Chapter 9: Summary of the Lower East Coast Regional Water Supply Plan

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INTRODUCTION

The *Lower East Coast Regional Water Supply Plan* (LEC Plan) provides a blueprint to help meet the water resource needs of a rapidly growing South Florida between now and 2020. Technical analyses of this area's future water needs, and the availability of water supplies, indicate that extensive actions are required to ensure that a sustainable water supply is available to fulfill future urban, agricultural and natural systems water needs. The actions recommended in this plan will meet these needs. Analyses show that the recommended projects must be built on schedule, or the region will face a significant increase in the risk of water shortages and environmental decline.

The Lower East Coast (LEC) Planning Area is expected to experience substantial growth between now and 2020, increasing by almost 58 percent from 1995. Most of this increase in population will occur in the coastal area, which is projected to have almost 7 million residents in 2020. This growth will create additional water demands for potable and irrigation water. Agricultural water demand, primarily for irrigation of row crops, ornamental horticulture, and sugarcane, is projected to decrease by 7 percent, reflecting a reduction in the area cultivated to approximately 480,000 acres. The overall water demands of consumptive users are projected to increase by 20 percent, to 2.52 billion gallons per day on average. In addition, significant increases in water supply deliveries will be needed to sustain and restore the natural systems of South Florida (SFWMD, 2000).

Development of proactive water resource and water supply development projects is imperative to both meet water demands and restore critical ecosystems in the coastal estuaries, Lake Okeechobee, the Everglades and the Biscayne Bay. Under the LEC Plan, the South Florida Water Management District (District) is primarily responsible for water resource development. Local governments, water users, and water utilities are primarily responsible for implementing water supply development. When appropriate, and resources are available, the District will also assist water supply development efforts at the local level.

PURPOSE

Implementation of the LEC Plan will do the following:

- Create a water supply that fully meets the future (2020) needs of almost 7 million people, agriculture and industries during a 1-in-10 year drought
- Reduce the number and severity of exceedences of minimum flow and levels (MFL) criteria for the Everglades, Lake Okeechobee and the Biscayne aquifer by 2020
- Reserve from allocations sufficient water to allow for the restoration of the Everglades and enhancement of other significant natural systems
- Reduce the uncertainty for issuing long-term permits for water users as they invest in tomorrow's water supply infrastructure
- Provide public forums to modernize District operational procedures and promote greater flexibility in the operation of the regional water management system.

RELATIONSHIP WITH COMPREHENSIVE EVERGLADES RESTORATION PLAN

In 1997, the District merged its LEC regional water supply analyses of major water storage facilities into the Central and Southern Florida Project Comprehensive Review (Restudy) process. The Restudy was a multiyear planning effort with a 2050 planning horizon developed by the U.S. Army Corps of Engineers and the District, which was completed in April 1999 with publication of the *Central and Southern Florida Comprehensive Review Study Final Feasibility Report and Programmatic Environmental Impact Statement* (USACE, 1999). The water supply planning efforts completed from 1992 to 1997 for the LEC Plan provided the foundation, in the form of analytical tools, evaluation techniques and storage projects for the Restudy (SFWMD, 1998b). The Restudy is being refined and implemented through the Comprehensive Everglades Restoration Plan (CERP). This LEC Plan incorporates the CERP construction and operational features into the state planning process to determine how much water can be made available from the regional system through the state regulatory program by 2020. The water supply planning process also verified that the sequencing of CERP components at 5-year increments, through 2020, would protect existing legal water users, protect water resources from significant harm and balance the future water needs of the region. The LEC Plan also identified improvements that should be considered as the CERP moves forward.

PLANNING PROCESS AND CONCLUSIONS

This planning document is the product of a public process, which relied heavily on an advisory committee representing federal, state, tribal, agricultural, urban and environmental interests. The LEC Regional Water Supply Plan Advisory Committee was initiated in 1992. The committee participated in development of both the *Interim Plan for Lower East Coast Water Supply* (LEC Interim Plan [SFWMD, 1998b]) and this 20-year plan.

