A PROTOCOL FOR COLLECTING SURFACE WATER SAMPLES IN MARSHES OF THE FLORIDA EVERGLADES

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EXECUTIVE SUMMARY

This document sets forth a protocol for collecting surface water samples from Everglades marshes. The protocol is intended to ensure that uniform methods are used by technical staff involved in water quality sample collection to collect a proper, representative sample of Everglades marsh water. It is the Department's intent that all parties collecting Everglades surface water samples will adopt the use of and ensure that all technical staff adhere to the provisions of this protocol.

This protocol was developed through the deliberations of the Everglades Technical Advisory Committee, which has endorsed the protocol. The Department acknowledges the contributions of Drs. Robert Kadlec and John Davis, who collaborated on the initial draft protocol from which this document was derived.

EVERGLADES MARSH SAMPLING PROTOCOL

I. INTRODUCTION.

The collection of a proper, representative sample is the first and, perhaps, the most important step in a series of steps that lead to data for use in decision making. The sampler must use good judgement and great care to ensure that the sample collected is representative of the area and medium (e.g. water column) being sampled. Flawless chain-of-custody and analytical procedures cannot correct for an improperly collected sample.

Marsh aquatic environments are highly stratified in the vertical direction, and often spatially inhomogeneous in horizontal directions. Water depths can vary from negative (below ground), to over one meter. Often, the water is in motion at speeds that may be visually indiscernible. Visible, wind-driven surface currents may not reflect the net speed or direction of the water column.

Marsh soils contain strong vertical gradients of various water quality parameters in their porewater. That porewater is often markedly different from the surface water in terms of the concentrations of chemical constituents. For instance, typically, porewater concentrations of phosphorus are greater than those in surface waters.

The bottom sediments of many marshes are very easily disturbed, and, hence, easily suspended by vehicles, foot travel, and bottle dipping. These materials are often of near-neutral buoyancy, and can be moved by small water currents, such as those created by the flow of water into a sample bottle near the bottom. The water surface may contain floating debris, small, floating leafed plants (e.g., duckweed), and filamentous algae. These materials will flow with surface water into a partially immersed sample bottle opening. The surface water column may also be stratified, with vertical gradients of water chemistry parameters.

Horizontal variability in water chemistry can result from patterns of live and dead vegetation, and the microtopography of the wetland bottom. Some areas are shaded, others more open to sunlight. A region of dense litter is subject to the influences of vegetation leaching and decay processes. Animal activity can create micro-regions of altered water chemistry due to a variety of processes, such as excretion. Thus, the surface waters in the vicinity of a bird rookery will usually exhibit elevated nutrient concentrations.

II. PURPOSE OF THE SAMPLE.

The sampler should understand what the sample is supposed to represent (e.g. open water, slough, sawgrass).

Most often, the purpose of the water sample is to represent the condition of the flowing surface waters in the marsh. It is normally **not** to represent: porewater, for which other methods exist, the easily disturbed surface vegetation and detritus which is attached to stems or leaves of vegetation, or water quality in anomalous regions of high animal activity (e.g. gator holes), excessive shading, or vegetation clumps. When sampling in vegetated areas, great care must be taken to **not** dislodge detritus which is attached to stems or leaves of vegetation. The sampling device must be carefully inserted and handled to prevent detritus on the vegetation from being collected.

Concentrations of chemical species determined for the sample will frequently be used to compute mass loadings or transportation fluxes of those chemicals. In that calculation, concentrations are multiplied by the bulk water velocity. It follows that the sample should be representative of the bulk water

concentration, including both dissolved and suspended solid forms of the constituent. The sample should include plankton, and other suspended materials that are moving with the undisturbed bulk water. It should not include floating materials that move under the influence of wind, nor settled materials that are not suspended under the influence of the undisturbed bulk water.

III. PRELIMINARIES.

Phosphorus is ubiquitous parameter often found at low concentrations, and it is susceptible to adsorption on a number of types of surfaces. Therefore, sampling equipment, such as pumps, syringes, and bottles, should be appropriately prepared before entering the field. Wash with phosphorus-free detergents, acid wash with phosphorus-free acid. Rinse with de-ionized water. Affix blank labels to sample containers. Transport sample bottles and collection apparati to the field in appropriate protective containers.

