Technical comments on the draft Marsh Monitoring Network
presented by FDEP on 17 August 2005

The comments below are a compilation of technical comments from Matt Harwell, Bill Walker, Mike Waldon, Joffre Castro, Mike Zimmerman and Dilip Shinde; however, this is not a "DOI Technical Review". As these comments come from a technical perspective, they do not represent DOI policy or management input into establishing a marsh monitoring network.

General

1) We appreciate the iterative exercise FDEP is undertaking to develop an appropriate marsh monitoring network. We look forward to seeing the updated soil TP maps that will help with the continued effort to best locate networks stations throughout the greater Everglades in subsequent multi-agency iterations of network development. We also look forward to reviewing all of the raw data that are going into these maps (the floc as well as the soil data (TP, density, etc.) at whatever depth increments they were collected (not just the 0-10 cm TP values). These maps are needed to support a thorough review of the network.

2) Effective monitoring of ENP resources can only be achieved by having appropriately selected sampling stations. These stations should be located (a) in the marsh (b) downstream of inflow structures and (c) not too far from surface-water inflow structures, which have the potential for discharging TP-rich water into the ENP. To make a determination on location and selection of monitoring stations, information on impacted and un-impacted regions within the ENP is essential. We would like to review and have copies of the most up-to-date soil P contour maps in ENP that FDEP used for this determination.

Refuge Network

3) Given that there are 14 existing stations (EVPA) for compliance monitoring of the less impacted Refuge interior, there is a need for more than just 6 additional stations to characterize the outer perimeter, and more impacted, region of the Refuge. The higher spatial variance of surface water constituent concentrations requires a more dense network to achieve similar resolution. Additionally, a higher density of sites across the gradient from unimpacted to impacted is needed to identify movement of the impact threshold and support adaptive management. No less than 14 additional sites should be monitored in the Refuge.

4) In WCA-2 and WCA-3 there are examples of station placement with one station placed in an impacted zone, and one placed in the adjacent unimpacted zone. This approach of monitoring near the boundary has the potential to provide protection of unimpacted region by being able to follow changes in the impacted zone boundary. This approach was not explicitly used in establishing the draft network for the A.R.M. Loxahatchee National Wildlife Refuge and needs to be considered.

The outer perimeter of the 'unimpacted' sites should be immediately adjacent to the outer perimeter of the 'unimpacted zone', as defined based upon the 500 mg/kg soil P contour. This is necessary to ensure that the area of the impacted zone does not increase. For example, an additional site should be added at the outer edge of the unimpacted zone in the vicinity of the STA1E discharge (i.e. south west of impacted site LOXA136.).

5) The network for the Refuge has some notable gaps that should be examined in greater detail. For one, there are gaps in spatial coverage in the northern region of the Refuge. Sites LOXA101 and LOXA102 are possible candidates sites in the northern Refuge. Additional sites in the southern region of the Refuge are also needed. There are approximately 30 other existing stations in the Refuge (between the XYZ, and LOXA programs) where water quality data are collected that may help in providing a more appropriate network. When the other data pieces are available (e.g., soil maps), Refuge technical staff would be happy to collaboratively examine which of those other existing stations should be considered.

6) The measurement methodology will not detect impacts in marsh regions between the outer edge of the station network and the STA discharge or other inflow points. For this reason, the outer perimeter of the network should be expanded to include sites immediately adjacent to inflow points or, in the case of the Refuge, the rim canal. At a minimum, the impacted sites Z1 and X1 should be added.

7) There is uncertainty regarding the placement of stations in the vicinity of the STA1E discharge zone. Penetration into the marsh will depend on hydraulic gradients generated by the discharge, topography, and potential effects of the berm and dredging efforts occurring in the L-40 rim canal to reduce erosion and penetration in the vicinity of the discharge. There needs to be flexibility to adjust the station placement, depending upon where the penetration of the discharge is observed to occur after the facility is in full-scale operation.