Two existing hydrologic models, the South Florida Water Management Model and the Natural System Model (as well as five recently developed, high resolution, ground water models), were applied to analyze how the hydrology of South Florida performs under future conditions. Projections for urban and agricultural water demands and sources were incorporated, as well as future land use projections, construction of water management features, such as the Everglades Construction Project, and operational features, such as the Water Supply and Environmental schedule for Lake Okeechobee. Performance measures were developed and applied to evaluate the computer simulations. The performance measures relate to the goals of the plan, provide water to meet a 1-in-10 year level of certainty, meet proposed minimum flows and levels criteria, and provide for hydrologic restoration of the Everglades through 2020.

The LEC Plan concluded that construction and implementation of the CERP components and appropriate management and diversification of water supply sources will ensure sufficient water to meet the needs of the LEC Planning Area up to and including a 1-in-10 year drought condition. Urban areas may reach a 1-in-10 year level of certainty by 2010. Agricultural users that depend on Lake Okeechobee may reach a 1-in-10 year level of certainty by 2015 if the construction and operational features in the LEC Plan are implemented. The proposed MFLs will also be achieved in Lake Okeechobee, the Everglades, and the Biscayne aquifer by 2020. Also, a majority of restoration targets for the Everglades can be met by 2020 if this plan is implemented, although CERP features will not be fully implemented until 2037.

RECOMMENDATIONS FOR WATER RESOURCE DEVELOPMENT

The LEC Plan recommends water resource development projects and lists water supply development options available to public and private water suppliers. The primary water resource development projects will be completed as part of the CERP. The District and local sponsor costs for the first 5 years of implementation are expected to be $922,491,000 and the 20-year costs are estimated at $3,395,470,000. The recommendations fall into eight categories, listed in **Table 9-1**, along with the District and local 5- and 20-year costs.

Table 9-1. Summary of District 5- and 20-year costs of the water resource development projects recommended in the LEC Plan.

Category	Recommendation Number	5-Year Cost (FY2001-FY2005)	20-Year Cost [1] (FY2001-FY2020)
Ongoing Projects from LEC Interim Plan	1 - 11	$19,509,000	$33,789,000
Other Federal, State and District Projects	12 - 16	$4,245,000	$4,245,000
CERP Projects	17 - 30	$893,417,000	$3,352,116,000
Operational Recommendations	31 - 33	$750,000	$750,000
Consumptive Use Permitting and Resource Protection Projects	34 - 40	$1,920,000	$1,920,000
Other Water Resource Development Projects	41 - 46	$2,650,000	$2,650,000
TOTAL		$922,491,000	$3,395,470,000

1. 20-year costs may be updated in the 2005 Update to the LEC Plan.

Implementation of the CERP is critical to meeting the state mandates to achieve a 1-in-10 year level of certainty, provide MFLs and meet restoration targets for natural systems. Implementation of the LEC Plan, in conjunction with the CERP, should avert water shortages and harm to the environment during a 1-in-10 year drought. However, successful implementation of the LEC Plan is dependent on completing the rule development for MFLs, reservations of water for the environment and consumptive use permits.

RECOMMENDATIONS FOR REGULATION

Consensus is reflected in the LEC Plan that environmental water supplies made available from implementation of CERP would be protected under specific Florida laws, primarily water reservations to protect fish and wildlife, and minimum flows and levels. In addition, through water shortage and consumptive use permitting rule amendments, the availability of water for consumptive users would be defined, consistent with the minimum flows and levels and water reservations.

Along with the water reservations, the District will be developing rainfall driven formulas designating the timing and quantity of water deliveries necessary to achieve Everglades restoration. These environmental water supplies will be reserved in phases to reflect the incremental benefits in implementing the CERP projects. Operational protocol for the regional system will also be developed, for both interim and long-term phases, to ensure that the structural projects in the CERP will be operated for their designated purposes.

The timely development of water supplies necessary to meet both human and environmental water supply needs is crucial to the success of both the CERP and LEC Plan implementation. This process was outlined in the LEC Plan with timetables for implementation of each CERP component and LEC component, funding estimates, and estimates of water supply benefits to both the environment and consumptive users.

Table 9-2, contained in the LEC Plan, identifies the water bodies where reservations will be adopted, the basis upon which the reservations of water will be derived, and the targeted operation dates for water resource development projects providing for reservation water supplies.

Table 9-2. Water resource development projects that provide water supplies associated with MFL recovery plans and water reservations.

