The MilCor Group Inc.

Engineering a sustainable environment

Caulkins Water Farm

Northern Everglades Public Private Partnership Projects Technical Suitability Criteria

Prepared For:
Seabranch Management

For Review By:
South Florida Water Management District

September 2016

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Attachments:

Exhibit 1 - Cost Effective Analysis
- Exhibit 1a – Cost Effective Analysis (Minimum Volume)
- Exhibit 1b – Cost Effective Analysis (Average Volume)
- Exhibit 1c – Cost Effective Analysis (Maximum Volume)

Exhibit 2 - Capital Cost Analysis
Exhibit 3 - 10-Year Rainfall Data
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Exhibit 7 - Boundary Survey
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Technical Suitability Criteria

1. Cost Effectiveness

A. Cost Effectiveness Analysis:

Acre-Ft/Year:

The minimum, maximum, and average acre-ft/year estimated of pumped water volumes were calculated with SFWMD modeling software using inputs from the past 27 years. Additionally, the reservoir will retain rainfall that was historically discharged into the C-44, as calculated in section 2.B. t

Below are the total volumes of water anticipated to be held within the Water Farm:

Minimum Yearly Impounded Volume = 36,443 ac-ft/year
Maximum Yearly Impounded Volume = 80,079 ac-ft/year
Average Yearly Impounded Volume = 60,616 ac-ft/year

A cost analysis for a 10 year period of operation was conducted based upon the agreed contract price as shown in Exhibit 2. The average cost over the 10 year period is **$117.17/ac-ft** (Exhibit 1)**.**

Average values for nitrogen and phosphorous removal for the minimum, maximum, and average pumped volumes per year were calculated based on the average nutrient concentrations sampled from the pilot project and historical data for the area. The calculations, data and assumptions are provided in the Nutrient Removal Report.

A seepage investigation of the pilot project was conducted by the SFWMD that determined 45% of the total phosphorous and nitrogen was being removed by the reservoir. Although we believe these values to be extremely low, they have been utilized to calculate the total nutrient removal and removal cost, as shown below.

Nitrogen Average Density = 1.258 mg/l
Phosphorous Average Density = 0.172 mg/l

Nitrogen Removal: 1.258 mg/l x 0.45 = 0.5661 mg/l
Phosphorous Removal: 0.172 mg/l x 0.45 = 0.0774 mg/l

Total Nitrogen Removed:

Minimum: (36,443 ac-ft/year) x (0.5661 mg/liter) x (1 liter/0.0353147 ft^3) x (43,560 ft^3/ac-ft) x (1 lbs/453,592 mg) x 1 MT/2204.62 lbs) = **25.447 MT/year**

Maximum: (80,079 ac-ft/year) x (0.5661 mg/liter) x (1 liter/0.0353147 ft^3) x (43,560 ft^3/ac-ft) x (1 lbs/453,592 mg) x 1 MT/2204.62 lbs) = **55.917 MT/year**

Average: (60,616 ac-ft/year) x (0.5661 mg/liter) x (1 liter/0.0353147 ft^3) x (43,560 ft^3/ac-ft) x (1 lbs/453,592 mg) x 1 MT/2204.62 lbs) = **42.326 MT/year**

Total Phosphorous Removed:

Minimum: (36,443 ac-ft/year) x (0.0774 mg/liter) x (1 liter/0.0353147 ft^3) x (43,560 ft^3/ac-ft) x (1 lbs/453,592 mg) x 1 MT/2204.62 lbs) = **3.479 MT/year**
Maximum: (80,079 ac-ft/year) x (0.5661 mg/liter) x (1 liter/0.0353147 ft^3) x (43,560 ft^3/ac-ft) x (1 lbs/453,592 mg) x 1 MT/2204.62 lbs) = **7.645 MT/year**

Average: (60,616 ac-ft/year) x (0.5661 mg/liter) x (1 liter/0.0353147 ft^3) x (43,560 ft^3/ac-ft) x (1 lbs/453,592 mg) x 1 MT/2204.62 lbs) = **5.787 MT/year**

Cost/lb TN Removed:

($117.17/acre-ft) x (1 acre-ft/43,560 ft^3) x (0.0353147 ft^3/liter) x (1 liter/0.5661 mg TN) x (453,592 mg/lb) x = **$76.11/lb TN**

Cost/lb TP Removed:

($117.17/acre-ft) x (1 acre-ft/43,560 ft^3) x (0.0353147 ft^3/liter) x (1 liter/0.0774 mg TP) x (453,592 mg/lb) = **$555.87/lb TP**

B. Detailed Cost Estimate:

Please see attached cost estimates in Exhibits 1 and 2. Our annual costs of $117.17/ac-ft are based on the capital costs to design and construct the project.

