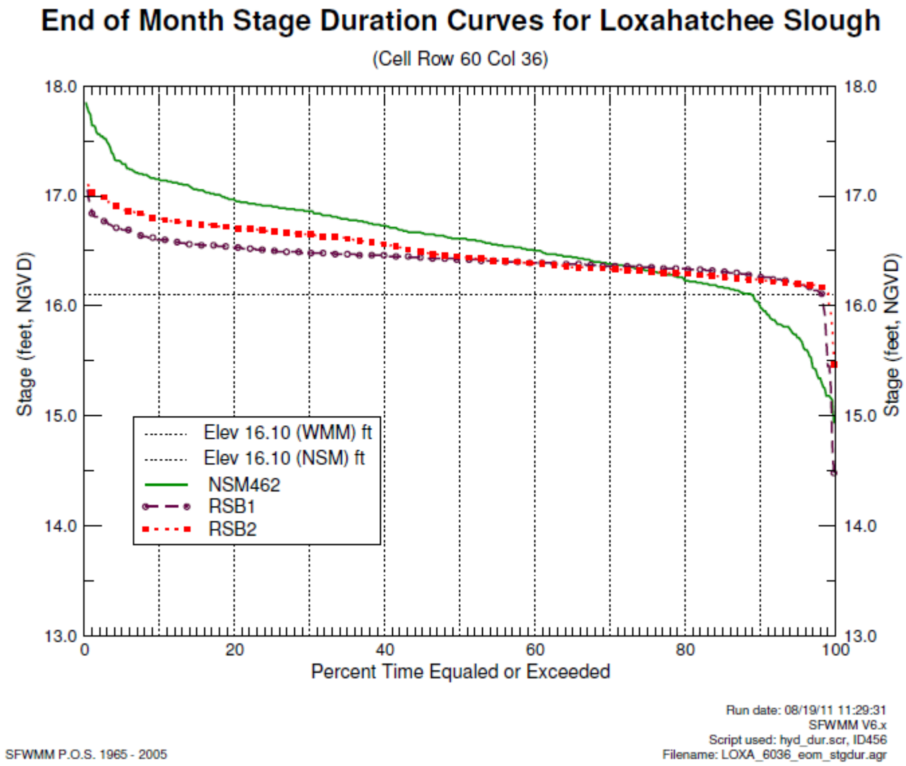

Figure 4-11

Achievement of Modeling Objectives

The overall objectives of the modeling effort were met as identified under MRF 5041. The RS_BASE2 is a valid representation of the future system with planned projects built by circa 2015-2020. All stormwater treatment areas are modeled along with the regional system including Lake Okeechobee. Use of the SFWMM to provide basin hydrology helps to account for critical hydrologic and operational feedback not present in DMSTA modeling alone.

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Attachment A – Table of Assumptions

Feature	Restoration Strategies Baseline 2 Assumptions 41-Year Simulation Version 6.5.1r954 of SFWMM (Linux)
Climate	• The climatic period of record is from 1965 to 2005. • Rainfall estimates have been revised and updated for 1965-2005. • Evapotranspiration data have been extended up to 2005 using same methods as those used for the 1965-2000 extension.
Topography	Updated November 2001 and September 2003 using latest available information (in NGVD 29 datum). Nov 2001 update (Documented in November 2001 SFWMD memorandum from M. Hinton to K. Tarboton) includes: • USGS High Accuracy Elevation data from helicopter surveys collected 1999-2000 for Everglades National Park and Water Conservation Area (WCA) 3 south of Alligator Alley • USGS LiDAR data (May 1999) for WCA-3A north of Alligator Alley • Lindahl, Browning, Ferrari & Helstrom 1999 survey for Rotenberger Wildlife Management Area. • Stormwater Treatment Area surveys from 1990s • Aerometric Corp. 1986 survey of the 8-1/2 square mile area • Includes estimate of Everglades Agricultural Area subsidence • Other data as in SFWMM v3.7 • FWC survey 1992 for the Holey Land Wildlife Management Area. September 2003 update includes: • Reverting to FWC 1992 survey data for Rotenberger Wildlife Management Area. • DHI gridded data from Kimley–Horn contracted survey of EAA, 2002-2003. Regridded to 2x2 scale for EAA outside of STAs and WMAs.
Sea Level	• Sea level data from six long-term NOAA stations were used to generate a historic record to use as sea level boundary conditions for the 1965 to 2005 evaluation period.
Land Use	• All land use has been updated using most recent FLUCCS data (1995), modified in the Lower East Coast urban areas using 2000 aerial photography (2x2 scale). (Documented in August 2003 SFWMD memorandum from J. Barnes and K. Tarboton to J. Obeysekera).
Natural Area Land Cover (Vegetation)	Vegetation classes and their spatial distribution in the natural areas comes from the following data: • Walsh 1995 aerial photography in Everglades National Park • Rutchey 1995 classification in WCA-3B, WCA-3A north of Alligator Alley and the Miami Canal, WCA-2A & 2B • Richardson 1990 data for Loxahatchee National Wildlife Refuge • FLUCCS 1995 for Big Cypress National Preserve, Holey Land & Rotenberger Wildlife Management Areas & WCA-3A south of Alligator Alley and Miami Canal. (Documented in August 2003 SFWMD memorandum from J. Barnes and K. Tarboton

Feature	Restoration Strategies Baseline 2 Assumptions 41-Year Simulation Version 6.5.1r954 of SFWMM (Linux)
	to J. Obeysekera).
Lake Okeechobee Service Area	
LOSA Basins	• Southern Indian Prairie Basin, S-4, North Lake Shore and Northeast Lake Shore demands and runoff based on AFSIRS (Agricultural Field-Scale Irrigation Requirement Simulation) modeling.
Lake Okeechobee	• Lake Okeechobee Interim Regulation Schedule (LORS2008) • Lake Okeechobee Water Shortage Management (LOWSM) Plan for Lake Okeechobee Service Area • Emergency flood control back pumping to Lake Okeechobee from the Everglades Agricultural Area. • Kissimmee River Restoration and Headwaters Revitalization Projects are complete.

CERP Components	• C44 Reservoirs: 9,315 acres, depth 5 .ft.
	• C43 Reservoirs: 11,000 acres, depth 15 ft.
	• Loxahatchee River Watershed Restoration Plan
	  • L-8 Borrow Pit Reservoir: 784 acres; depth 58.5 ft. with Regulation Schedule as in ALT5B
	  • Flowway 1north then east to the C-51 West canal to Loxahatchee River
	  • Flowway 2 west through Grassy Waters Preserve and north to the C-18 canal to Loxahatchee River
	  • Jupiter and Seacoast Utilities wellfield recharge
	• WPA's
	  • Site 1 Impoundment: 1,660 acres; depth 8 ft.
	  • C-9 Impoundment: 1,739 acres; depth 4 ft.
	  • C-11 Impoundment: 1,730 acres; depth 4 ft.
	  • Acme Basin B discharge to C51W and then to STA1E
	• WCA-3A/3B Seepage Management

Caloosahatchee River Basin	• Caloosahatchee River Basin irrigation demands and runoff were estimated using the AFSIRS method based on 2010 land use. • C43 reservoir supplements basin irrigation needs and estuarine environmental needs • 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 method based on 2010 land use. • C44 reservoir supplements basin irrigation needs and estuarine environmental needs • 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 in a manner consistent with that applied to other basins not in the distributed mesh of the SFWMM. • 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 2,414 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.

Feature	Restoration Strategies Baseline 2 Assumptions 41-Year Simulation Version 6.5.1r954 of SFWMM (Linux)
	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 in a manner consistent with that applied to other basins not in the distributed mesh of the SFWMM. • The 2 in 10 demand set forth in the Seminole Compact Work Plan equals 2,606 MGM. AFSIRS modeled 2 in 10 demands equaled 2,652 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
Seminole Hollywood Reservation	• 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.
Everglades Agricultural Area	• Everglades Agricultural Area irrigation demands are simulated using climatic data for the 41 year period of record and a soil moisture accounting algorithm, with parameters calibrated to match historical regional supplemental deliveries from Lake Okeechobee. • SFWMM EAA runoff and irrigation demand response to rainfall was calibrated for 1984-95 and verified for 1979-1983/1996-2000. No runoff reduction adjustment was necessary to account for Best Management Practices (BMPs). • EAA Reservoir footprint taken out of sugar cane production (7 cells)
Everglades Construction Project Stormwater Treatment Areas	• Operation of STAs assumes maintenance of a 6" minimum depth. • STA-1E: 5,132 acres total treatment area • STA-1E does not receive flow from L101 Basin • STA-1W: 6,670 acres total treatment area • STA-2: 6,430 acres total treatment area • Compartment B: 9,388 acres total treatment area (includes cell 4 of STA-2) • STA-3/4: 16,543 acres total treatment area • STA-3/4 received Lake Okeechobee regulation releases at or below 60,000 acre-feet annual average for entire POR through the Miami Canal • STA-5: 11,081 acres total treatment area (includes 4916 acres from Compartment C and is expanded with cell 3) • STA-5 uses rain driven operations to send water south to WCA-3 • STA-6: 2,854 acres total treatment area (includes 600 acres from Compartment C and is expanded with phase 2 • STA-6 includes an additional pump (125 cfs) going to Rotenberger Tract

Feature	Restoration Strategies Baseline 2 Assumptions 41-Year Simulation Version 6.5.1r954 of SFWMM (Linux)
Holey Land Wildlife Management Area	• As per Memorandum of Agreement between the Florida Fish & Wildlife Commission and the District
Rotenberger Wildlife Management Area	• Interim Operational Schedule as defined in the Operation Plan for Rotenberger (SFWMD Jan 2001)
Water Conservation Areas	
Water Conservation Area 1 (ARM Loxahatchee National Wildlife Refuge)	• Current C&SF Regulation Schedule which 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 from Lake Okeechobee.
Water Conservation Area 2 A&B	• Current C&SF regulation schedule which 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 from Lake Okeechobee.
Water Conservation Area 3 A&B	• Structural and operational modifications for L-67 canal conveyance and S-355 structures as in the federally authorized Modified Water Deliveries Project. • 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 from Lake Okeechobee.
Lower East Coast Service Areas	
Public Water Supply and Irrigation	• Projections based upon population changes by 2010 • Irrigation demands are based upon 2010 land use and calculated using AFSIRS, reduced to account for landscape and golf course areas irrigated using reuse water and landscape areas irrigated using public water supply.
Other Natural Areas	• For the Northwest Fork of the Loxahatchee River, the District operates the G-92 structure and associated structures to provide approximately 50 cfs over Lainhart Dam to the Northwest Fork, when sufficient water is available in C-18 Canal. • Flows to Pond Apple Slough through S-13A are adjusted in the model to approximate measured flows at the structure. • Flows to Biscayne Bay are simulated through Snake Creek, North Bay, the Miami River, Central Bay and South Bay
Upper East	• L-8 Reservoir: 870 acres, depth 44 ft.