<u>Park Network</u>

8) It is unclear whether the existing transects monitored by FIU's LTER program were considered for Everglades National Park. More information about that program can be found at: http://fcelter.fiu.edu.

9) Without reviewing the TP soil survey map it is difficult to comment on the location of the stations, however, the following suggestion/comments are offered:

    a. The proposed monitoring stations P33 and P37 are redundant. Because CSOP is planning to remove the L67 extension canal and the proposed station (NP201, NE1 and S355B6) are located upstream of P33 and near the inflows, P33 may not add any additional information to the network. Instead, a new station should be located between the L67 extension and the western boundary of the ENP and south of the L29 canal.

b. Similarly, the P37 station should be removed. The TSB station, which is located upstream of P37, would detect any changes in TP levels a lot sooner than P37.

c. Additionally, two new stations are proposed along the L31N canal. The exact location would depend on the TP soil map and the CSOP proposed surface-water discharges from the detention basins into ENP (somewhere between the 8.5 Square Mile Area and S3332D).

6-Sample Criterion

10) The Data Quality Screening Protocol (7/15/2004 document) drops from assessment sites having fewer than 6 screened monthly values in one year. This significantly limits the effectiveness of the marsh monitoring network. The Refuge has an elevation gradient from the north to the south, such that there are periods when regions in the north are dry (or do not have 10 cm of clear water column (representative) for sampling) while the southern region has sufficient water to sample. In fact, several CD compliance stations (LOX 3, 4, 5, 9, 10) would frequently not have met this six samples per year criterion in recent years. Given that the inflow points to the Refuge are in the north, we recommend either revision to the minimum number of samples needed for station assessment, or an increase in sampling frequency such that the entire marsh is assessed as intended. This 6-sample-per-year criterion poses similar problems at shallower sites in northern WCA-3A and southern ENP.

    One potential way to increase the monitoring frequency at shallow sites may be to increase the radius within which the sampling crew can search to find 10 cm depth when conditions are generally dry. That would certainly be cheaper than adding another sampling event.

11) All the inflow to ENP occurs along the northern and eastern boundaries. As a result of the north-to-south natural elevation gradient, it is expected that there may be a large number of sites not meeting the Data Quality Screening Protocol (< 10 cm of clear water column for sampling) during the dry period. Hence a revision to the Data Quality Screening Protocol is also needed to protect ENP. The revision should address issues such as-

    a. Missing samples,
    b. Missing stations,
    c. Extreme values,
    d. Minimum number of stations to be included in evaluating compliance,
    e. Dry-period sampling,
    f. Minimum number of samples per station,
    g. Frequency of sampling, for e.g. additional samples during wet period.

Implementation and Analyses

12) Another problem related to shallow sites pertains to the method that will be used to compute the spatial geometric mean in each year. One method is to compute it directly from the individual samples across sites. Another is to compute it as the geometric mean of the individual site geometric means. The former procedure would under-weight data from shallower sites with shorter hydroperiods that would be sampled less frequently. It would over-weight deeper sites that tend to have lower concentrations and thus introduce a negative bias into the spatial geometric mean. The second procedure would produce a more representative spatial geometric mean, assuming that problem related to the 6-sample per year screening criterion is also addressed.

13) It is important to consider the differences in sampling protocol and laboratories between the XYZ transect sites and the LOX and LOXA sites. Samples at XYZ sites are collected using a pump and are not processed at the SFWMD laboratory. These differences, as well as others, may greatly complicate data interpretation.

14) Because of the expected variability, sites in the impacted zone may move in and out of compliance from year to year. How will this be handled?

15) Answers to other important questions regarding use of the test are needed to support further review of the proposed station networks:
    a. Will the station placement, classification (impacted vs. unimpacted) and test results have any effect on the ultimate treatment requirements or upon the rate at which those are reached?
    b. How is this related to permit transect monitoring?
    c. How permit/transect monitoring affect ultimate treatment requirements?