sampled. Autosamplers are discussed in detail in Taylor et al. (1991).

Autosamplers are designed to collect a series of water samples throughout the duration of a drainage event without necessitating the presence of a person. They can also be connected to pump controls so that sampling initiation can be triggered by pump operations. This type of sampling scheme is by far the best for characterizing drainage water nutrient concentrations. However, capital and operating costs are relatively high.

As was shown in Figure 2, concentrations can change during pumping. Collecting a series of samples on relatively short, equal time intervals during the drainage event ensures that a representative time averaged nutrient concentration results. Additionally, when using water sample analyses to determine the effectiveness of a BMP program, it is desirable to know when during the drainage event phosphorus loading reductions occurred as well as how much of a reduction was achieved. Knowing the timing, duration, and height of the nutrient concentration peaks under BMP and pre-BMP conditions could yield important differences that may have been hidden in a simple average concentration for the event.

Flow integrating composite samples

Flow integrated composite samplers collect water samples in amounts proportional to flow rates during a pumping event. The water samples are deposited in a single large container, yielding a composite sample that accounts for flow changes that occur during sampling.

A flow integrating sampler usually requires that a water flow measuring device be installed in the channel being monitored. The flow meter is electronically connected to the autosampler and a data logger, and its output is used to control the sample flow rate into the receiving bottle. These systems are more complex with respect to installation and management, and are expensive.

Flow integrated composite samples can also, at times, be obtained when pumps are being used. A good composite sample can be collected by simply attaching a small tube to the discharge port of the pump. The head on the discharge side of the pump will be sufficient to produce a small stream of water through the tube as long as the discharge pipe is flowing full. The flow from the tube will be approximately flow proportional and can be deposited in a large (5 to 10 gal) collection container. If the flow fills the container too quickly, a smaller diameter tube can be used or the sample stream can be split on the edge of a funnel.

A single subsample can be extracted from the large composite sample for analysis. It is probably desirable to analyze more than one subsample because of the concentration variability between subsamples which will occur when analyzing for TP. The TP concentration of the subsample is flow weighted, and hence, it can be directly multiplied by the flow volume to calculate TP loads.

Sample collection locations

At the very least, a water sample collection station should be located near the main pump station serving the farm. Ideally, samples should be taken directly from the pump discharge pipe, before it has a chance to mix with canal water outside the farm boundaries. In the case where the discharge pipe is above the canal or discharge sump water level, sampling discharge water is a fairly easy task to accomplish. In the case of a submerged outlet pipe, water should be taken from within the discharge pipe, necessitating access into the pipe. Simply placing the autosampler suction strainer in the discharge pit may yield highly variable results since the bottom sediment will be stirred up by the discharge waters.

An autosampler could be placed at the pump inlet in the sump pit. The operator will have to contend with floating trash and rapidly fluctuating water levels. Additionally, much sediment will be stirred up by the vortex created as water is sucked up into the pump. On the other hand, the pump inlet sump pit should provide a well mixed water sample. The operator may also have to install an additional sampling station to account for irrigation water unless it feeds into the drainage inlet sump.

A sampling station can be installed upstream of the pump within the confines of the farm (Figure 3). The station should be at a point where no water can enter or leave the farm in surface ditches without passing the sampler. Mounting the sampler a sufficient distance upstream of the pump station will minimize the rapid and frequent changes in water level, enabling the collection of samples from