Feature	**Restoration Strategies Baseline 2 Assumptions** 41-Year Simulation Version 6.5.1r954 of SFWMM (Linux)
Coast Operational CERP	• 25% of L-8 runoff (L-8 and Indian Trails Upper Basin) is sent to STA-1E.
Western Basins and Big Cypress National Preserve	
Western Basins	• Updated historical inflows from western basins based on DMSTA model; represents potential inflow from the C-139 Basin into STA 5.
Big Cypress National Preserve	• Tamiami Trail culverts are not modeled in SFWMM due to the coarse (2x2 mile) model resolution.
Everglades National Park and Florida Bay	
Everglades National Park	• 8.5 Square Mile Area as per the federally authorized Alternative 6D of the 8.5 Square Mile Area project. • Northern C-111 project (2002 IOP EIS) • Southern C-111 project modeled per C-111 Project 1994 GRR • C111 Spreader Canal (includes) – enlarging S332E pump station, filling southern reach of C-111 Canal, and removing S-18C and S-197 structures.

Attachment B – Model Request Form 5041

Modeling Request Form

Tracking#: 5041	**CERP Project:** No

Requestor Information

Today's Date:	07/06/2011	*** Due Date:**	07/28/2011
*** Requestor:**	JENNIFER LEEDS	*** Requestor Phone#:**	6088
*** Requestor E-mail:**	jleeds@sfwmd.gov	*** Division Director:**	Temperince Morgan
*** Org. / Dept. Name:**	Everglades Policy and Coordination	*** Division Dir. E-mail:**	tmorgan@sfwmd.gov

Project Information

*** Project Name:**	RESTORATION STRATEGIES		
*** Project Manager:**	Jennifer Leeds	*** Phone #:**	6088
SAP-PS Project#:	100712	**Business Area:**	3312
Timesheet Code:	Network - 5006408 activity - 0120	**Functional Area:**	BH01

Work Description

*** Request Type:**	Other
*** Brief Description of Requested Work:**	Additional planning level modeling runs to support the Restoration Strategies Regional Planning project for various scenerios of potential water quality facilities. Models discussed that could be used in this effort is the 2X2, DMSTA and RSM.
Attachments:	**File:**
	Description:

Attachment C – SFWMM Tags Used in DMSTA Processing

SFWMM Tag	RS_BASE	RS_BASE2	Diff
S1324P	9,685	9,685	1
S155A	24,967	108,584	83,617
S319	159,726	154,725	-5,001
S5A3SO	25,022	49,085	24,063
WLC352	2,394	2,015	-379
EBDST1	0	17,331	17,331
RFWPBB	239,900	254,670	14,770
ST1EI1	0	0	0
715ST2	1,525	5,664	4,139
DIVERS	60,075	59,852	-223
ESDST2	4,250	9,862	5,612
FLIMPH	0	0	0
RFTST2	247,960	257,613	9,652
ST2REX	8,122	8,560	437
ST2BYP	84	84	0
STA2EO	122,483	127,366	4,883
STA2MO	123,817	128,751	4,934
RFTST2	247,960	257,613	9,652
WSST2M	0	0	0
WSST2E	26	11	-15
S6LCWS	637	527	-110
NNRST2	142,163	142,277	113
WLES7	46	54	8
STA2BO	139,077	139,195	118
WSST2B	124	0	-124
354RG	58,547	58,346	-201
FLIMPM	0	0	0
FLIMPN	0	0	0
351RG	0	0	0
G136SO	12,089	14,680	2,592
MIAST3	243,131	257,373	14,242
NNRST3	121,503	121,594	91
S236SO	10,866	18,711	7,845
S3PMP	4,932	5,133	201
S8BPMR	0	39	39
WLES8	2,522	2,028	-494
SSDST3	3,741	7,562	3,821
ST3QIN	423,034	437,313	14,279
ST3BYP	0	39	39

SFWMM Tag	RS_BASE	RS_BASE2	Diff
G136SO	11,704	14,680	2,976
ST3NEA	135,068	135,179	111
ST3TL4	0	0	0
ST3TNW	0	0	0
ST3TS7	87,959	94,028	6,069
ST3TS8	112,879	119,861	6,982
ST3OT4	78,751	79,918	1,167
S2PMP	20,937	20,960	23
ST3OT1	33,788	33,333	-455
ST3OT2	54,584	55,142	558
ST3OT3	46,703	46,710	8
ST3OT4	78,751	79,918	1,167
ST3TNE	1,126	1,090	-36
ST3REX	27	33	6
ST3S71	87,959	94,028	6,069
ST3S81	112,879	119,861	6,982
STA5IQ	176,376	186,678	10,302
G136EA	3,377	992	-2,385
G136SO	12,089	14,680	2,592
STA6IQ	28,069	52,074	24,006
WSSTA6	6,818	0	-6,817
S155	221,894	232,066	10,171
S155A	24,967	108,584	83,617
S4BTLK	22,079	11,130	-10,949
WL1351	2,614	2,513	-101
WL3351	3,572	3,216	-356
S5AWC1	2,274	1,760	-514
LKTSEM	17,724	16,647	-1,077
WLC354	19,644	21,571	1,927
WSHOLY	149	148	-1
S354PK	0	0	0

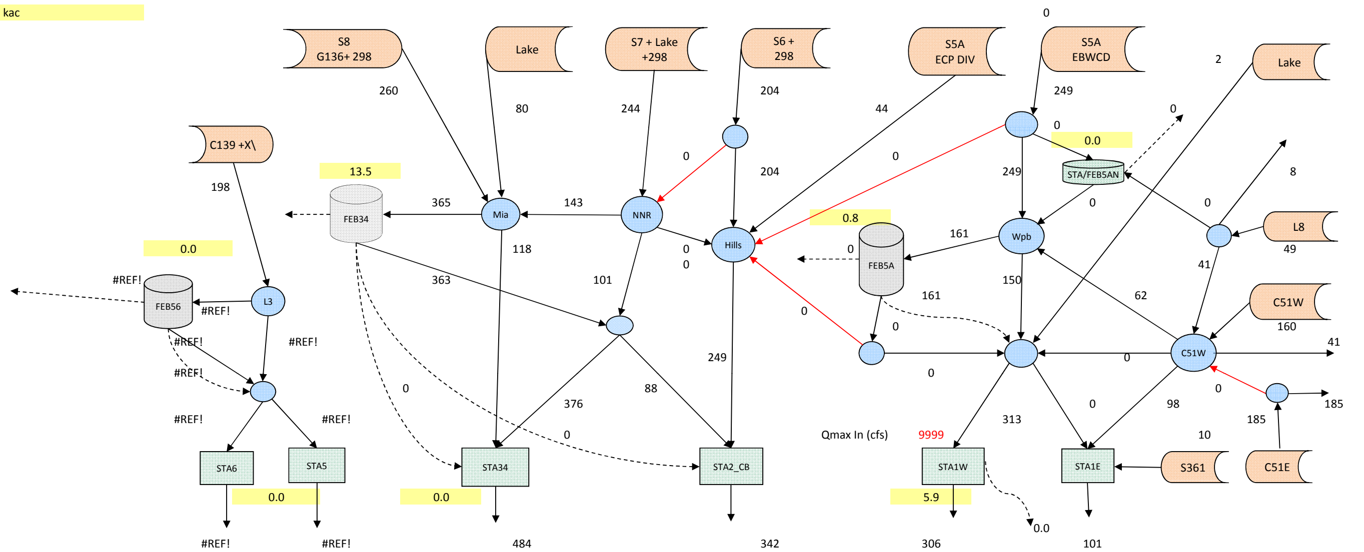
SFWMM Tag	RS_BASE	RS_BASE2	Diff
WL2351	636	503	-133
WSST1W	0	0	0
WSST2B	124	0	-124
WSST2E	26	11	-15
WSST2M	0	0	0
WSST5E	0	203	203
WSSTA	6,837	216	-6,621
WSSTA3	0	0	0
WSSTA5	0	203	203
WSSTA6	6,818	0	-6,817
WST1EE	0	0	0
WST1EW	0	2	2

Appendix B

DMSTA Modeling sheets

Scenario: sfwmd_ec_01mar2012 Min Depth = 5 ft (FEB_S5A), 0.5 ft (FEB34), Lake P, STA1WX = 5,900 ac, 80% SAV Displayed: Flow kac

STA Expansion kac



	STA6	STA5		STA34	STA2_CB	STA1W		STA1E	Totals	
STA Outflow TP ppb	#REF!	#REF!		12.4	12.4	11.1		11.1	#REF!	
STA Expansion kac	0.0			0.0		5.9				5.9
STA Total Area kac	#REF!	#REF!		16.3	15.5	12.4		5.0	#REF!	
STA Outflow kacf/yr	#REF!	#REF!		484	342	306		101	#REF!	
WCA Inflow kacft			#REF!		342		407		#REF!	

Starting Date for Simulation	01/01/65
Ending Date for Simulation	04/30/05
Starting Date for Output	05/01/65

Inputs for Scenario sfwmd_ec_01ma Min Depth = 5 ft (FEB_S5A), 0.5 ft (FEB34), Lake P, STA1WX = 5,900 ac, 80% SAV

Diversion Rules

Diversion	Default	Diverted to	Fraction	Qmax	Description
C51E Diversion	C51W Canal	EAST	0		
S5A Div (ECART)	S5A Div	HILLS_C	0		divert to hills up to qmax
S5A Div (ECART)	S5A Div	HILLS_C	0		low-flow bypass to WPB
S5A Div to FEB North	FEBS5A	FEBS5A_N	0		northern STA.FEB
FEB S5A Outflow	HILLS_C	STA1DW	1	9999	diversion to Hills
C51W Outflow	EAST	STA1E	0.613		direct to STA1E
C51W Outflow	EAST	STA1_DW	0		direct to STA1DW
C51W Outflow	EAST	FEB_S5A	1		remainder to East
STA1W Distrib	STA1W	STA1E	0		WPB C STA1E
S6 Runoff	STA2CB	NNRC	0		S6 divert to NNR
NNR Canal	FEB34	STA34	1	1200	NNR LowQ Bypass to STA34
STA56 Distrib	STA5	STA6	0.365		Balance STA56 Loads, Hint=
L8 to STA1N	North	FEBS5A_N	0		To FEB S5AN (Rest to C51W)
L8 to C51W	North	C51W	1	700	CERP
NNR to CB	STA34	Comp B	0	500	Original Design for Comp B =1
NNR to CB 2	STA34	Comp B	0	500	Additional NNR Diversion to CB
S5A to WS	S5A Div	WS	0	2000	
FEB34 Distrib	STA34	STA2B	0.190	1600	
Other					
Other					

Mass Balance Summary sfwmd_ec_01m project_sfwmd_ec_01mar2012.xls Run Date 4/4/12 9:50

		Inflows			Outflows				
	Area	Flow	Load	Conc	Flow	Load	Conc	HLR	HLR Max
STA	kac	kac-ft	mt	ppb	kac-ft	mt	ppb	cm/d	cm/d
STA1E	5.0	108	19.7	148	101	1.4	11.1	1.80	13.8
STA1W	12.4	313	67.3	174	306	4.2	11.1	2.10	26.0
STA2B	15.5	337	45.6	110	342	5.2	12.4	1.81	18.5
STA34	16.3	494	40.0	66	484	7.4	12.4	2.53	30.5
STA5	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#VALUE!	#REF!
STA6	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#VALUE!	#REF!
Total STA	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#VALUE!	

