

District Review of: ‘A.R.M. Loxahatchee Wildlife Refuge Enhanced Water Quality Monitoring and Modeling’ (4/19/05 draft)

For the TOC Meeting, May 17, 2005

The District has reviewed the “A.R.M. Loxahatchee Wildlife Refuge Enhanced Water Quality Monitoring and Modeling Interim Report,” dated April 19, 2005. The District recognizes, as pointed out by the Report’s authors at page 23, “[t]he nine months of data in this *Interim Report* are not sufficient to demonstrate relationships between specific environmental conditions, water management activities, and the degree of intrusion [into the Refuge].” However, it is clear that considerable time and effort went into the Report’s preparation, the result of which is a quality work product that can serve as an excellent starting point for future analyses and reporting.

The District understands that the Department of Interior will continue with its monitoring regime and submit another report in approximately a year. Towards that goal, the District provides the following suggestions to guide the development of this next product into a report that is more responsive to the stated objectives and fulfills more information needs for the TOC.

1. The interim report does not directly address the fundamental objective of the enhanced monitoring, as requested by the Principals in their November 2004 letter and as reported to Judge Moreno at the September and December hearings, i.e., “to assist us in gaining scientific understanding of historic and future exceedances.” With the additional data, there is an opportunity to assess the influence of the various factors contributing to uncertainty, including the evaluation of internal phosphorus loading and error in the compliance equation relating to phosphorus concentrations to Refuge stage. How well do values generated by the equation work for various combinations of stations at various distances from the peripheral canals? Such comparisons could provide insight on the role of internal versus external factors influencing marsh phosphorus levels and on strengths and weaknesses of the compliance equation. Together such analyses could aid in “understanding of historic and future exceedances.”
2. Further consideration of LOX4 is needed. The data indicate that there is a clear correlation between the phosphorus concentration at LOX4 and discharges from the Acme Pump Station – a facility which is **not** under the control of either State party. Any role that this station may play in exceedances should not be attributed to a failure of State parties in meeting their obligations. This association should be corrected by attributing responsibility for the Acme discharge appropriately. Significantly, discharges into the Refuge the inflow point closest to LOX4 will discontinue in 2007 when the Acme Basin B CERP project comes on line. Monitoring the transect after discharges cease may provide an opportunity to better understand the relationship between discharges and water quality.
3. The Report repeatedly asserts that intrusion of canal water into the marsh is occurring. Accepting that penetration can and does occur at times in the Refuge,

evidence of penetration is not new or particularly helpful as a major theme of this Report. Anthropogenic water quality influences to the Refuge must be conveyed via some intrusion from the rim canal; this is the fundamental tenet of the Settlement Agreement. In fact, some intrusion must have occurred during the baseline period used for setting the Settlement Agreement interim and long-term levels, so that the value of documenting its occurrence over a decade later is unclear. On the other hand, developing quantitative linkages between penetration events and water conditions at the 14 compliance sites is a worthwhile purpose of the enhanced monitoring. This more focused effort should be clarified and emphasized in the Report. However, as the data summarized in the Report indicate, the use of conductivity as a tracer for phosphorus may not be feasible due to the extreme differences in biogeochemical behavior of these parameters.

4. The figures on page 11 are worth additional discussion in the text, noting the linkage between net inflow, stages and periods of potential intrusion. Regarding figure 5 b introducing the idea of 'net inflow', the concept is worth continuing analysis, but expressing it as 'net inflow' is confusing. Maybe just changing 'inflow' to 'water balance' would help.
5. Also on page 11, inflow and net inflow dynamics present an opportunity to look at canal velocities. These figures demonstrate that large amounts of water were moving into the Refuge during September and early October, and that at the same time, water was exiting the Refuge at high rates. Both canals must have been flowing at considerable velocities. This aspect should be explored and may present a limiting factor for future attempts to manage inflows and outflows for water quality.
6. Is there evidence that sondes remain stable for the period of deployment? If they don't, how are the data treated? Why not use chloride as a tracer?
7. Regarding page 13, is it important to note that data interpretation for sulfate could be very problematic. Florida's climate is marine dominated and there are over 2 grams per liter of sulfur in the oceans (not to mention the coal-powered generating plant in Rivera Beach). Sulfur has a strong atmospheric component and can be actively cycled by microbial communities. How does one know if sulfate increases are attributable to deposition, intrusion, oxidation or reduction? Balancing these cycling components may generate the variability seen in the data on page 20 and make interpretation of this parameter difficult. These constraints should be noted in the Report.
8. Again on page 13, conductivity does not remain stable at a particular site without any external inputs. Stage, rainfall, precipitation/dissolution and intrusion are all involved in changing conductance levels. These factors should be spelled out as the Report attempts to deal with documentation of intrusion events. If conductance is truly conservative, it will vary by several fold just based on

rainfall and depth changes. A finding of intrusion for any particular date must include an explicit consideration of these factors.

9. A comparison of figures 12 and 5 & 6 illustrates how difficult it is going to be to associate stage, inflows, rainfall and conductivity in any predictive manner. We see no easy answer here, but expectations should be realistic and sources of uncertainty stated clearly. Analyses should begin by demonstrating a statistical correlation between external loading and the geomorphology for various time lags.
10. The report states on page 27: “none of the 2004 hurricanes should be considered extreme natural events.” District disagrees with this opinion based on the cumulative rainfall at S-5A and in upstream watersheds.

There is nothing wrong with looking at rainfall over the Refuge as one factor, but this must be done on a cumulative and regional basis. Doing a frequency curve of individual events is simply not valid to determine extremeness of four storms in one month over the region. It is like looking at individual punches and arguing the prize fighter really wasn't hammered that hard because no one punch was extreme. Furthermore, using a 3-day duration for these hurricanes is inappropriate for at least three reasons: the rainfall events lasted more than 3 days; it does not account antecedent conditions and it does not consider regional operations.

The more appropriate duration is the entire month. For the month of September, the 30-day cumulative recorded rainfall at S-5A was the second highest in the 48-yr history, equating to a return frequency of between 50 and 100 years (SFWMD publication WRE 371, 1999). Rainfall onto the Refuge should not be the sole tool to ascertain whether inflow events are unusual or not. It is just one factor; another should be cumulative inflow volumes from upstream basins. Refuge staff may recall that while the District was still in emergency operations associated with Hurricane Frances, Hurricane Ivan was forecast to track due north up the center of the Florida peninsula, requiring operations to further lower canals in anticipation.

11. We understood that the Refuge was going to use the first year of data to optimize the enhanced network. Is this being done?
12. Future versions of this interim report will fall under the Federal Data Quality Act (PL 106-544, H.R. 5658), and will require peer review using OMB guidelines “Final Information Quality Bulletin for Peer Review”, dated December 15, 2004.

We appreciate the high level of effort and expertise demonstrated in this Report and look forward to its discussion at the May 17, 2005 TOC meeting. We hope that these comments will help guide the next annual report. With more data and additional attention to external and internal factors in relation to ambient TP concentrations and limits predicted by the equation, the next report should be in a much better position “to assist us in gaining scientific understanding of historic and future exceedances.”