

1.0 Performance Measure Title

WS-5 Prevent Saltwater Intrusion of the Biscayne Aquifer in South Miami-Dade County

Last Date Revised: March 14, 2005

2.0 Justification

A CERP goal is to enhance economic values and social well being. One means to accomplish this is through ensuring adequate water supplies for current and future water users by protecting the primary water supply source, the Biscayne aquifer. Saltwater intrusion poses a continuing threat to the Biscayne aquifer. In order to restrict the inland migration of the saline interface, a sufficient freshwater head must be consistently maintained within the aquifer. Inadequate water levels occurred in 1939, when more than 10,000 water supply wells in South Florida were affected by high chloride concentrations, including the partial loss of five major wellfields (Parker et al.1955). Since that time, a number of different actions have been taken to protect public and private wellfields from the threat of saltwater intrusion. One of which was the completion of coastal water control structures in the 1950s. CERP implementation will increase the storage capacity of water in the regional system for delivery to the Lower East Coast Service Area. The increase in regional storage capacity provided by the CERP will supplement regional and local sources used to maintain sufficient water levels behind these coastal water control structures to prevent saltwater intrusion. In addition to public water supply, the Biscayne aquifer also provides base flow to important estuaries such as the Lake Worth Lagoon, Biscayne Bay and Florida Bay during low rainfall years.

In order to prevent harmful movement of the saltwater interface in the Biscayne aquifer, the South Florida Water Management District (SFWMD) manages coastal groundwater levels by operating the primary canal network, regulating surface water control elevations for developments (through surface water management permitting), and by limiting coastal consumptive use withdrawals. Operational criteria for the coastal canals are maintained by the SFWMD to prevent harm. These management levels vary seasonally as the SFWMD works to balance the goals of flood protection (wet season control level) and water supply (drought management control level). The drought management control levels represent target management elevations during the dry season. Water supply releases are made from regional storage sources (currently the Water Conservation Areas and Lake Okeechobee) to achieve these targets whenever possible. These canal levels in turn influence the adjacent dry season groundwater elevations within the Biscayne aquifer.

Two metrics are applied to measure the likelihood of saltwater intrusion based on different climatic conditions:

1) Two feet National Geodetic Vertical Datum (NGVD) is used for comparison in keeping with the Ghyben-Herzberg relationship that estimates that one foot of freshwater head is required to protect forty feet of aquifer. The aquifer along the southern Miami-Dade is approximately eighty feet thick and would require two feet of freshwater head. The stage where the frequency of exceedance is 90% was used since it reflects lower stage of the dry season when the risk of saltwater intrusion is increased.

2) The second metric uses the stage when the frequency is exceeded 50% of time since it represents approximately the midpoint between the wet and dry seasons and can be viewed as “average conditions” for the 2000 base condition. Saltwater encroachment has occurred during the period of record and, therefore, exceeding the 50th return frequency is considered an improvement but may not prevent further encroachment.

Currently, these canals are generally maintained at these stages. During drought or the dry season, there may not be enough water in the regional system to maintain these canal stages.

3.0 Source of Performance Measure

Section 373.044, Florida Statutes

C&SF Project Restudy (USACE and SFWMD 1999)

4.0 Restoration Expectation

4.1 Predictive Metric and Target

The target is to maintain the canal stages at the following levels:

<u>Canal at Structure</u>	<u>Canal Stage (feet NGVD*)</u>
C100A at S123	2.00
C-1 at S21	2.00
C-102 at S21A	2.00
C-103 at S20F	2.00

* NGVD = National Geodetic Vertical Datum

4.2 Assessment Parameter and Target

The target is to maintain the canal stages at the following levels:

<u>Canal at Structure</u>	<u>Canal Stage (feet NGVD*)</u>
C100A at S123	2.00
C-1 at S21	2.00
C-102 at S21A	2.00
C-103 at S20F	2.00