#REF!

STA Areas					
STA1E	R	STA1W+E	407.2	5.6	11.1
STA1W	R	STA2+34+B	826.0	12.6	12.4
STA2B	R	STA5+6	#REF!	#REF!	#REF!
STA34	R				
STA56	W2				

L = Levee; W = Waterbody; P = Published; R = Draft 2011 Revised; AD = USEPA AD 2010; W2 = Comp. C mitigation area removed
Refer to Sheet "STA_Areas" for Effective Treatment Area calculations

FEB Calculations	FEB_S5A	FEB_34	FEB_56	FEBS5A_N
DMSTA calibration	none	EMG_3	RES_3	EMG_3
Area kac	0.786	13.5	0	0
HRT days	30	30	30	30
Bypass Depth ft	58.5	4	4	4
LowQ Bypass cfs	250	200	50	100
Max Qin cfs	2000	5500	1000	2000
Max Qout cfs	450	9999	9999	500
Control Depth ft	5	0.5	1.25	1
Min Release Depth ft	5	0.5	1.25	1
Regulation Schedule	FEB_REG			
STA WS Release	Rel_opt			
Farm WS Release				REL_FARM
Frac Irrig Demand	0.5			0.25
Frac C51 Urban WS	1			
STA Expansion	STA1WX	STA34X	STA56X	Exist Cell Calib
Area kac	5.9	0	0	
Fraction SAV	-0.8	0.67	0.4	
Enhanced	SAV_3	SAV_3	EMG_3	SAV_3
Treat C139 Annex Runoff in STA56	FALSE			
Base Period for Concs	3	1=2005-2009, 2=1995-2009, 3=2000-2009		
Use Lake P Concs	TRUE	for Lake Releases		
C139 Load Reduc	35%	Max TP ppb	0	C139 calc 35.23%
STA Duty Cycle	0.95	New Lake Rel kaf	0	
Target Conc ppb	12.5	Iterations	1	use iter=1 for testing, 2 for final
Output Interval	1	S5A/C51 Cmax	0	
S5A Load Reduc	0%	S678 Cmax	0	
EBWCD Load Reduc	0%	C139 Cmax	0	
Treat Urban WS	TRUE	Modify Lake WS to STA6		TRUE

Release Mutiplying factor	
FEB5A_STA1W	1
FEB34_STA34	5
FEB34_STA2B	5
FEB56_STA5	1

		Treated Inflow			Outflows				
	Area	Flow	Load	Conc	Flow	Load	Conc	Depth cm	
FEBs	kac	kac-ft	mt	ppb	kac-ft	mt	ppb	Mean	Min
FEBS5A_N	0.0	0	0.0	#N/A	0	0.0	#N/A	0	0
FEB_S5A	0.8	161	35.2	178	0	0.0	#N/A	735	117
FEB_34	13.5	365	43.0	96	363	15.5	35	53	1
FEB_56	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
Total FEB	14.3	525	78.2	121	363	15.5	35		

Optional:
See FEB_Design Sheet
See input series sheet
""
A1 Res Seep 0
1 or <0= Series, 0-0.99 = Paralle

Input Time Series	Flow	Load	Conc	Flow	Flow CV	Flow Max
	kac-ft	mt	ppb	cfs	-	cfs
TS_FEBS5A_N	0.0	0.0	0	0	#N/A	0
TS_FEBS5A	310.9	66.8	174	429	1.60	5345
TS_STA1DW	1.9	0.4	176	3	10.59	647
TS_STA1W	0.0	0.0	0	0	#N/A	0
TS_STA1E	107.8	19.7	148	149	0.84	1142
TS_STA2B	248.6	40.2	131	343	1.99	3626
TS_FEB34	482.7	60.3	101	666	2.08	8222
TS_STA34	0.0	0.0	0	0	#N/A	0
TS_FEB56	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
Total	#REF!	#REF!	#REF!	0	0.00	0

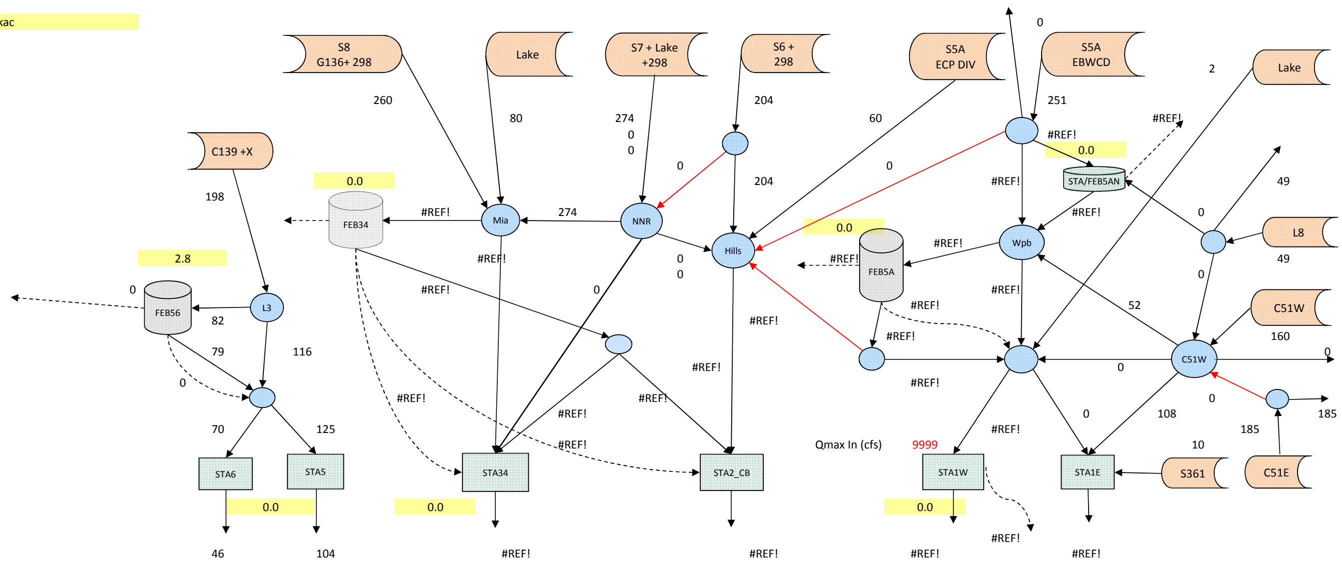
Watershed Areas	Land kac	Fraction	New STA kac	FEB kac	Runoff Rescale
Scale_S5A	107	1	5.9	0.8	0.99
Scale_S6	105	1			1.00
Scale_S7	120	1	0.0	13.5	0.89
Scale_S8	120	0			1.00
Scale_Annex	18	1	0.0	0.0	0.00
Scale_S5A_DIV	23	1	5.9		0.74

S5A Runoff Adj. Location for STA1WX 2 1 = S5A/WBWCD, 2 = S5A ECP DIV

End of Design Input Parameters .....

Scenario: sfwmd_w_01mar2012 C139 Conc 35% Reduc, C139A Not Treated in STA56, 2,800 ac FEB, STA56 PEW Calib Displayed: Flow kac

STA Expansion kac



	STA6	STA5		STA34	STA2_CB	STA1W		STA1E	Totals
STA Outflow TP ppb	11.8	11.8		#REF!	#REF!	#REF!		#REF!	#REF!
STA Expansion kac	0.0			0.0		0.0			0.0
STA Total Area kac	5.4	9.1		#REF!	#REF!	#REF!		#REF!	#REF!
STA Outflow kacf/yr	46	104		#REF!	#REF!	#REF!		#REF!	#REF!
WCA Inflow kacft			#REF!		#REF!		#REF!		#REF!

Starting Date for Simulation	01/01/65
Ending Date for Simulation	04/30/05
Starting Date for Output	05/01/65

Inputs for Scenario sfwmd_w_01ma C139 Conc 35% Reduc, C139A Not Treated in STA56, 2,800 ac FEB, STA56 PEW Calib

Diversion Rules

Diversion	Default	Diverted to	Fraction	Qmax	Description
C51E Diversion	C51W Canal	EAST	0		
S5A Div (ECART)	S5A Div	HILLS_C	0		divert to hills up to qmax
S5A Div (ECART)	S5A Div	HILLS_C	0		low-flow bypass to WPB
S5A Div to FEB North	FEBS5A	FEBS5A_N	0		northern STA.FEB
FEB S5A Outflow	HILLS_C	STA1DW	1	9999	diversion to Hills
C51W Outflow	EAST	STA1E	0.672		direct to STA1E
C51W Outflow	EAST	STA1_DW	0		direct to STA1DW
C51W Outflow	EAST	FEB_S5A	1		remainder to East
STA1W Distrib	STA1W	STA1E	0		WPB C STA1E
S6 Runoff	STA2CB	NNRC	0		S6 divert to NNR
NNR Canal	FEB34	STA34	0		NNR LowQ Bypass to STA34
STA56 Distrib	STA5	STA6	0.357		Balance STA56 Loads, Hint= 0.373
L8 to STA1N	North	FEBS5A_N	0		To FEB S5AN (Rest to C51W)
L8 to C51W	North	C51W	0		CERP
NNR to CB	STA34	Comp B	0		Original Design for Comp B =1
NNR to CB 2	STA34	Comp B	0		Additional NNR Diversion to CB
S5A to WS	S5A Div	WS	0		
FEB34 Distrib	STA34	STA2B	0.000		
Other					
Other					

Mass Balance Summary sfwmd_w_01m project_sfwmd_w_01mar2012.xls Run Date #REF!

		Inflows			Outflows				
	Area	Flow	Load	Conc	Flow	Load	Conc	HLR	HLR Max
STA	kac	kac-ft	mt	ppb	kac-ft	mt	ppb	cm/d	cm/d
STA1E	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#VALUE!	#REF!
STA1W	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#VALUE!	#REF!
STA2B	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#VALUE!	#REF!
STA34	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#VALUE!	#REF!
STA5	9.1	125	18.0	117	104	1.5	11.8	1.15	11.9
STA6	5.4	70	10.0	117	46	0.7	11.8	1.08	11.1
Total STA	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#VALUE!	