Water Body	Basis of Reservation	Water Supply Development Projects	Year Project Becomes Operational
Everglades National Park	Rainfall driven/ Stage formula	Everglades Construction Project	2005
		MOD Water	2005
		C-111	2005
		L-31 Seepage Management Without Barrier	2010
		WCA-3A and 3B Seepage Management	2010
		WCA 3A Decompartmentalization Phase I	2010
		WCA-3A Decompartmentalization Phase II	2020
		Miami-Dade Reuse	2020
		Lake Belt Central	2020
WCAs and Everglades National Park	Rainfall driven/ Stage formula	EAA Reservoir	2010
		EAA Storage North	2010
		EAA Storage South	2015
		Taylor Creek Reservoir	2010
		Lake Okeechobee Aquifer Storage and Recovery (ASR)	2015
		Lake Okeechobee ASR	2020
		North Lake Okeechobee Reservoir	2015
St. Lucie Estuary	Salinity envelope criteria	C-44 Reservoir	2010
Caloosahatchee Estuary	Salinity envelope criteria	C-43 Reservoir	2010
		C-43 Aquifer Storage and Recovery (ASR)	2015
Stormwater Treatment Areas (STAs)[1]	Six-inch minimum depth	Lake Okeechobee Storage	2005
Loxahatchee River	Salinity envelope criteria	Southern L8 Reservoir	2015
		West Palm Beach Water Catchment Area ASR	2015
Biscayne Bay	Salinity envelope criteria	Degrade L-29, New S-336B and S-338 structures	2010
Florida Bay		Miami-Dade Reuse, South	2020
		Central Lake Belt Storage Area	2020
		North Lake Belt Storage Area	2020

[1]MFL criteria are not applicable to this water body.

RECOMMENDATIONS FOR WATER SUPPLY DEVELOPMENT

Use of the traditional source for public water, the Surficial Aquifer System, can be expanded with completion of proposed water resource development projects and more efficient use of regional and local water supplies. The Surficial Aquifer System is limited in some areas due to increased potential for impacts on wetland systems and for saltwater intrusion in coastal areas in the vicinity of public water supply wellfields. Coastal areas with limited access to regional water are more likely to require implementation of the water supply development options described in the LEC Plan.

Eight water source options were identified to address water supply needs of the LEC Planning Area. These options either make additional water available from historically used sources or other sources, or provide additional management through conservation and storage of water. The options are as follows (no implied priority):

- Conservation
- Surficial Aquifer System
- Floridan Aquifer System
- Reclaimed Water
- Seawater
- Aquifer Storage and Recovery
- Reservoirs
- Surface Water

Strong emphasis is placed on implementation of a comprehensive water conservation program. Conservation will be encouraged through cooperative efforts among water users, utilities, local governments, and the District. These efforts will incorporate many initiatives, including continued development and compliance with water conservation ordinances, development and implementation of public education programs, use of alternative water sources, continued emphasis on water conservation in the District's surface water and consumptive use permitting programs, and other means. Local governments and users will play a key role in making these strategies a success, through adoption of conservation ordinances, homeowner awareness programs, land use decisions, and development of water supply options by local governments, utilities, and water users.

The Floridan aquifer appears to be a promising source for additional potable water in areas with limited access to regional supplies, but little is known about long-term water quality impacts of sustained withdrawals from this aquifer. As a result, the District is currently refining the Floridan aquifer ground water model and the Floridan aquifer water quality and water level monitoring networks. Several public water utilities already use reverse osmosis technology to remove salt from the saline water in the Floridan aquifer.

From a regional perspective, the use of ground water sources, reclaimed water, surface water, and storage through development of a regional or subregional irrigation water distribution system(s) will be sufficient to meet the urban and irrigation demands. Water from the Surficial Aquifer System and reclaimed water have been used historically to meet such demands. However, in some areas of the LEC Planning Area, these sources will need to be augmented. The feasibility of developing a regional irrigation water distribution system using reclaimed water is being considered in northern Palm Beach County.

In the southeastern portion of the LEC Planning Area, it was concluded that existing surficial aquifer and Floridan aquifer system ground water sources are sufficient to meet the 2020 projected urban demands with minimal potential impacts. Some modifications to wellfield configurations and well operations will be needed at the local level to meet a 1-in-10 year level of certainty and avoid potential impacts to water resources and other existing legal users.

