

Guidelines for Recollecting Samples from Marsh Stations

Introduction

Marsh water quality monitoring projects are designed to collect data from specific stations at a particular frequency, usually monthly or biweekly. Data from a subset of these stations are used to calculate compliance with State of Florida TP (Total Phosphorus) Rule and the 1991 Settlement Agreement LNWR Marsh Phosphorus Levels. As written, the compliance tests require a single monthly datum from each station with no provision for multiple data points from a single station within a given month. Consequently, the existence of more frequent data, whether collected routinely or in response to unplanned events, creates difficulties in both the application and interpretation of compliance tests. This document briefly outlines the theoretical causes which may result in the collection of a second sample from a station and suggests guidelines for when and if such a sample collection should or should not be considered.

Multiple Causes for Sample Recollection

Reasons for sample recollection can be divided into four categories: 1) Project Logistics, 2) Sample Collection Failure, 3) Laboratory Failure, and 4) Result Validation. Each of these categories is discussed in detail below.

1) Project Logistics and Overlapping Monitoring Designs

Logistical issues within a project may lead to the collection of data that may be interpreted as a recollection whether they actually are or not. Frequency of sample collection within a month is determined in response to multiple mandates, some with different required frequencies; consequently, sampling frequency to meet all mandates can often be different than that required by a specific mandate. Additionally, a sample can also be perceived as having been recollected when the number of stations required to be sampled on a given day to satisfy multiple mandates, exceeds the capacity of the sampling crew. This may lead to overlapping stations having several independent samples collected on different days for multiple projects. Addressing the recollection issue that arises through project logistics can be done through optimization of sampling stations coupled with an understanding by data end-users that datasets may have to be screened for frequency issues before being used.

2) Sample Collection Failure

The successful collection of data and/or samples in the field can be influenced by a variety of circumstances, such as equipment failures, adverse weather conditions, human error and/or other factors. Often these “lost” samples are the result of a variety of problems associated with the sampling, including failure to collect sample, failure to properly process and/or preserve a collected sample, bottle breakage, transportation errors that either damage samples or delay them beyond holding times, or a combination of any of these. Regardless of the cause, the result is that the sample is not available to be analyzed; subsequently, the project manager may request that a second sample be collected from the station(s) in order to allow the compliance calculation to be made. Sample recollection to replace a lost sample is defensible as long as the second sample is collected in a timely manner and before any event that might alter ambient conditions.

3) Laboratory Failure

Following the delivery of a sample to the laboratory, a variety of circumstances can result in a sample being lost and can include bottle breakage, exceeding holding times and improper processing. Similar to Sample Collection Failure, the result is that the sample is not available to be analyzed or the analytical result may be questionable, regardless of the cause. Fundamentally however, the two differ in the amount of time that passes before a sample has been identified as “lost”. Unlike the narrow temporal window (hours) during sampling in which a sample can be deemed lost, hours to days to weeks may mark the difference between a sample arriving at the laboratory and it being identified as lost. Because of the time sensitive nature of collection samples and the possibility of changes in the ambient environmental conditions at a station in response to an extreme weather event especially during the wet season, it is not probable that a sample can be recollected that would be comparable to the lost sample. Although staff may request that a second sample be collected from a station for the compliance calculation when the original has been lost to Laboratory Failure, such a request is not defensible as timely or as cost effective under most circumstances.

4) Result Validation

Following the successful collection and analysis of a sample, the analytical result may appear to be a historical outlier. In this example the sample, which has passed all field and laboratory quality controls, yields a value so far outside the expected range of values that the project manager (or another, acting in an official capacity) deems it a gross outlier and subsequently requests that a second sample be collected to validate the original. This decision is wrought with potential problems. First, the time difference between the collection of a sample and the analytical results being presented to the project manager may be separated by weeks or months. Similar to collecting a second sample to replace a sample lost through Laboratory Failure, our ability to collect a second sample that represents an aberrant sample is usually precluded by temporal constraints. Second, data that are shown to be real outliers ~~are not statistical anomalies~~ may necessitate additional sampling to address why the sample value was so different. This is a research question rather than a monitoring objective and may not be feasible

Factors Influencing Guidelines for Recollection

When contemplating recollection, one must also take into account the parameter of interest and its priority within the mandate, permit, and/or compliance requirement. Not all parameters have the same priority. Although some parameters have regulatory significance they are not subject to monthly compliance testing. Thus, the second sample policy outlined herein follows the logical dictate that TP, which is the most important compliance parameter, is the parameter around which a second sample decision should be developed. Consequently, the following three factors were considered in formulating the guidelines for determining if a second sample is needed:

1. Total water depth influences the applicability of compliance tests and dictates which parameters are collected at any station (i.e. <10 cm no sample, >10 cm

but <20 cm TP only, and >20 cm all parameters), therefore; total water depth needs to be included in the decision matrix with TP.

2. There is no requirement for TP Rule stations to be sampled on the same day (regardless of previous interpretations), therefore; sampling trips should be scheduled in such a way that eliminates duplicate (second) samplings of the same station.
3. Beyond any legally mandated requirements, there is significant logistical and interpretive value in minimizing the time between sampling different stations in the same waterbody, therefore; stations from a single water body should be sampled in the shortest possible time frame, preferably within the same day.