* NGVD = National Geodetic Vertical Datum

5.0 Evaluation Application

5.1 Evaluation Protocol

Performance is evaluated using South Florida Water Management Model (SFWMM) output for stages at the 50th and 90th exceedance frequency based on the stage duration curves for the canals at each of these structures. The first metric is the difference between an alternative's water stage in tenths of feet and the target at the 90th exceedance frequency. This information is used to calculate its score: $(2.00\text{ft} - \text{Difference})/2$. The second metric identifies the percent time equaled or exceeded at which an alternative's stage duration curve is the same as the stage when the frequency is exceed 50% of the time during the 2000 Base Condition. The scores for these two measures across the four structures are then averaged to create an indexed performance.

5.2 Normalized Performance Output

5.3 Model Output (example attached)

Saltwater Intrusion Prevention in South Miami-Dade County

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Location          Target      Indexed 90th Percentile Score*  
Stage (ft)      2000B3      2050B3      CERPA  
  
C-100A@S-123      2.00         0.90         0.96         1.00  
C-1@S-21          2.00         0.82         0.84         0.91  
C-102N@S-21A     2.00         0.77         0.76         0.87  
C-103@S-20F      2.00         0.47         0.40         0.87
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* Calculated as $(2.00 - D)/2$ where D is the difference between the target stage and an alternative's water stage at the 90th exceedance frequency.

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Location          2000 50%      Indexed 50th Percentile Score**  
Stage (ft)      2000B3      2050B3      CERPA  
  
C-100A@S-123      2.80         0.50         0.49         0.96  
C-1@S-21          2.08         0.52         0.44         0.61  
C-102N@S-21A     1.66         0.51         0.50         0.95  
C-103@S-20F      1.50         0.51         0.48         0.98
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** Calculated as the exceedance frequency at which an alternative's stage is the same as the stage when the frequency is exceeded 50% of the time during the 2000 Base Condition.

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Location          Averaged Indexed Performance  
                2000B3      2050B3      CERPA  
  
C-100A@S-123      0.70         0.72         0.98  
C-1@S-21          0.67         0.64         0.76  
C-102N@S-21A     0.64         0.63         0.91  
C-103@S-20F      0.49         0.44         0.93  
  
Average For All Locations      0.62         0.61         0.90
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RECOVER Performance Measure  
For Planning Purposes Only  
Run date: 06/06/05 17:01:28  
SPWMM V5.4.3  
SPWMM P.O.S. 1965 - 2000  
Script used: mfl.scr V1.10
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5.4 Uncertainty	
6.0 Monitoring and Assessment Approach	
See <i>CERP Monitoring and Assessment Plan: Part 1 Monitoring and Supporting Research</i> - South Florida Hydrology Monitoring Network Module section 3.5.3.5 (RECOVER 2004a)	
7.0 Future Tool Development Needed to Support Performance Measure	
7.1 Evaluation Tools Needed	
7.2 Assessment Tools Needed	
8.0 Notes	
9.0 Working Group Members	
Linda McCarthy, FDACS Brenda Mills, SFWMD Carl Woehlcke, SFWMD	
10.0 Acceptance Status	
WS Working Group	March 14, 2005
ET	
AT	
Public Review	
Final Acceptance Date	
11.0 References	
RECOVER. 2004a. <i>CERP Monitoring and Assessment Plan: Part 1 Monitoring and Supporting Research</i> . Restoration Coordination and Verification Program, c/o United States Army Corps of Engineers, Jacksonville District, Jacksonville, Florida, and South Florida Water Management District, West Palm Beach, Florida.	
SFWMD. 2000a. <i>Lower East Coast Regional Water Supply Plan</i> . South Florida Water Management District, West Palm Beach, Florida.	
USACE and SFWMD. 1999. <i>Central and Southern Florida Project Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement</i> . United States Army Corps of Engineers, Jacksonville District, Jacksonville, Florida, and South Florida Water Management District, West Palm Beach, Florida.	