STA Areas					
STA1E	R	STA1W+E	#REF!	#REF!	#REF!
STA1W	R	STA2+34+B	#REF!	#REF!	#REF!
STA2B	R	STA5+6	150.0	2.2	11.8
STA34	R				
STA56	W2				

L = Levee; W = Waterbody; P = Published; R = Draft 2011 Revised; AD = USEPA AD 2010; W2 = Comp. C mitigation area removed
Refer to Sheet "STA_Areas" for Effective Treatment Area calculations

FEB Calculations	FEB_S5A	FEB_34	FEB_56	FEBS5A_N	ase Mutiplying factor	
DMSTA calibration	RES_3	EMG_3	custom	EMG_3	FEB5A_STA1W	1
Area kac	0	0	2.8	0	FEB34_STA34	1
HRT days	30	30	30	30	FEB34_STA2B	1
Bypass Depth ft	58.5	4	4	4	FEB56_STA5	1
LowQ Bypass cfs	200	400	50	100		
Max Qin cfs	2000	9999	1000	2000	FEB56 Seepage	0.001
Max Qout cfs	320	9999	9999	500	Seep to STA	0%
Control Depth ft	1.5	1.5	1.25	0.5		
Min Release Depth ft	1.5	1.5	1.25	0.5	Optional:	
Regulation Schedule	FEB_REG	FEB_REG			See FEB_Design Sheet	
STA WS Release	Rel_opt	REL_STA			See input series sheet	
Farm WS Release				REL_FARM	""	
Frac Irrig Demand	0.5			0.25		
Frac C51 Urban WS	1					
STA Expansion	STA1WX	STA34X	STA56X			
Area kac	0	0	0			
Fraction SAV	1	0.67	0.4		1 = Series, 0-0.99 = Parallel	
Ehnanced	SAV_3	SAV_3	PEW_3			
Treat C139 Annex Runoff in STA56	FALSE					
Base Period for Concs	3	1=2005-2009, 2=1995-2009, 3=2000-2009				
Use Lake P Concs	TRUE	for S354 & S351 Lake Releases				
C139 Load Reduc	35%	Max TP ppb	0	C139 calc	35.23%	
STA Duty Cycle	0.95	New Lake Rel kaf	0			
Target Conc ppb	13	Iterations	1	use iter=1 for testing, 2 for final		
Output Interval	1	S5A/C51 Cmax	0			
S5A Load Reduc	0%	S678 Cmax	0			
EBWCD Load Reduc	0%	C139 Cmax	0			
Treat Urban WS	TRUE	Modify Lake WS to STA6		TRUE		
Watershed Areas	Land kac	Fraction	New STA kac	FEB kac	Runoff Rescale	
Scale_S5A	107	1	0.0	0.0	1.00	
Scale_S6	105	1			1.00	
Scale_S7	120	1	0.0	0.0	1.00	
Scale_S8	120	0			1.00	
Scale_Annex	18	1	0.0	2.8	0.00	
Scale_S5A_DIV	23	1	0.0		1.00	

		Treated Inflow			Outflows				
	Area	Flow	Load	Conc	Flow	Load	Conc	Depth cm	
FEBs	kac	kac-ft	mt	ppb	kac-ft	mt	ppb	Mean	Min
FEBS5A_N	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
FEB_S5A	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
FEB_34	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
FEB_56	2.8	82	14.9	147	79	5.7	59	79	1
Total FEB	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!		

Input Time Series	Flow	Load	Conc	Flow	Flow CV	Flow Max
	kac-ft	mt	ppb	cfs	-	cfs
TS_FEBS5A_N	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
TS_FEBS5A	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
TS_STA1DW	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
TS_STA1W	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
TS_STA1E	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
TS_STA2B	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
TS_FEB34	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
TS_STA34	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
TS_FEB56	197.5	37.1	152	273	1.08	2584
Total	#REF!	#REF!	#REF!	0	0.00	0

S5A Runoff Adj. Location for STA1WX 2 1 = S5A/WBWCD, 2 = S5A ECP DIV

End of Design Input Parameters .....

DMSTA2 - Network Simulation

Model Release: 07/29/11
Current Date: 04/04/12
Forecast Type: Base
Stop after Case Num:

Network Name: NET_EAA   Project: PROJECT_SFWMD_EC_01MAR2012V2
Description: Network for EAA Basins

Routing Table — Enter a downstream CASE name or OUTLET number (1-5) in rows 9-13

Case Name-->	FEBS5A_N	FEB_S5A	FEBS5A_OUT	STA1_DW	STA1W	STA1E	FEB_34	FEB34_OUT	STA2B	STA34
Send Bypass to -->	FEB_S5A	STA1_DW	STA1_DW	STA1E	1	2	STA34	STA34	3	4
Send Release 1 to -->	FEB_S5A	STA1_DW					STA34			
Send Release 2 to -->	5	5					STA2B			
Send Outflow to -->	FEB_S5A	FEBS5A_OUT	STA2B	**STA1W**	1	2	FEB34_OUT	STA2B	3	4
Send Seepage to -->							FEB34_OUT			

Overall Mass Balance		Flow	Load	FWC	Geo Mn
Outlet Number	Outlet Description	hm3/yr	kg/yr	ppb	ppb
Outlet 1	STA1W	378.1	4204	11.1	8.0
Outlet 2	STA1E	124.6	1379	11.1	8.6
Outlet 3	STA2B	422.0	5229	12.4	7.4
Outlet 4	STA34	597.6	7393	12.4	8.4
Outlet 5	AGRIC	0.0	0	#N/A	#N/A
Total Outlets		1522.3	18205	12.0	
Watershed Inputs		1546.5	199996	129.3	134.9
Storage Increase		-0.3	319		
Rain - ET		-4.1	8480		
Net Seepage Losses		20.5	1917		
Burial		0.0	188029		
Mass Balance Check		0.0	5		
Input/Outlet Reduction		24.3	181791	117.4	
Reduction %		2%	91%	91%	

Select Network:

Select Simulation Type:

DMSTA2- Inputs & Outputs

Project: PROJECT_SFWMD_EC_01MAR2012

Model Release:

Current Date:

Input Variable	Units	Value
Design Case Name	-	FEB_S5A
Input Series Name		TS_FEBS5A
Starting Date for Simulation	-	01/01/65
Ending Date for Simulation	-	04/30/05
Starting Date for Output	-	05/01/65
Integration Steps Per Day	-	4
Number of Iterations	-	1
Output Averaging Interval	days	1
Inflow Conc Scale Factor	-	1
Rainfall P Conc	ppb	10
Atmospheric P Load (Dry)	mg/m2-yr	20

Case Description:

S5A Flow Equalization Basin	Area kac	0.786	Control Z	5	Duty Cyc:	1
TS Contains Rule for Irrigation Withdrawal	HRT Days	30	Release Z	5		
Outflow & Bypass to STA1 Inflow Distr	Byp Depth ft	58.5	Frac to Hill:	1		
Outflow to Hills	Qin max cfs	2000	Low Byp	250		
Bypass to STA1DW	Qo Max cfs	450				

Simulation Type:

Output Variable	Mean	Lower CL	Upper CL	Diagnostics		
FWM Outflow C (ppb)	#N/A	#N/A	#N/A	H20 Balance Error Mean & Max	0.0%	0.0%
GM Outflow C (ppb)	#N/A	#N/A	#N/A	Mass Balance Error Mean & Max	0.0%	0.0%
Load Reduction %	0%	#N/A	#N/A	Iterations & Convergence	1	0.0%
Bypass Load (%)	47.2%			Warning/Error Messages	3	

Cell Number -->		1	2	3	4	5	6	7	8	9	10	11	12
Cell Label	-	LowQ Byp	FEB_S5A										
Vegetation Type	-->	none	none										
Inflow Fraction	-	1											
Downstream Cell Number	-	2											
Surface Area	km2		3.18										
Mean Width of Flow Path	km		1.78										
Number of Tanks in Series	-		1.0										
Minimum Depth for Releases	cm		152										
Release 1 Series Name			Rel_opt										
Release 2 Series Name													
Outflow Series Name													
Depth Series Name			FEB_REG										
Outflow Control Depth	cm		9999										
Outflow Weir Depth	cm												
Outflow Coefficient - Exponent	-		1										
Outflow Coefficient - Intercept	-		0.059465										
Bypass Depth	cm		1783.537										
Maximum Inflow	hm3/day		4.896911										
Maximum Outflow	hm3/day	-0.61211387	1.101805										
Inflow Seepage Rate	(cm/d) / cm												
Inflow Seepage Control Elev	cm												
Inflow Seepage Conc	ppb												
Outflow Seepage Rate	(cm/d) / cm												
Outflow Seepage Control Elev	cm												
Max Outflow Seepage Conc	ppb												
Seepage Recycle to Cell Number	-												
Seepage Recycle Fraction	-												
Seepage Discharge Fraction	-												
Initial Water Column Conc	ppb		50										
Initial P Storage Per Unit Area	mg/m2		1079.532										
Initial Water Column Depth	cm		30										
C0 = Conc at 0 g/m2 P Storage	ppb												
C1 = Conc at 1 g/m2 P storage	ppb												
C2 = Conc at Half-Max Uptake	ppb												
K = Net Settling Rate at Steady State	m/yr												
Z1 = Saturated Uptake Depth	cm												
Z2 = Lower Penalty Depth	cm												
Z3 = Upper Penalty Depth	cm												

DMSTA2- Inputs & Outputs

Project: PROJECT_SFWMD_EC_01MAR2012

Model Release:

Current Date:

Input Variable	Units	Value	Case Description:		
Design Case Name	-	FEBS5A_OUT	Splits FEB Outflow to Hills or STA1DW	Duty Cyc:	1
Input Series Name		TS_NULL	Fraction to STA1DW 1		
Starting Date for Simulation	-	01/01/65	Max Flow to STA1D\ 9999		
Ending Date for Simulation	-	04/30/05	Bypass goes to STA1DW, Outflow goes to HILLS		
Starting Date for Output	-	05/01/65			
Integration Steps Per Day	-	4	Simulation Type:		
Number of Iterations	-	1			
Output Averaging Interval	days	1			
Inflow Conc Scale Factor	-	1			
Rainfall P Conc	ppb	10			
Atmospheric P Load (Dry)	mg/m2-yr	20			

Output Variable	Mean	Lower CL	Upper CL	Diagnostics		
FWM Outflow C (ppb)	#N/A	#N/A	#N/A	H20 Balance Error Mean & Max	0.0%	#N/A
GM Outflow C (ppb)	#N/A	#N/A	#N/A	Mass Balance Error Mean & Max	0.0%	#N/A
Load Reduction %	#N/A	#N/A	#N/A	Iterations & Convergence	1	0.0%
Bypass Load (%)	#N/A			Warning/Error Messages	5	

Cell Number -->		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Cell Label	-	To STA1DW	To Hills										
Vegetation Type	-->	none	none										
Inflow Fraction	-	1											
Downstream Cell Number	-	2											
Surface Area	km2												
Mean Width of Flow Path	km												
Number of Tanks in Series	-												
Minimum Depth for Releases	cm												
Release 1 Series Name													
Release 2 Series Name													
Outflow Series Name													
Depth Series Name													
Outflow Control Depth	cm												
Outflow Weir Depth	cm												
Outflow Coefficient - Exponent	-												
Outflow Coefficient - Intercept	-												
Bypass Depth	cm												
Maximum Inflow	hm3/day												
Maximum Outflow	hm3/day	-24.48210632											
Inflow Seepage Rate	(cm/d) / cm												
Inflow Seepage Control Elev	cm												
Inflow Seepage Conc	ppb												
Outflow Seepage Rate	(cm/d) / cm												
Outflow Seepage Control Elev	cm												
Max Outflow Seepage Conc	ppb												
Seepage Recycle to Cell Number	-												
Seepage Recycle Fraction	-												
Seepage Discharge Fraction	-												
Initial Water Column Conc	ppb												
Initial P Storage Per Unit Area	mg/m2												
Initial Water Column Depth	cm												
C0 = Conc at 0 g/m2 P Storage	ppb												
C1 = Conc at 1 g/m2 P storage	ppb												
C2 = Conc at Half-Max Uptake	ppb												
K = Net Settling Rate at Steady State	m/yr												
Z1 = Saturated Uptake Depth	cm												
Z2 = Lower Penalty Depth	cm												
Z3 = Upper Penalty Depth	cm												