Improved management of surface water through storage could increase freshwater availability in the region and reduce potential impacts resulting from water use. Aquifer Storage and Recovery (ASR) technology shows promise both for treated and untreated water by providing capacity to capture and store excess water when it is available. ASR is the injection of freshwater into a confined saline aquifer during times when supply exceeds demand (wet season), and recovering it during times when there is a supply deficit (dry season). This technology is currently being used by several utilities at the local level. In addition to continued use and development at the local level, application of ASR on a regional scale has been identified as an option to capture excess surface water in several basins including Lake Okeechobee. Regional and local retention projects will reduce excess water discharged to estuarine systems and increase water availability inland by increasing water levels in canals and providing additional ground water recharge.

LEC PLAN PERFORMANCE FOR NATURAL AREAS

Implementation of the LEC Regional Water Supply Plan, with its various regional water supply development projects, will result in a number of major environmental benefits to South Florida's natural areas. **Table 9-3** provides a color-coded summary of the results of incremental SFWMM simulations for the years 1995, 2005, 2010, 2015 and 2020, based on a review of key environmental and water supply performance measures developed for the LEC Plan. The color codes listed in **Table 9-3** (green, yellow, or red) represent a scoring system to evaluate model output, based on a review of key environmental performance measures (listed in the LEC Plan) and use of best professional judgement by District scientists. Model results for each area are discussed in the following paragraphs.

Lake Okeechobee, St. Lucie and Caloosahatchee Estuaries show major improvements by 2010 and meet water supply and environment schedule for the lake and the construction of regional water storage reservoirs within the C-43 and C-44 basins by 2015, and implementation of regional Aquifer Storage and Recovery (ASR) projects by 2020. Similarly, construction and operation of the regional storage projects north of the lake greatly reduces the need to (1) make large releases of freshwater to the St. Lucie and Caloosahatchee estuaries and Lake Worth Lagoon during high rainfall years, and (2) meet low flow criteria proposed to protect these ecosystems during dry periods.

Table 9-3. South Florida Water Management model results for incremental simulations for natural areas within LEC Planning Area.

Area	Indicator Region	1995 Base	2005	2010	2015	2020
Lake Okeechobee		R/Y	Y	Y	G	G
Caloosahatchee Estuary		R	R	Y	G	G
St. Lucie Estuary		R	R	Y	G	G
Lake Worth Lagoon		R	R	Y	Y	Y
Holey Land WMA		R	R	G	G	G
Rotenberger WMA		R	Y	G	G	G
Water Conservation Areas						
Loxahatchee NWR (WCA-1)	27, 26	G	Y/G	G	G	G
WCA-2A (North/South)	25, 24	Y/G	G/Y	G/Y	G/Y	G/Y
WCA-2B	23	R	R	R	R	R
WCA-3A NE	21	R	G	G	G	G
WCA-3A NW	20, 22	R	Y	G	G	G
WCA-3A East	19	R	Y	Y	Y	Y
WCA-3A Central	18, 17	R/Y	Y/G	Y/G	Y/G	Y/G
WCA-3A South	14	R	Y	Y	Y	G
WCA-3B	15, 16	Y	Y	Y	Y	Y
Everglades National Park						
Shark River Slough	9,10, 11	R	R	R/Y	Y	G/Y
Rockland Marl Marsh	8	R	Y	Y	Y	Y
Western Florida Bay, Whitewater Bay		R	Y	Y	Y	G
Biscayne Bay						
Northern Biscayne Bay		G	Y	G	G	Y
Central Biscayne Bay		Y	Y	Y	Y	Y
Southern Biscayne Bay		Y	Y	Y	Y	G

Legend:
Green = Alternative meets the 2020 LEC planning target and will likely results in recovery and long-term sustainability of the ecosystem if water quality standards are met.
Yellow = Marginal or uncertain ability to meet planning targets or achieve recovery or long-term sustainability.
Red = Planning target not met; ecosystem recovery will not occur. Major improvement is needed if targets are to be met.