IV. APPROACH TO THE SAMPLE SITE.

A. Vehicular travel (boat, airboat, helicopter).

Ideally, approach the site from downwind and downstream. This minimizes the risk of wind and water currents transporting extraneous materials to the final sample location. Pending the results of research to define minimum distances to maintain from sample vehicles (helicopters, airboats, or boats), a minimum distance from vehicle to site should be about 10 meters. It is extremely important not to sample areas which have been disturbed by the approach of helicopters or airboats or hovering of helicopters while examining the site or taking photos.

B. Foot travel.

Exit the vehicle with all necessary sampling equipment, and proceed upstream to the sampling location. Make sure that the sampling site is representative of the area (habitat) to be sampled. Take care to minimize disturbance of sediments. Visually inspect the sampling location to ensure that such disturbance has not occurred, as evidenced by a cloud of resuspended solids, for example. Continue to closely observe the location to make sure that detritus has not been dislodged from the vegetation or sediment has not become disturbed by your approach. If the site is disturbed, move to a new site and start over. Remember, your presence will cause changes in the conditions and your movements will generate currents which will pick up base detritus.

V. SELECTION OF CORRECT MICRO-LOCALE.

Select a spot that is not filled with dense vegetation or litter, not excessively shaded (unless the shaded condition is representative of the general area), and shows no evidence of excessive animal usage. In other words, don't sample in plant clump base, a gator hole, a bird rookery, or next to a dead frog. Select a spot that has a water depth representative of those in the vicinity. Choose the final sample point (depth) as outlined in Section VI.

VI. SAMPLE COLLECTION.

Write the sample location, date, time, and sampler identification on the bottle. Be sure the chain-of-custody (COC) number is on the bottle(s). Verify that this information is correct before leaving the sampling site.

Collect sample in a manner appropriate to the equipment:

Manual sampling: Rinse the bottle and cap three times with water from an adjacent location. Do not disturb the final sampling location. Make sure that no macro detritus, duckweed or algae remain in the bottle. Remember to examine the sample collection location for items discussed in Part IV. Reach out to the final sampling location and insert the inverted capped bottle to mid-depth in the water column and carefully remove the cap. Tip the inverted bottle just past horizontal, allowing the bottle to fill very slowly. Rapid filling creates localized water currents that may entrain bottom sediments or floating materials. Replace the cap while submerged. [If samples are to be frozen, be sure to leave air space.] Remove the bottle from the water and inspect the contents for anomalous materials, such as sediment, periphyton or flocculent materials. If contaminated, re-rinse the bottle and repeat the sampling.

Pump or syringe sampling: Flush pump tubing with at least 3 volumes of site water before collecting/rinsing sample bottle. Rinse three times with water from an adjacent location as for manual sampling, bringing the rinse water through the pump or syringe to bottle and cap. Appropriate pump flow rates should be used so as not to disturb the final sampling location. Inspect bottle for extraneous materials after rinsing. Place the system intake carefully at the selected sampling point (Section V), and fill the sample bottle. Inspect the contents for anomalous materials, such as sediment, periphyton or flocculent materials. If contaminated, re-rinse the bottle and repeat the sampling.

Sample preservation: Be sure to preserve the sample immediately or handle as required (e.g. ice). Check to ensure cap is tightened on bottle. Place samples that require refrigeration on ice within 15 minutes of collection.

VII. RECORD SAMPLING CONDITIONS.

After sampling, measure and record water depth at the sample location. Five depth measurements should be taken, and the average computed, to define the mean depth at the location. If the program is long-term, staff gauges should be installed and read each time. Record the depth at which the sample was taken. Record weather conditions, and any other required and other appropriate field measurements, such as water or air temperatures, wind velocities, DO, pH, or conductivity. Record any unusual features of the site, such as evidence of hurricane, insect or fire damage. Record sampler I.D. Make notes on any unusual or special conditions. If a sample could not be collected without detritus, note it and explain.

VIII. LOW WATER DEPTHS.

The shallower the water, the greater the potential for imbibing bottom sediments and/or surface materials. It is not good practice to use the submerged dip sampling technique in water depths less than twice the bottle diameter. As noted previously, it is important to **not** disturb bottom sediments or detritus attached to stems or leaves of vegetation during sampling. Sampling can be achieved by pump or syringe in shallow water, provided that sediment disturbance does not occur. The filling or pumping rate must be slower for low water depths. At water depths less than 5 cm, very great care and patience are required.