DMSTA2- Inputs & Outputs

Project: PROJECT_SFWMD_EC_01MAR2012

Model Release:
Current Date:

Input Variable	Units	Value	Case Description:						
Design Case Name	-	STA1_DW	STA Inflow Distribution - to STA1E, W, X					Duty Cyc:	1
Input Series Name		TS_STA1DW	STA	STA1E	STA1W				
Starting Date for Simulation	-	01/01/65	Split	0	1				
Ending Date for Simulation	-	04/30/05	Stream	Bypass	Outflow				
Starting Date for Output	-	05/01/65							
Integration Steps Per Day	-	4	Simulation Type:						
Number of Iterations	-	1	Output Variable	Mean	Lower CL	Upper CL	Diagnostics		
Output Averaging Interval	days	1	FWM Outflow C (ppb)	173.8	#N/A	#N/A	H20 Balance Error Mean & Max	0.0%	#N/A
Inflow Conc Scale Factor	-	1	GM Outflow C (ppb)	161.8	#N/A	#N/A	Mass Balance Error Mean & Max	0.0%	#N/A
Rainfall P Conc	ppb	10	Load Reduction %	0%	#N/A	#N/A	Iterations & Convergence	1	0.0%
Atmospheric P Load (Dry)	mg/m2-yr	20	Bypass Load (%)	0.0%			Warning/Error Messages	3	

Cell Number -->		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Cell Label	-	To 1W	To 1E										
Vegetation Type	-->	none	none										
Inflow Fraction	-	1											
Downstream Cell Number	-												
Surface Area	km2												
Mean Width of Flow Path	km												
Number of Tanks in Series	-												
Minimum Depth for Releases	cm												
Release 1 Series Name													
Release 2 Series Name													
Outflow Series Name													
Depth Series Name													
Outflow Control Depth	cm												
Outflow Weir Depth	cm												
Outflow Coefficient - Exponent	-												
Outflow Coefficient - Intercept	-												
Bypass Depth	cm												
Maximum Inflow	hm3/day		0.00001										
Maximum Outflow	hm3/day												
Inflow Seepage Rate	(cm/d) / cm												
Inflow Seepage Control Elev	cm												
Inflow Seepage Conc	ppb												
Outflow Seepage Rate	(cm/d) / cm												
Outflow Seepage Control Elev	cm												
Max Outflow Seepage Conc	ppb												
Seepage Recycle to Cell Number	-												
Seepage Recycle Fraction	-												
Seepage Discharge Fraction	-												
Initial Water Column Conc	ppb												
Initial P Storage Per Unit Area	mg/m2												
Initial Water Column Depth	cm												
C0 = Conc at 0 g/m2 P Storage	ppb												
C1 = Conc at 1 g/m2 P storage	ppb												
C2 = Conc at Half-Max Uptake	ppb												
K = Net Settling Rate at Steady State	m/yr												
Z1 = Saturated Uptake Depth	cm												
Z2 = Lower Penalty Depth	cm												
Z3 = Upper Penalty Depth	cm												

DMSTA2- Inputs & Outputs

Project: PROJECT_SFWMD_EC_01MAR2012

Model Release:
Current Date:

Input Variable	**Units**	**Value**	**Case Description:**										
Design Case Name	-	STA1W	STA1W w Series		Expansion			Existing	Expanded	Total	inTotal	Duty Cyc:	0.95
Input Series Name		TS_STA1W	No Seepage Recycle				Area		5.9	12.44065	6.54065		
Starting Date for Simulation	-	01/01/65	Fed by STA1 Inflow Distribution Works				SAV% =		-0.8	0.011326			
Ending Date for Simulation	-	04/30/05	Expansion Cells 1WX-A & B				Check Total Area			12.44065	Cells 1A,2a,5		EMG_3
Starting Date for Output	-	05/01/65	For C51E_B: Conv 1A & 2A to SAV				Check Inflow Frac			1		Max. Inflow	05/17/27
Integration Steps Per Day	-	4	Simulation Type:										
Number of Iterations	-	1	Output Variable		Mean	Lower CL	Upper CL		Diagnostics				
Output Averaging Interval	days	1	FWM Outflow C (ppb)		11.1	#N/A	#N/A		H20 Balance Error Mean & Max			0.0%	0.0%
Inflow Conc Scale Factor	-	1	GM Outflow C (ppb)		8.0	#N/A	#N/A		Mass Balance Error Mean & Max			0.0%	0.0%
Rainfall P Conc	ppb	10	Load Reduction %		94%	#N/A	#N/A		Iterations & Convergence			1	0.0%
Atmospheric P Load (Dry)	mg/m2-yr	20	Bypass Load (%)		0.0%				Warning/Error Messages			13	
Cell Number -->		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Cell Label	-	1A	1B	3	2A	2B	4	5A	5B	1WX-A	1WX-B		
Vegetation Type	-->	EMG_3	SAV_3	SAV_3	EMG_3	SAV_3	SAV_3	EMG_3	SAV_3	EMG_3	SAV_3		
Inflow Fraction	-	0.331754279			0.209199			0.459046					
Downstream Cell Number	-	2	3	9	5	6	9	8	9	10			
Surface Area	km2	2.89	2.34	3.57	2.84	1.25	1.45	2.44	9.72	4.78	19.11		
Mean Width of Flow Path	km	1.10	1.10	1.10	2.40	2.00	1.30	1.78	2.34	2.19	2.19		
Number of Tanks in Series	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0	3.0		
Minimum Depth for Releases	cm												
Release 1 Series Name													
Release 2 Series Name													
Outflow Series Name													
Depth Series Name													
Outflow Control Depth	cm	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	40	40		
Outflow Weir Depth	cm												
Outflow Coefficient - Exponent	-	4	4	4	4	4	4	4	4	4	4		
Outflow Coefficient - Intercept	-	1	1	1	1	1	1	1	1	1	1		
Bypass Depth	cm												
Maximum Inflow	hm3/day	8.122043525			5.121639			11.23842					
Maximum Outflow	hm3/day												
Inflow Seepage Rate	(cm/d) / cm	0.0084	0.00432	0.00552									
Inflow Seepage Control Elev	cm	172	172	185									
Inflow Seepage Conc	ppb	20	20	20									
Outflow Seepage Rate	(cm/d) / cm	0.0002	0.0002	0.0051	0.00927	0.004356	0.00787	0.0059	0.00562				
Outflow Seepage Control Elev	cm												
Max Outflow Seepage Conc	ppb												
Seepage Recycle to Cell Number	-												
Seepage Recycle Fraction	-												
Seepage Discharge Fraction	-												
Initial Water Column Conc	ppb	30	30	30	30	30	30	30	30	40	40		
Initial P Storage Per Unit Area	mg/m2	4783.993416	3298.823	1732.969	4616.234	3117.595	1836.039	5157.009	2228.1	1277.017	481.7938		
Initial Water Column Depth	cm	40	40	40	40	40	40	40	40	40	40		
C0 = Conc at 0 g/m2 P Storage	ppb	3	3	3	3	3	3	3	3	3	3		
C1 = Conc at 1 g/m2 P storage	ppb	22	22	22	22	22	22	22	22	22	22		
C2 = Conc at Half-Max Uptake	ppb	300	300	300	300	300	300	300	300	300	300		
K = Net Settling Rate at Steady State	m/yr	16.8	52.5	52.5	16.8	52.5	52.5	16.8	52.5	16.8	52.5		
Z1 = Saturated Uptake Depth	cm	40	40	40	40	40	40	40	40	40	40		
Z2 = Lower Penalty Depth	cm	100	100	100	100	100	100	100	100	100	100		
Z3 = Upper Penalty Depth	cm	200	200	200	200	200	200	200	200	200	200		

DMSTA2- Inputs & Outputs

Project: PROJECT_SFWMD_EC_01MAR2012

Model Release:

Current Date:

Input Variable	Units	Value	Case Description:									
Design Case Name	-	STA1E	GG Update Sept 2009								Duty Cyc:	0.95
Input Series Name		TS_STA1E	Calibrated Hydraulics, No Seepage Recycle Area kc=									
Starting Date for Simulation	-	01/01/65	No Inflow Distribution Cell				SAV% =					
Ending Date for Simulation	-	04/30/05	Fed by S361 & C51W Canal									
Starting Date for Output	-	05/01/65	No Design Changes									
Integration Steps Per Day	-	4	Simulation Type:									
Number of Iterations	-	1	Output Variable		Mean	Lower CL	Upper CL		Diagnostics			
Output Averaging Interval	days	1	FWM Outflow C (ppb)		11.1	#N/A	#N/A		H20 Balance Error Mean & Max		0.0%	0.0%
Inflow Conc Scale Factor	-	1	GM Outflow C (ppb)		8.6	#N/A	#N/A		Mass Balance Error Mean & Max		0.0%	0.0%
Rainfall P Conc	ppb	10	Load Reduction %		93%	#N/A	#N/A		Iterations & Convergence		1	0.0%
Atmospheric P Load (Dry)	mg/m2-yr	20	Bypass Load (%)		0.0%				Warning/Error Messages		10	
Cell Number -->		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Cell Label	-	1	2	3	4N	4S	7	5	6				
Vegetation Type	-->	EMG_3	SAV_3	EMG_3	SAV_3	SAV_3	EMG_3	EMG_3	SAV_3				
Inflow Fraction	-	0.21665999		0.388266			0.167276	0.227798					
Downstream Cell Number	-	2		4	5		8	8					
Surface Area	km2	2.19	2.19	2.31	2.57	2.96	1.61	2.19	4.18				
Mean Width of Flow Path	km	1.55	1.55	1.55	1.55	1.55	1.61	1.18	0.75				
Number of Tanks in Series	-	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0				
Minimum Depth for Releases	cm												
Release 1 Series Name													
Release 2 Series Name													
Outflow Series Name													
Depth Series Name													
Outflow Control Depth	cm	38	38	38	38	38	38	38	38				
Outflow Weir Depth	cm												
Outflow Coefficient - Exponent	-	4	4	4	4	4	4	4	4				
Outflow Coefficient - Intercept	-	1	1	1	1	1	1	1	1				
Bypass Depth	cm												
Maximum Inflow	hm3/day												
Maximum Outflow	hm3/day												
Inflow Seepage Rate	(cm/d) / cm						0.0054		0.0057				
Inflow Seepage Control Elev	cm						69		94				
Inflow Seepage Conc	ppb						20		20				
Outflow Seepage Rate	(cm/d) / cm	0.00789	0.00155	0.00155	0.00155	0.013062	0.00155	0.00155	0.00155				
Outflow Seepage Control Elev	cm												
Max Outflow Seepage Conc	ppb	20	20	20	20	20	20	20	20				
Seepage Recycle to Cell Number	-												
Seepage Recycle Fraction	-												
Seepage Discharge Fraction	-												
Initial Water Column Conc	ppb	30	30	30	30	30	30	30	30				
Initial P Storage Per Unit Area	mg/m2	3387.53122	768.3317	3966.34	1527.572	310.6707	3430.848	3474.946	845.8887				
Initial Water Column Depth	cm	40	40	40	40	40	40	40	40				
C0 = Conc at 0 g/m2 P Storage	ppb	3	3	3	3	3	3	3	3				
C1 = Conc at 1 g/m2 P storage	ppb	22	22	22	22	22	22	22	22				
C2 = Conc at Half-Max Uptake	ppb	300	300	300	300	300	300	300	300				
K = Net Settling Rate at Steady State	m/yr	16.8	52.5	16.8	52.5	52.5	16.8	16.8	52.5				
Z1 = Saturated Uptake Depth	cm	40	40	40	40	40	40	40	40				
Z2 = Lower Penalty Depth	cm	100	100	100	100	100	100	100	100				
Z3 = Upper Penalty Depth	cm	200	200	200	200	200	200	200	200				