Recollection Guidelines for Project Logistics

As described above, logistical issues may generate, or appear to generate, duplicate samples. To eliminate or minimize this issue, the following recommendations are made:

1. All projects should be optimized in terms of station number, location, and sample frequency to eliminate duplicative work if possible.
2. Samples that are collected under the auspices of multiple projects, mandates, permits, etc. must be collected using approved and standardized collection and data validation methods. Any data resulting from using other methodologies must not be considered as appropriate for inclusion in the compliance calculation.

Recollection Guidelines for Sample Collection Failures

To eliminate or minimize problems associated with collecting a second sample to replace a sample deemed lost because of sampling failures, the following recommendations are made:

1. A second sample may only be collected if the lost sample is a TP sample or if the measurement of total water depth was done improperly.
2. The nature of sampling is such that if failures occur, they may occur in singular or systematic manners, compromising individual, multiple or even all samples. Consequently, a threshold value of lost samples must be considered. As a guideline, a sampling event which suffers a failure of at least three samples, which amount to at least 25% of the monthly samples required for the monthly compliance test for a specific waterbody, should be considered compromised and require the mandatory collection of second samples at all stations at which samples have been lost.
3. If the total number of lost samples is <3, or <25% of the total monthly samples needed for the compliance calculation, a mandatory collection of second samples is not required. If a second sample is requested, it must be justified in writing and approved by the supervisor of the Field Project Manager making the request.

4. If the compliance test is not time or stage sensitive (such as the TP Rule), the collection of a second sample may be scheduled for any other regularly scheduled sampling trip within that month unless ambient conditions have so obviously changed (e.g. a storm event occurs between the initial and second sampling event) that replacement samples can not be collected.
5. If the compliance test is time or stage sensitive (such as the Loxahatchee National Wildlife Refuge portion of the Settlement Agreement) the collection of a second sample may only be scheduled for any regularly scheduled sampling trip within two days of the original event.
6. The collection of a second sample whether mandatory or by choice, requires that all parameters need to be included at the station(s) in question.

Recollection Guidelines for Laboratory Failures

Overall, the number of lost samples generated as a result of laboratory failures should be extremely low. Consequently, such failures should have little impact on compliance testing and therefore should not be a cause of concern. Additionally, because laboratory failures are unlikely to be detected within two days of the original event, lost time sensitive samples resulting from a laboratory failure can not be replaced by a second sample and thus no second sample should be collected. While non-time sensitive samples lost to laboratory failures have the potential to be recollected, this course of action is not recommended except under the unusual circumstance that the failure is discovered quickly.

Recollection Guidelines for Result Validation

Collecting a second sample in order to validate results at a particular station is fraught with logistical, scientific, compliance and political factors, and should not be considered without extensive discussion. Central to these discussions should be the timeliness of sampling. Results from the initial sampling may not be available for days or weeks, and it may take several days to review those results. As a result, it is not likely that samples for result validation can be taken within a few days of the original sampling. As a guideline it is suggested that if the unusual results were generated from stations that are collected on a biweekly or weekly basis, then a trip for result validation is not recommended.

If the data in question are collected on a monthly basis, the following recommendations are made to eliminate or minimize problems associated with the real and/or perceived need to validate results. It may be helpful to view these guidelines as a process by which the need for result validation sampling is determined.

1. Any member of District staff who notices an aberrant result can initiate the process to consider taking a second sample for result validation.

2. Recollection should only be considered in cases where TP results are derived from samples required for monthly compliance testing.
3. Recollection should only be considered in cases in which TP results are unusual. As a guideline unusual is defined as greater than the historical maximum  plus twice the standard deviation, ~~or less than the historical minimum value minus twice the standard deviation.~~ 
4. Prior to recollection, the initial samples should be re-analyzed and the Laboratory and Field QA officers should review the results, lab notes, and field notes 
5. The collection should be carried out within the same calendar month as the original sample, noting that within two weeks being more desirable.
6. Recollection for sample validation is to be used only in isolated cases, not to investigate events that appear to have some periodicity or confounding factors, or to determine the causality of specific events. In these cases the development of a research plan should be required.
7. Recollection for result validation should only be carried out if it is determined that a systematic sampling error has occurred on the entire trip. If the error can be isolated to a specific station or stations, sufficient options exist to qualify the existing data, and recollect under the sample collection failure guidelines.
8. The collection of a second sample requires approval from the WQM Division and Department Director who must weigh the logistical costs and the potential impacts on compliance.
9. The collection of a second sample requires notification of the Technical Oversight Committee (TOC) at the next scheduled TOC meeting.
10. The collection of a second sample should ~~not~~  be station specific, but rather requires that all stations and all parameters ~~be~~ re-sampled. This requirement serves to validate the entire trip and examines the possibility that any unusual phenomenon may, or may not be mobile within the system.
11. Sampling staff and the Project Manager are required to assure that the field notes and sample comments clearly record that a second sample has been collected to validate unusual results.
12. The results of the second sampling event will not automatically replace the results of the original sampling event. Rather they should be used to evaluate the original results in an effort to determine if an error or extraordinary natural phenomena may have occurred.