2. Water Quantity

A. Water Budget Analysis over a ten year period of record using local rainfall data and an average annual estimate of volumes in, volumes out and volumes retained/stored:

Please see attached Exhibits 3 and 4. Exhibit 3 is 10 years of rainfall data, with a summary provided in Exhibit 4. The 10-year average rainfall is 48.269" per year.

B. Average annual volume retained and stored:

Assumptions:

All rainfall retained during growing seasons of October - March since the land's previous use was as an agricultural citrus grove. All other rainfall is considered to be discharged from the site.

Average Rainfall On-Site: 48.269"/year x 3,274 acres x 1'/12" = 13,169 acre-ft/year
Average Rainfall Retained: 14.659"/year x 3,274 acres x 1'/12" = **3,999.46 acre-ft/year**
Average Rainfall Discharged: 13,169 acre-ft/year – 3,999.46 acre-ft/year = **9,169.93 acre-ft/year**

C. Net Water Quality Benefit:

Average Pumped Inflow + Average Rainfall On-Site – Average Rainfall Retained =

51,446 acre-ft/year + 13,169 acre-ft/year – 3,999.46 acre-ft/year = **60,616 acre/ft/year**

3. Water Quality

A. Total Maximum Daily Load (TMDL), Basin Management Action Plan (BMAP) appropriate model or analysis over a ten year period of record using local rainfall data:

Please see Exhibit 6, FDACS Nutrient Removal Report

B. Average annual nutrient removal estimate in tons of total Phosphorous (TP) and tons of total Nitrogen (TN) removed:

TP = 5.787 metric tons/year
TN = 42.326 metric tons/year

4. Project Benefits to the Regional System

A. Operational Plan

The purpose of "water farming" is to capture and divert surface water from the regional system before said system becomes staged so high that it requires discharge of fresh water to tide, causing environmental damage to the St. Lucie Estuary and Indian River Lagoon, and wasting the resource to tide. The regional system is defined as Lake Okeechobee and the series of canals and outfalls exiting the lake and discharging to the C-44 canal, or Okeechobee Waterway.

The Caulkins Water Farm was chosen by the South Florida Water Management District's Board of Governors as a "pilot" project to test and demonstrate the operational feasibility and capacities of the concept of "water farming". An Agreement, No. 4600002925, was executed in August of 2013 to construct and operate the "pilot program for a period of two years following construction of the required infrastructure. The infrastructure, the impoundment/catchment basin, pumping station, monitor station and ancillary facilities were completed in December of 2013, and have greatly outperformed estimated capacity.

This proposed operational plan is for the expansion of the water farm to a 3,014 acre impoundment.

There are four criteria for when pumping will occur at the water farm:

1) Lake Okeechobee Pulse Release in accordance with the 2008 LORS, or
2) S-80 is discharging, or
   72% of the water discharged through the S-80 comes from the local C-44 drainage basin, and these discharges greatly impact the health of the St. Lucie Estuary and Indian River Lagoon. Therefore, any of the basin runoff that can be captured within the water farm prior to discharge is an environmental benefit.
3) C-44 is at Elevation 14.2' NGVD, or
   Normal operation of the C-44 maintains a water elevation of 13.5. During heavy rain events, efforts are made to keep the elevations between 13.5 and 15.5. Beginning pumping at 14.2 will aid in this maintenance level; and aid in keeping the S-80 lock under the 125 percent rating in the 2008 LORS which requires increased discharges when the C-44 elevation reaches 15.5.
4) Eminent major rain event:
   If a hurricane or large tropical storm is on a direct route to Florida, proper planning for said event is required.

The water farm pumps will be operated at their full capacity of 464.01 ac-ft/day. The pumps will continue to operate at full capacity for as long as any of the above four conditions are met, or until the elevation within the water farm reaches 27.50' NAVD.