DMSTA2- Inputs & Outputs

Project: PROJECT_SFWMD_EC_01MAR2012

Model Release:

Current Date:

Input Variable	Units	Value	Case Description:					
Design Case Name	-	FEB_34	S5A Flow Equalization Basin	Area kac	13.5	Control Z 0.5	Duty Cyc:	1
Input Series Name		TS_FEB34	TS Contains Rule for Irrigation Withdrawal	HRT Days	30	Release Z 0.5		
Starting Date for Simulation	-	01/01/65	Outflow & Bypass to STA1 Inflow Distr	Byp Depth ft	4	Low Q Byp 200		
Ending Date for Simulation	-	04/30/05	Network inflow from FEB34_IN	Qin max cfs	5500	Calibration EMG_3		
Starting Date for Output	-	05/01/65	TS_FEB34 has rainfall, release, reg	Qo Max cfs	9999			

Input Variable	Units	Value	Simulation Type:						
Integration Steps Per Day	-	4							
Number of Iterations	-	1	Output Variable	Mean	Lower CL	Upper CL	Diagnostics		
Output Averaging Interval	days	1	FWM Outflow C (ppb)	34.7	#N/A	#N/A	H20 Balance Error Mean & Max	0.0%	0.0%
Inflow Conc Scale Factor	-	1	GM Outflow C (ppb)	29.6	#N/A	#N/A	Mass Balance Error Mean & Max	-0.1%	0.1%
Rainfall P Conc	ppb	10	Load Reduction %	46%	#N/A	#N/A	Iterations & Convergence	1	0.0%
Atmospheric P Load (Dry)	mg/m2-yr	20	Bypass Load (%)	28.7%			Warning/Error Messages	2	

Cell Number -->		1	2	3	4	5	6	7	8	9	10	11	12
Cell Label	-	LowQByp	FEB_34		RES_3	EMG_3	EMG_3L						
Vegetation Type	-->	none	EMG_3		RES_3	EMG_3	none						
Inflow Fraction	-	1											
Downstream Cell Number	-	2											
Surface Area	km2		54.66										
Mean Width of Flow Path	km		7.39										
Number of Tanks in Series	-		3.0		1.0	3.0	1.0						
Minimum Depth for Releases	cm		15										
Release 1 Series Name													
Release 2 Series Name													
Outflow Series Name													
Depth Series Name													
Outflow Control Depth	cm		15.24										
Outflow Weir Depth	cm												
Outflow Coefficient - Exponent	-		4		1	4	4						
Outflow Coefficient - Intercept	-		1		0.246443	1	1						
Bypass Depth	cm		121.9512										
Maximum Inflow	hm3/day		13.46651										
Maximum Outflow	hm3/day	-0.4896911	24.48211										
Inflow Seepage Rate	(cm/d) / cm												
Inflow Seepage Control Elev	cm												
Inflow Seepage Conc	ppb												
Outflow Seepage Rate	(cm/d) / cm												
Outflow Seepage Control Elev	cm												
Max Outflow Seepage Conc	ppb												
Seepage Recycle to Cell Number	-												
Seepage Recycle Fraction	-												
Seepage Discharge Fraction	-												
Initial Water Column Conc	ppb		10										
Initial P Storage Per Unit Area	mg/m2		1693.108										
Initial Water Column Depth	cm		15										
C0 = Conc at 0 g/m2 P Storage	ppb		3				3						
C1 = Conc at 1 g/m2 P storage	ppb		22				13						
C2 = Conc at Half-Max Uptake	ppb		300				300						
K = Net Settling Rate at Steady State	m/yr		16.8				10.0						
Z1 = Saturated Uptake Depth	cm		40				40						
Z2 = Lower Penalty Depth	cm		100				100						
Z3 = Upper Penalty Depth	cm		200				200						

DMSTA2- Inputs & Outputs

Project: PROJECT_SFWMD_EC_01MAR2012

Model Release:

Current Date:

Case Description:

Splits FEB Outflow to STA34 or STA2B — Duty Cyc: 1

Fraction to STA2B		0.19
Max Flow	STA34	1600

Bypass goes to STA34 Outflow goes to STA2B

Input Variable	**Units**	**Value**
Design Case Name	-	FEB34_OUT
Input Series Name		TS_FEB34_OUT
Starting Date for Simulation	-	01/01/65
Ending Date for Simulation	-	04/30/05
Starting Date for Output	-	05/01/65
Integration Steps Per Day	-	4
Number of Iterations	-	1
Output Averaging Interval	days	1
Inflow Conc Scale Factor	-	1
Rainfall P Conc	ppb	10
Atmospheric P Load (Dry)	mg/m2-yr	20

Simulation Type:

Output Variable	Mean	Lower CL	Upper CL
FWM Outflow C (ppb)	48.9	#N/A	#N/A
GM Outflow C (ppb)	37.4	#N/A	#N/A
Load Reduction %	0%	#N/A	#N/A
Bypass Load (%)	81.0%		

Diagnostics		
H20 Balance Error Mean & Max	0.0%	#N/A
Mass Balance Error Mean & Max	0.0%	#N/A
Iterations & Convergence	1	0.0%
Warning/Error Messages	4	

Cell Number -->		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Cell Label	-	toSTA2B	toSTA34										
Vegetation Type	-->	none	none										
Inflow Fraction	-	0.19	0.81										
Downstream Cell Number	-												
Surface Area	km2												
Mean Width of Flow Path	km												
Number of Tanks in Series	-												
Minimum Depth for Releases	cm												
Release 1 Series Name													
Release 2 Series Name													
Outflow Series Name													
Depth Series Name													
Outflow Control Depth	cm												
Outflow Weir Depth	cm												
Outflow Coefficient - Exponent	-												
Outflow Coefficient - Intercept	-												
Bypass Depth	cm												
Maximum Inflow	hm3/day		0.00001										
Maximum Outflow	hm3/day	3.917528765											
Inflow Seepage Rate	(cm/d) / cm												
Inflow Seepage Control Elev	cm												
Inflow Seepage Conc	ppb												
Outflow Seepage Rate	(cm/d) / cm												
Outflow Seepage Control Elev	cm												
Max Outflow Seepage Conc	ppb												
Seepage Recycle to Cell Number	-												
Seepage Recycle Fraction	-												
Seepage Discharge Fraction	-												
Initial Water Column Conc	ppb												
Initial P Storage Per Unit Area	mg/m2												
Initial Water Column Depth	cm												
C0 = Conc at 0 g/m2 P Storage	ppb												
C1 = Conc at 1 g/m2 P storage	ppb												
C2 = Conc at Half-Max Uptake	ppb												
K = Net Settling Rate at Steady State	m/yr												
Z1 = Saturated Uptake Depth	cm												
Z2 = Lower Penalty Depth	cm												
Z3 = Upper Penalty Depth	cm												

DMSTA2- Inputs & Outputs

Project: PROJECT_SFWMD_EC_01MAR2012

Model Release:
Current Date:

Input Variable	Units	Value	Case Description						
Design Case Name	-	STA2B	STA-2/Comp. B				Duty Cycle	0.95	
Input Series Name		TS_STA2B	Southern 70% of Cell 2 assumed to be SAV				Area kac = 15.48719		
Starting Date for Simulation	-	01/01/65					No Expansion		
Ending Date for Simulation	-	04/30/05					S6 Runoff Diversion to STA34 =	0.00	
Starting Date for Output	-	05/01/65							
Integration Steps Per Day	-	4	Simulation Type:						
Number of Iterations	-	1	Output Variable	Mean	Lower CL	Upper CL	Diagnostics		
Output Averaging Interval	days	1	FWM Outflow C (ppb)	12.4	#N/A	#N/A	H20 Balance Error Mean & Max	0.0%	0.0%
Inflow Conc Scale Factor	-	1	GM Outflow C (ppb)	7.4	#N/A	#N/A	Mass Balance Error Mean & Max	0.0%	0.1%
Rainfall P Conc	ppb	10	Load Reduction %	89%	#N/A	#N/A	Iterations & Convergence	1	0.0%
Atmospheric P Load (Dry)	mg/m2-yr	20	Bypass Load (%)	0.0%			Warning/Error Messages	20	

Cell Number -->		1	2	3	4	5	6	7	8	9	10	11	12
Cell Label	-	1	2N	2S	3	5N	5S	6N	6S	4	7-Jan	8	
Vegetation Type	-->	PEW_3	PEW_3	SAV_3	SAV_3	EMG_3	SAV_3	EMG_3	SAV_3	SAV_3	EMG_3	SAV_3	
Inflow Fraction	-	0.11874703	0.153145		0.148176	0.208506		0.178087			0.19334		
Downstream Cell Number	-		3			6	9	8	9		11		
Surface Area	km2	7.45	3.17	6.43	9.29	2.42	6.42	2.07	5.48	7.86	6.22	5.90	
Mean Width of Flow Path	km	1.58	2.00	2.00	2.00	3.51	2.70	2.99	2.30	2.50	2.00	1.50	
Number of Tanks in Series	-	3.0	3.0	3.0	6.0	1.0	2.0	1.0	2.0	3.0	3.0	3.0	
Minimum Depth for Releases	cm												
Release 1 Series Name													
Release 2 Series Name													
Outflow Series Name													
Depth Series Name													
Outflow Control Depth	cm	52.73	29.26	29.26	35.97	42.9768	42.9768	42.9768	42.9768	46.0248	41.45	41.45	
Outflow Weir Depth	cm												
Outflow Coefficient - Exponent	-	4	4	4	4	4	4	4	4	4	4	4	
Outflow Coefficient - Intercept	-	0.815	1	2.098	2.852	1	1	1	1	1	1	1	
Bypass Depth	cm												
Maximum Inflow	hm3/day												
Maximum Outflow	hm3/day												
Inflow Seepage Rate	(cm/d) / cm					0.017819	0.006695			0.0064	0.0133	0.0164	
Inflow Seepage Control Elev	cm					48	48			60	53	63	
Inflow Seepage Conc	ppb					75	75			75	75	15	
Outflow Seepage Rate	(cm/d) / cm												
Outflow Seepage Control Elev	cm												
Max Outflow Seepage Conc	ppb												
Seepage Recycle to Cell Number	-												
Seepage Recycle Fraction	-												
Seepage Discharge Fraction	-												
Initial Water Column Conc	ppb	30	30	30	30	30	30	30	30	30	30	30	
Initial P Storage Per Unit Area	mg/m2	1027.49462	2104.605	383.4034	726.5016	2975.279	946.8444	2974.003	936.9114	274.9389	2488.151	624.3963	
Initial Water Column Depth	cm	40	40	40	40	40	40	40	40	40	40	40	
C0 = Conc at 0 g/m2 P Storage	ppb	3	3	3	3	3	3	3	3	3	3	3	
C1 = Conc at 1 g/m2 P storage	ppb	22	22	22	22	22	22	22	22	22	22	22	
C2 = Conc at Half-Max Uptake	ppb	300	300	300	300	300	300	300	300	300	300	300	
K = Net Settling Rate at Steady State	m/yr	34.9	34.9	52.5	52.5	16.8	52.5	16.8	52.5	52.5	16.8	52.5	
Z1 = Saturated Uptake Depth	cm	40	40	40	40	40	40	40	40	40	40	40	
Z2 = Lower Penalty Depth	cm	100	100	100	100	100	100	100	100	100	100	100	
Z3 = Upper Penalty Depth	cm	200	200	200	200	200	200	200	200	200	200	200	