Water Conservation Areas, Holey Land & Rotenberger Wildlife Management Areas. Completion of the Stormwater Treatment Areas (STAs), EAA reservoir and implementation of rainfall-driven water deliveries for the Everglades provide a number of hydrologic improvements to the Everglades ecosystem. As early as 2010, LEC planning targets are met for northern WCA-3A, WCA-1, the Holey Land, and Rotenberger Wildlife Management Areas. In contrast, performance targets are not met in central and southern WCA-3A and WCA-3B until 2020 (**Table 9-3)**. By 2020, all monitoring sites located within the WCAs and Holey Land & Rotenberger WMAs will meet the proposed minimum flows and levels criteria.

Five areas did not fully meet their respective planning targets and were scored as red or yellow in **Table 9-3**. WCA-2B was the only area that scored "red" by 2020 exhibiting both extreme high and low water events in excess of natural system targets. These extremes in both high and low water levels were evaluated as potentially damaging to remaining tree island and sawgrass communities and were similar to those recorded by CERP. Many restoration problems in WCA-2B appear to be linked to its relatively small size in comparison to the other WCAs, its location directly above the highly porous Biscayne aquifer which results in large seepage losses and over-drainage of the area during dry periods, large changes in ground level elevation (almost 3 feet) across the area due to soil subsidence, and its current position in the landscape surrounded by urban development. WCA-2B is currently being reviewed by the CERP RECOVERY Team to identify alternative ways to restore the hydrology of this area as a sustainable Everglades wetland.

Areas that scored "yellow" (indicating marginal or uncertain ability to meet the planning target) included eastern WCA-3A (indicator region 19), WCA-3B, and the southern portion of WCA-2A (indicator region 24). These results are similar to the findings presented by CERP, which identified similar problems in restoring natural system hydrology to these areas.

Everglades National Park/Florida Bay. Incremental modeling for Everglades National Park shows gradual improvements over time in attaining the desired flow targets to the Park. Beginning in 2005, the distribution and volume of water provided to northeast and northwest Shark River Slough show significant improvements over the bases cases. By 2010 substantial improvement in meeting natural system hydropattern targets were recorded within Shark River Slough, with nearly full achievement of LEC planning goals by 2020 (e.g., 100 percent of the slough matches the NSM hydroperiod target by 2020). In the Rockland marl marsh located in the eastern portion ENP, significant improvements in hydroperiod were noted beginning in 2005 within this over-drained region of the Park with improvements continuing through 2020. By 2020, minimum flows and levels are met for the majority of monitoring sites located within the Park with two exceptions. Model results also show major improvements over time in the volume of water directed toward Florida Bay. These results show the importance of the Lake Belt Project (which will only be 50 percent complete by 2020). This large water storage reservoir serves as an area where water can be captured and stored during wet periods and delivered to the Park with the proper volume, distribution, and timing.

In contrast, one area within the Park, the Rockland marl marsh (indicator region 8) located within the eastern portion of ENP area scored "yellow" indicating marginal or uncertain ability to meet LEC planning targets. In addition, this area failed to meet proposed MFL criteria by 2020. These findings are similar to CERP and indicate that further work is needed to improve the hydrology of this area.

Biscayne Bay. For purposes of the LEC Plan (until further information becomes available), the planning target for Biscayne Bay is that future flows delivered to the bay should not be less than those currently discharged to the Bay under the 1995 base case. Mean annual wet and dry season flows were based on SFWMM output for the primary water management structures that discharge into the northern, central, and southern portions of the Bay. Incremental modeling results showed a 22 percent reduction in flows delivered to the Bay as a whole in 2005, and an 18 percent reduction by 2020. These results varied from basin to basin. In north Biscayne Bay, mean annual flows remained near the target in 2005 and increased in 2010 and 2015 and decreased in 2020 due to the Lake Belt Project coming on line. The most striking results occurred in central Biscayne Bay in 2005 where total flows delivered to the bay were reduced by more 60 percent compared to the target. This was due to the construction of the C-4 structures that significantly reduced flows from S-25B, which discharges into the Miami Canal and central Biscayne Bay. These values increase in 2010 and 2015, but decrease in again in 2020, in part due to the Lake Belt Project. In contrast, there are noticeable improvements in southern Biscayne Bay where water reuse projects increase flows to the Bay by 20 percent by 2020. These improved flows should help improve estuarine conditions in southern Biscayne Bay.

LITERATURE CITED

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