After the water elevation reaches 27.50' NAVD, the pumps will be operated at the pump rate of 300 acre-feet/day which allows the water farm to maintain water elevations at 27.50' NAVD, until none of the above four conditions are met. It is estimated to take 64 days to fill the reservoir pumping at full capacity.

Record keeping. Water level conditions will be monitored weekly in the "water farm" reservoir. The conditions will be recorded using staff gauges installed for these purposes. SFWMD will record data using a monitor station located within the reservoir, this data will include water elevation, rain events and other operational data.

Q: Is the inflow pump adjacent to a regional canal or drainage feature?

A: Yes, the inflow pump pumps directly from the C-44 canal.

Q: Is enough regional water available seasonally to warrant the project?

A: Yes, the C-44 canal is a main arterial leading out of Lake Okeechobee. Over the past 10 years, there has been an average of 266,543 acre-ft/year of drainage discharged into the C-44 canal from Lake Okeechobee. Assuming a worst case scenario where the pumps were operated at 300.11 acre-ft/day every day of the year, Caulkins could pump 109,540.15 acre-ft/year (41% of the average discharge). Therefore, there is a large surplus of water available to warrant the project.

Q: Are the inflow facilities adequately sized in comparison with the size of the proposed storage area?

A: Yes, the pump will be able to pump 464.01 acre-ft/day of water compared to the expected 300.11 acre-ft of infiltration into the soil. At these flow rates, it will take 64.085 days to fill the reservoir to 27.50 ft NAVD after which the pumps will be operated at 300.11 acre-ft/day to maintain water levels. Therefore, the system is adequately sized to fill and maintain water levels within the impoundment.

B. List of facilities owned or controlled by others that are a part of the proposed project:

There are no facilities fitting this description.

5. Ease of Implementation

A. Provide confirmation that the property is enrolled in the Florida Department of Consumer Services (FDACS) Best Management Practices (BMP) program:

Please see attached Exhibit 6

B. Project Implementation Schedule:

Total construction will take 6 months.

C. Map depicting all encumberances on property (such as a Boundary Survey) and all adjacent landowners:

Please see Exhibit 7 - Boundary Survey

There are two adjacent landowners:
Pero Greenridge Farms, LLC
14095 State Road 7
Delray Beach, Florida 33446

And

St. Lucie River Farm, LLC
1291 US Highway 258N
Kinston, North Carolina 28504

D. Construction Plans and Technical Specifications:

Please see Exhibit 8 - Construction Plans

E. Summary of permit history including any past regulatory enforcement actions and their resolution:

Please see Exhibit 9 – SFWMD ERP History

F. Description of regulatory considerations including a detailed list of all local, state, tribal, and federal authorizations needed to construct, operate, and maintain the project:

SFWMD Environmental Resource Permit, ACOE permit, and FWC permit

G. Assessment of environmental baseline of the existing conditions including:

i. *Q: Water quantity attenuation volumes needed to meet regulatory requirements:*

A: The previous permits did not have any specific requirements for attenuation. More detail is described below in section ii.

ii. *Q: Water quality treatment volumes needed to meet regulatory requirements:*

A: The site retains all water on-site far in excess of the 1" retention over the site area required by regulatory requirements and historical retention on-site calculated in Section 2. Therefore, the site meets all water quality treatment and attenuation volumes needed to meet regulatory requirements. See calculations below:

Average Rainfall On-Site: 48.269"/year x 3274 acres x 1'/12" = 13,169 acre-ft/year
Average Rainfall Retained: 14.659"/year x 3,274 acres x 1'/12" = **3,999.46 acre-ft/year**
Average Rainfall Discharged: 13,169 acre-ft/year – 3,999.46 acre-ft/year = **9,169.93 acre-ft/year**

Net Water Quantity / Quality Benefit:

Average Pumped Inflow + Average Rainfall On-Site – Average Rainfall Retained
51,446 acre-ft/year + 13,169 acre-ft/year – 3,999.46 acre-ft/year =
60,616 acre/ft/year

iii. *Q: Wildlife utilization including state and federally protected species:*

A: See Exhibit 10

H. Site reconnaissance survey of cultural resources.
See Exhibit 11

I. A documented limited phase I/II environmental site assessment completed by the district or an equivalent ESA conducted within the last five years.
See Exhibit 12