DMSTA2- Inputs & Outputs

Project: PROJECT_SFWMD_EC_01MAR2012

Model Release:

Current Date:

Input Variable	Units	Value
Design Case Name	-	STA34
Input Series Name		TS_STA34
Starting Date for Simulation	-	01/01/65
Ending Date for Simulation	-	04/30/05
Starting Date for Output	-	05/01/65
Integration Steps Per Day	-	4
Number of Iterations	-	1
Output Averaging Interval	days	1
Inflow Conc Scale Factor	-	1
Rainfall P Conc	ppb	10
Atmospheric P Load (Dry)	mg/m2-yr	20

Case Description:

STA34 (ArcHydro levee centerline areas) with Expansion Cells — duty cycle 0.95

Expansion Area =	0	16.31864	16.31864
SAV Fraction=	0.67	0.513628	0.513628

Simulation Type:

Output Variable	Mean	Lower CL	Upper CL
FWM Outflow C (ppb)	12.4	#N/A	#N/A
GM Outflow C (ppb)	8.4	#N/A	#N/A
Load Reduction %	82%	#N/A	#N/A
Bypass Load (%)	0.0%		

Diagnostics		
H20 Balance Error Mean & Max	0.0%	#N/A
Mass Balance Error Mean & Max	0.0%	#N/A
Iterations & Convergence	1	0.0%
Warning/Error Messages	16	

Cell Number -->		1	2	3	4	5	6	7	8	9	10	11	12
Cell Label	-	1A	1B	2A	2B	3A	3B	34X-A	34X-B				
Vegetation Type	-->	EMG_3	SAV_3	EMG_3	SAV_3	EMG_3	SAV_3	EMG_3	SAV_3				
Inflow Fraction	-	0.3966436		0.327617		0.27574							
Downstream Cell Number	-	2		4		6		8					
Surface Area	km2	12.22	13.99	10.14	11.51	9.77	8.45						
Mean Width of Flow Path	km	3.42	4.50	2.89	4.02	4.88	4.88						
Number of Tanks in Series	-	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0				
Minimum Depth for Releases	cm												
Release 1 Series Name													
Release 2 Series Name													
Outflow Series Name													
Depth Series Name													
Outflow Control Depth	cm	38.1	38.1	38.1	38.1	38.1	38.1	40	40				
Outflow Weir Depth	cm												
Outflow Coefficient - Exponent	-	4	4	4	4	4	4	4	4				
Outflow Coefficient - Intercept	-	1	1	1	1	1	1	1	1				
Bypass Depth	cm												
Maximum Inflow	hm3/day												
Maximum Outflow	hm3/day												
Inflow Seepage Rate	(cm/d) / cm												
Inflow Seepage Control Elev	cm												
Inflow Seepage Conc	ppb												
Outflow Seepage Rate	(cm/d) / cm	0.000808	0.000873	7.88E-05	0.000935	7.88E-05	0.001316	0.00075	0.00075				
Outflow Seepage Control Elev	cm												
Max Outflow Seepage Conc	ppb												
Seepage Recycle to Cell Number	-												
Seepage Recycle Fraction	-												
Seepage Discharge Fraction	-												
Initial Water Column Conc	ppb	52	12	55	15	55	15	30	30				
Initial P Storage Per Unit Area	mg/m2	1854.773	511.6099	1853.428	515.5275	1766.466	522.5391	1000	1000				
Initial Water Column Depth	cm	40	40	40	40	40	40	40	40				
C0 = Conc at 0 g/m2 P Storage	ppb	3	3	3	3	3	3	3	3				
C1 = Conc at 1 g/m2 P storage	ppb	22	22	22	22	22	22	22	22				
C2 = Conc at Half-Max Uptake	ppb	300	300	300	300	300	300	300	300				
K = Net Settling Rate at Steady State	m/yr	16.8	52.5	16.8	52.5	16.8	52.5	16.8	52.5				
Z1 = Saturated Uptake Depth	cm	40	40	40	40	40	40	40	40				
Z2 = Lower Penalty Depth	cm	100	100	100	100	100	100	100	100				
Z3 = Upper Penalty Depth	cm	200	200	200	200	200	200	200	200				

DMSTA2 - Network Simulation

Model Release: 07/29/11
Current Date: 04/04/12
Forecast Type: Base
Stop after Case Num:

Network Name: NET_56

Project: PROJECT_SFWMD_W_01MAR2012

Description: STA56 With FEB

Routing Table

Enter a downstream CASE name or OUTLET number (1-5) in rows 9-13

Case Name-->	FEB_56	STA56_DW	STA5	STA6						
Send Bypass to -->	STA56_DW	STA6	1	2						
Send Release 1 to -->	STA56_DW									
Send Release 2 to -->	5									
Send Outflow to -->	STA56_DW	STA5	1	**2**						
Send Seepage to -->	STA56_DW									

Overall Mass Balance		Flow	Load	FWC	Geo Mn
Outlet Number	Outlet Description	hm3/yr	kg/yr	ppb	ppb
Outlet 1	STA5 Out	128.3	1512	11.8	8.0
Outlet 2	STA6 Out	56.9	669	11.8	8.0
Outlet 3		0.0	0	#N/A	#N/A
Outlet 4		0.0	0	#N/A	#N/A
Outlet 5	AGRIC	0.0	0	#N/A	#N/A
Total Outlets		185.2	2182	11.8	
Watershed Inputs		243.9	37144	152.3	115.7
Storage Increase		0.7	560		
Rain - ET		-1.0	2280		
Net Seepage Losses		56.9	1243		
Burial		0.0	35436		
Mass Balance Check		0.0	2		
Input/Outlet Reduction		58.7	34962	140.5	
Reduction %		24%	94%	92%	

Select Network:

Select Simulation Type:

DMSTA2- Inputs & Outputs

Project: PROJECT_SFWMD_W_01MAR2012

Model Release:

Current Date:

Input Variable	**Units**	**Value**	**Case Description:**							
Design Case Name	-	FEB_56	STA56 Flow Equilization Basin		Area kac	2.8	Control Z	1.25	Duty Cyc:	1
Input Series Name		TS_FEB56	TS Contains Rule for Irrigation Withdrawal		HRT Days	30	Release Z	1.25		
Starting Date for Simulation	-	01/01/65	Outflow & Bypass to STA56		Byp Depth ft	4	LowQ Byp:	50		
Ending Date for Simulation	-	04/30/05	Frac diverted to STA	0.357	Qin max cfs	1000	Seepage	0.001		
Starting Date for Output	-	05/01/65	Seepage Out to STA6		Qo Max cfs	9999				
Integration Steps Per Day	-	4	Simulation Type:							
Number of Iterations	-	1	Output Variable	Mean	Lower CL	Upper CL	Diagnostics			
Output Averaging Interval	days	1	FWM Outflow C (ppb)	57.7	#N/A	#N/A	H20 Balance Error Mean & Max		0.0%	0.0%
Inflow Conc Scale Factor	-	1	GM Outflow C (ppb)	56.6	#N/A	#N/A	Mass Balance Error Mean & Max		0.0%	0.0%
Rainfall P Conc	ppb	10	Load Reduction %	24%	#N/A	#N/A	Iterations & Convergence		1	0.0%
Atmospheric P Load (Dry)	mg/m2-yr	20	Bypass Load (%)	60.3%			Warning/Error Messages		2	

Cell Number -->		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Cell Label	-	LowQByp	FEB_56										
Vegetation Type	-->	none	none		Res	Emerg							
Inflow Fraction	-	1											
Downstream Cell Number	-	2											
Surface Area	km2		11.34										
Mean Width of Flow Path	km		3.37		3.37	1.92							
Number of Tanks in Series	-		3.0		1.0	3.0							
Minimum Depth for Releases	cm		38										
Release 1 Series Name													
Release 2 Series Name													
Outflow Series Name													
Depth Series Name													
Outflow Control Depth	cm		38.1										
Outflow Weir Depth	cm												
Outflow Coefficient - Exponent	-		1		1	4							
Outflow Coefficient - Intercept	-		0.112235		0.112235	1							
Bypass Depth	cm		121.9512										
Maximum Inflow	hm3/day		2.448455										
Maximum Outflow	hm3/day	-0.122423	24.48211										
Inflow Seepage Rate	(cm/d) / cm												
Inflow Seepage Control Elev	cm												
Inflow Seepage Conc	ppb												
Outflow Seepage Rate	(cm/d) / cm		0.001										
Outflow Seepage Control Elev	cm												
Max Outflow Seepage Conc	ppb												
Seepage Recycle to Cell Number	-												
Seepage Recycle Fraction	-												
Seepage Discharge Fraction	-												
Initial Water Column Conc	ppb		50										
Initial P Storage Per Unit Area	mg/m2		2964.817										
Initial Water Column Depth	cm		30										
C0 = Conc at 0 g/m2 P Storage	ppb		3										
C1 = Conc at 1 g/m2 P storage	ppb		22										
C2 = Conc at Half-Max Uptake	ppb		300										
K = Net Settling Rate at Steady State	m/yr		15.1										
Z1 = Saturated Uptake Depth	cm		40										
Z2 = Lower Penalty Depth	cm		100										
Z3 = Upper Penalty Depth	cm		200										

DMSTA2- Inputs & Outputs

Project: PROJECT_SFWMD_W_01MAR2012

Model Release:

Current Date:

Input Variable	Units	Value
Design Case Name	-	STA56_DW
Input Series Name		TS_NULL
Starting Date for Simulation	-	01/01/65
Ending Date for Simulation	-	04/30/05
Starting Date for Output	-	05/01/65
Integration Steps Per Day	-	12
Number of Iterations	-	1
Output Averaging Interval	days	1
Inflow Conc Scale Factor	-	1
Rainfall P Conc	ppb	10
Atmospheric P Load (Dry)	mg/m2-yr	20

Case Description:

FEB Outflow to Split to STA5 & STA6

Duty Cyc: 1

Fraction to STA6 = 0.357

Outflow to STA5 bypass to STA6

Simulation Type:

