analyze samples for TDP. Although Ortho-P and SRP are the bio-available forms of P which would have the most immediate effect on aquatic systems, they are of limited value if monitoring is being conducted for the purpose of complying with terms of the SWIM Plan.

Other monitoring concerns

The SWIM Plan mandates a decrease in P loading to the EAA agricultural drainage water receiving areas. In calculating the desired loading reductions, however, much attention was directed to P concentrations. Loading is simply a flow-weighted concentration multiplied by the volume of drainage water pumped. Hence, loading reductions can be achieved by reducing P concentrations and/or the volume of drainage water pumped off a farm. However, water supply is also a major problem in south Florida, placing limitations on the desirability of retaining much water on farms. It is clear that a farm level water quality monitoring program must include measurements of the volume of drainage water pumped off farms as well as the P concentration of that water.

Ideally, a monitoring program should enable a grower to account for all water and P that enters and leaves the confines of the farm. This information will yield farm water and P budgets. However, for SWIM Plan compliance purposes, only TP outputs to area canals will be necessary. To achieve total farm water and P budgets, the following parameters will need to be obtained: 1) fertilization amounts; 2) irrigation volumes and corresponding P concentrations; 3) rainfall amounts and P concentrations; 4) drainage volumes and P concentrations; and 5) evapotranspiration volumes. Irrigation and rainfall concentrations are important since P concentrations in both of these waters, at times, exceed P concentrations desired at the receiving areas (Izuno et al., 1990a; LOTAC II, 1990; SFWMD, 1990). Additionally, even low P concentrations in these waters can result in high loadings because of the large volumes of water involved.

Finally, a monitoring program should also include farm water table levels in order to better determine the effectiveness of the water management programs for given farms or fields. Procedures for accomplishing this will not be discussed in this publication since they are covered in depth elsewhere (Izuno et al., 1988; 1989a; 1989b; 1990).

Types of water samples

There are essentially three basic sampling procedures used in evaluating the effects of agricultural production on water quality and the environment. Each sampling procedure has specific advantages and disadvantages, depending on the intended use of the resulting data. The three sampling protocols are: 1) point-in-time grab sampling; 2) time sequenced sampling using autosamplers; and 3) flow integrated proportional sampling using integrating composite samplers.

Grab samples

Grab samples are water samples which are manually collected from the pump sump, canal, ditch, etc. and are representive only of one point in time. The manual sample collection procedure requires that an individual be present to physically collect the sample. The sample collector may use peristaltic pumps (very low flow positive displacement pumps) or the sample may be simply dipped or scooped out of the channel using a bottle. Data inconsistencies can be introduced if the samples are not collected at the same location each time. To alleviate this problem, mark the sampling location and depth or use a tube/strainer assembly (a device used to restrict the uptake of particles that would plug the suction hose or pump) that can be permanently mounted at or near the pump station in the pump sump, ditch, or canal. The hose attached to the strainer can be run to a point above the highest water surface level expected and hooked to a pump when a sample is being collected.

The most appropriate depth for sample collection is about 20 to 40 percent of the total channel depth beneath the water surface. For systems that do not use the fixed mounted strainer assembly, a suction strainer can be attached to a length of hose and lowered into the water body prior to start-up of the sampling pump. In the case where a bottle is used to dip a sample, the collector may simply turn the bottle upside down and push it down to the appropriate depth. No water will enter the bottle since the above action traps the air inside the bottle, inhibiting the air displacement with water. At the appropriate depth, the bottle should be tipped sideways or upright to allow water entry. Once filled, the bottle may be capped under water or raised to the surface sideways to reduce the potential for contamination by water from undesired