Output Variable	Mean	Lower CL	Upper CL
FWM Outflow C (ppb)	114.9	#N/A	#N/A
GM Outflow C (ppb)	88.4	#N/A	#N/A
Load Reduction %	0%	#N/A	#N/A
Bypass Load (%)	35.7%		

Diagnostics		
H20 Balance Error Mean & Max	0.0%	#N/A
Mass Balance Error Mean & Max	0.0%	#N/A
Iterations & Convergence	1	0.0%
Warning/Error Messages	4	

Cell Number -->		1	2	3	4	5	6	7	8	9	10	11	12
Cell Label	-	To STA5	To STA6										
Vegetation Type	-->	none	none										
Inflow Fraction	-	0.643	0.357										
Downstream Cell Number	-												
Surface Area	km2												
Mean Width of Flow Path	km												
Number of Tanks in Series	-												
Minimum Depth for Releases	cm												
Release 1 Series Name													
Release 2 Series Name													
Outflow Series Name													
Depth Series Name													
Outflow Control Depth	cm												
Outflow Weir Depth	cm												
Outflow Coefficient - Exponent	-												
Outflow Coefficient - Intercept	-												
Bypass Depth	cm												
Maximum Inflow	hm3/day		0.00001										
Maximum Outflow	hm3/day												
Inflow Seepage Rate	(cm/d) / cm												
Inflow Seepage Control Elev	cm												
Inflow Seepage Conc	ppb												
Outflow Seepage Rate	(cm/d) / cm												
Outflow Seepage Control Elev	cm												
Max Outflow Seepage Conc	ppb												
Seepage Recycle to Cell Number	-												
Seepage Recycle Fraction	-												
Seepage Discharge Fraction	-												
Initial Water Column Conc	ppb												
Initial P Storage Per Unit Area	mg/m2												
Initial Water Column Depth	cm												
C0 = Conc at 0 g/m2 P Storage	ppb												
C1 = Conc at 1 g/m2 P storage	ppb												
C2 = Conc at Half-Max Uptake	ppb												
K = Net Settling Rate at Steady State	m/yr												
Z1 = Saturated Uptake Depth	cm												
Z2 = Lower Penalty Depth	cm												
Z3 = Upper Penalty Depth	cm												

DMSTA2- Inputs & Outputs

Project: PROJECT_SFWMD_W_01MAR2012

Model Release:

Current Date:

Input Variable	Units	Value	Case Description:						
Design Case Name	-	STA5	STA5 + Compartment C Cell 4					Duty	0.95
Input Series Name		TS_STA5	No Changes			Enhanced Calib =	PEW_3		
Starting Date for Simulation	-	01/01/65	Expansion modeled as part of STA6						
Ending Date for Simulation	-	04/30/05	Total Area kac	9.066046					
Starting Date for Output	-	05/01/65	PEW%	0.42383					
Integration Steps Per Day	-	4	Simulation Type:						
Number of Iterations	-	1	Output Variable	Mean	Lower CL	Upper CL	Diagnostics		
Output Averaging Interval	days	1	FWM Outflow C (ppb)	11.7	#N/A	#N/A	H20 Balance Error Mean & Max	0.0%	0.0%
Inflow Conc Scale Factor	-	1	GM Outflow C (ppb)	8.0	#N/A	#N/A	Mass Balance Error Mean & Max	0.0%	0.0%
Rainfall P Conc	ppb	10	Load Reduction %	92%	#N/A	#N/A	Iterations & Convergence	1	0.0%
Atmospheric P Load (Dry)	mg/m2-yr	20	Bypass Load (%)	0.0%			Warning/Error Messages	3	

Cell Number -->		1	2	3	4	5	6	7	8	9	10	11	12
Cell Label	-	5-1A	5-1B	5-2A	5-2B	5-3A	5-3B	5-4A1	5-4A2	5-4A3	5-4B		
Vegetation Type	-->	EMG_3	PEW_3	EMG_3	PEW_3	EMG_3	PEW_3	EMG_3	EMG_3	EMG_3	PEW_3		
Inflow Fraction	-	0.2665729		0.267675		0.26073		0.205022					
Downstream Cell Number	-	2		4		6		8	9	10			
Surface Area	km2	4.84	4.95	4.84	4.99	5.85	3.72	2.15	1.51	1.97	1.90		
Mean Width of Flow Path	km	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56		
Number of Tanks in Series	-	3.0	3.0	3.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0		
Minimum Depth for Releases	cm												
Release 1 Series Name													
Release 2 Series Name													
Outflow Series Name													
Depth Series Name													
Outflow Control Depth	cm	38.1	60.96	38.1	60.96	38.1	60.96	38.1	38.1	38.1	60.96		
Outflow Weir Depth	cm												
Outflow Coefficient - Exponent	-	4	4	4	4	4	4	4	4	4	4		
Outflow Coefficient - Intercept	-	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
Bypass Depth	cm												
Maximum Inflow	hm3/day												
Maximum Outflow	hm3/day												
Inflow Seepage Rate	(cm/d) / cm												
Inflow Seepage Control Elev	cm												
Inflow Seepage Conc	ppb												
Outflow Seepage Rate	(cm/d) / cm	0.002	0.005	0.0015	0.00541	0.0015	0.00541	0.0015	0.0015	0.0015	0.00719		
Outflow Seepage Control Elev	cm												
Max Outflow Seepage Conc	ppb												
Seepage Recycle to Cell Number	-												
Seepage Recycle Fraction	-												
Seepage Discharge Fraction	-												
Initial Water Column Conc	ppb	30	30	30	30	30	30	30	30	30	30		
Initial P Storage Per Unit Area	mg/m2	2119.5836	435.4698	2128.175	437.5349	1893.337	426.0265	2583.462	1621.142	927.3413	352.5148		
Initial Water Column Depth	cm	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1		
C0 = Conc at 0 g/m2 P Storage	ppb	3	3	3	3	3	3	3	3	3	3		
C1 = Conc at 1 g/m2 P storage	ppb	22	22	22	22	22	22	22	22	22	22		
C2 = Conc at Half-Max Uptake	ppb	300	300	300	300	300	300	300	300	300	300		
K = Net Settling Rate at Steady State	m/yr	16.8	34.9	16.8	34.9	16.8	34.9	16.8	16.8	16.8	34.9		
Z1 = Saturated Uptake Depth	cm	40	40	40	40	40	40	40	40	40	40		
Z2 = Lower Penalty Depth	cm	100	100	100	100	100	100	100	100	100	100		
Z3 = Upper Penalty Depth	cm	200	200	200	200	200	200	200	200	200	200		

DMSTA2- Inputs & Outputs

Project: PROJECT_SFWMD_W_01MAR2012

Model Release:

Current Date:

Input Variable	Units	Value	Case Description:									
Design Case Name	-	STA6	STA6 + CompC Cell5 + STA56 Expansion								Duty	0.95
Input Series Name		TS_STA6		Existing	Expansion	Total				PEW_3		
Starting Date for Simulation	-	01/01/65	Area kac	5.391473	0	5.391473	5.391473			0.542731	0.542731	
Ending Date for Simulation	-	04/30/05		0.542731	0.4	0.542731	1			2.629903		
Starting Date for Output	-	05/01/65	Rescale HLR to Cells		1							
Integration Steps Per Day	-	4	Simulation Type:									
Number of Iterations	-	1	Output Variable		Mean	Lower CL	Upper CL		Diagnostics			
Output Averaging Interval	days	1	FWM Outflow C (ppb)		11.7	#N/A	#N/A		H20 Balance Error Mean & Max		0.0%	#N/A
Inflow Conc Scale Factor	-	1	GM Outflow C (ppb)		7.9	#N/A	#N/A		Mass Balance Error Mean & Max		0.0%	#N/A
Rainfall P Conc	ppb	10	Load Reduction %		93%	#N/A	#N/A		Iterations & Convergence		1	0.0%
Atmospheric P Load (Dry)	mg/m2-yr	20	Bypass Load (%)		0.0%				Warning/Error Messages		15	

Cell Number -->		1	2	3	4	5	6	7	8	9	10	11	12
Cell Label	-	5-5A1	5-5A2	5-5A3	5-5B	6-4	6-2	6-3	6-5	S56X_A	S56X-B		
Vegetation Type	-->	EMG_3	EMG_3	EMG_3	PEW_3	EMG_3	PEW_3	PEW_3	PEW_3	EMG_3	PEW_3		
Inflow Fraction	-	0.4877893				0.352225		0.044863	0.115123				
Downstream Cell Number	-	2	3	4		6				10			
Surface Area	km2	2.63	2.00	3.17	2.85	2.18	5.51	0.98	2.51				
Mean Width of Flow Path	km	2.34	2.34	2.34	2.34	2.34	2.34	0.61	1.31				
Number of Tanks in Series	-	2.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0		
Minimum Depth for Releases	cm												
Release 1 Series Name													
Release 2 Series Name													
Outflow Series Name													
Depth Series Name													
Outflow Control Depth	cm	38.1	38.1	38.1	60.96	38.1	60.96	38.3922	39.3063	40	40		
Outflow Weir Depth	cm							38.3922	39.3063				
Outflow Coefficient - Exponent	-	4	4	4	4	4	4	1.5	1.5	4	4		
Outflow Coefficient - Intercept	-	0.5	0.5	0.5	0.5	1	1	1.3	1.3	1	1		
Bypass Depth	cm												
Maximum Inflow	hm3/day												
Maximum Outflow	hm3/day												
Inflow Seepage Rate	(cm/d) / cm												
Inflow Seepage Control Elev	cm												
Inflow Seepage Conc	ppb												
Outflow Seepage Rate	(cm/d) / cm	0.0015	0.0015	0.0015	0.009854	0.003048	0.007204	0.009182	0.008211	0.01	0.01		
Outflow Seepage Control Elev	cm	15	15	15	-59.436	15	-30	-30	-30				
Max Outflow Seepage Conc	ppb	20	20	20	20	20	20	20	20				
Seepage Recycle to Cell Number	-												
Seepage Recycle Fraction	-												
Seepage Discharge Fraction	-												
Initial Water Column Conc	ppb	30	30	30	30	30	30	30	30	30	30		
Initial P Storage Per Unit Area	mg/m2	2645.5762	1686.214	901.5547	290.552	2595.647	440.5526	584.3545	604.1687	1000	1000		
Initial Water Column Depth	cm	38.1	38.1	38.1	38.1	38.1	38.1	10	10	40	40		
C0 = Conc at 0 g/m2 P Storage	ppb	3	3	3	3	3	3	3	3	3	3		
C1 = Conc at 1 g/m2 P storage	ppb	22	22	22	22	22	22	22	22	22	22		
C2 = Conc at Half-Max Uptake	ppb	300	300	300	300	300	300	300	300	300	300		
K = Net Settling Rate at Steady State	m/yr	16.8	16.8	16.8	34.9	16.8	34.9	34.9	34.9	16.8	34.9		
Z1 = Saturated Uptake Depth	cm	40	40	40	40	40	40	40	40	40	40		
Z2 = Lower Penalty Depth	cm	100	100	100	100	100	100	100	100	100	100		
Z3 = Upper Penalty Depth	cm	200	200	200	200	200	200	200	200	200	200		