Alligator Creek
FDEP 319h Water Quality Monitoring Program
Final Report - May 8, 2015
Prepared for Sarasota County by
WATERMARK ENGINEERING GROUP, INC.

APPENDIX C –
QUALITY ASSURANCE PROJECT PLAN (QAPP)

QUALITY ASSURANCE PROJECT PLAN

FDEP AGREEMENT NO G0260

ALLIGATOR CREEK STORMWATER TREATMENT PROJECT

WATERMARK ENGINEERING GROUP , INC.
1718 MAIN STREET
SARASOTA FLORIDA 34236

FDEP AGREEMENT #G0260

PROJECT: SARASOTA COUNTY ALLIGATOR CREEK STORMWATER PROJECT

November 3, 2011

Prepared By:

WATERMARK
ENGINEERING GROUP, INC

A.1 APPROVALS FOR ALLIGATOR CREEK STORMWATER PROJECT QUALITY ASSURANCE MEASURES

FDEP AGREEMENT NO. G0260

Mark J. Flint, PE [Date]
WATERMARK QA Officer

Peter Peduzzi, P.E. [Date]
Sarasota County Project Manager

Jon Perry [Date]
Sarasota County Technical Manager

Cesar A. Rodriguez [Date]
Sarasota County Quality Assurance Officer

Dale Dixon, Benchmark EnviroAnalytical, Inc. [Date]
Laboratory Director

Tulay Tanrisever, Benchmark EnviroAnalytical, Inc. [Date]
Quality Assurance Manager

Michael Scheinkman, FDEP [Date]
FDEP Project Manager

Michele L. Reliford, FDEP . [Date]
Quality Assurance Officer

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A.1 QUALITY MANUALS
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A.3 OPERATING MANUALS

A.3 DISTRIBUTION LIST

A.3.1 Sarasota County Public Works (County)
Environmental Services Program Management
1001 Sarasota Center Boulevard
Sarasota, FL 34240
Peter Peduzzi, P.E., Project Manager
Phone: (941) 861-0523
Fax: (941) 861-0986
Email: ppeduzzi@scgov.net

A.3.2 Sarasota County Public Works (County)
Water Resources Department
1001 Sarasota Center Boulevard
Sarasota, FL 34240
Jon Perry, Technical Manager
Phone: (941) 650-7680
Fax: (941) 861-0986
Email: jperry@scgov.net

A.3.3 Sarasota County Public Works (County)
Environmental Services Department
c/o Carlton Water Treatment Plant: 1255 T. Mabry Carlton Parkway
Venice, FL 34293
Cesar A. Rodriguez, QA Officer
Phone: (941) 650-1112
Fax: (941) 480-3558
Email: crodrigu@scgov.net

A.3.4 WATERMARK ENGINEERING GROUP, INC.
1718 Main Street
Sarasota Florida 34236
Phone: (941) 726-2910
Fax: (941) 954-8917
Email: mflint@watermarkengineers.com

A.3.5 Stormwater Treatment Environments, LLC
481 Genius Drive
Winter Park, FL 32789
Marty Wanielista, PhD, PE, President
Phone: (407) 761-1834
Email: marty@greensmarts.com

A.3.6 Benchmark EnviroAnalytical, Inc.
1711-12th Street East

Palmetto, FL 34221
Dale Dixon, Laboratory Task Manager
Phone: (941) 723-9986
Fax: (941) 723-6061
Email: dale.dixon@benchmarkea.net

A.3.7 Benchmark EnviroAnalytical, Inc.
1711-12th Street East
Palmetto, FL 34221
Radica Koutselas, QA Officer
Phone: (941) 723-9986
Fax: (941) 723-6061
Email: radica.koutselas@benchmarkea.net

A.3.8 Florida Department of Environmental Protection (FDEP)
Bureau of Watershed Management/Nonpoint Source Management Program
29 Dune Drive
Santa Rosa Beach, Fl 32459
Michael Scheinkman, Project/Grants Manager
Phone: (850) 267-2075
Fax: (850) 267-2075
Email: Michael.Scheinkman@dep.state.fl.us

A.3.11 Florida Department of Environmental Protection (FDEP)
Environmental Assessment Section
2600 Blair Stone Road, MS# 6500
Tallahassee, FL 32399-2400
Andy Tintle, QA Officer
Phone: (850) 245-8077
Email: Michele.Reliford@dep.state.fl.us

A.4 PROJECT/TASK ORGANIZATION

A.4.1 Sarasota County
Peter Peduzzi, P.E., Project Manager
Jon Perry, Technical Manager
Cesar A. Rodriguez, QA Officer
Responsible for contract management, technical guidance, laboratory coordination, QA review, work product review.

A.4.2 FDEP
Michael Scheinkman, Project Manager
Michele L. Reliford, QA Officer
Responsible for QA review.

A.4.3 WATERMARK ENGINEERING GROUP, INC.
Mark J. Flint, PE
Responsible for hydrologic data collection, management and analysis.

A.4.5 STE, LLC
Marty Wanielista, PhD, PE
Responsible for Water Quality QA review and data statistical analysis.

A.4.6 Description of Organization

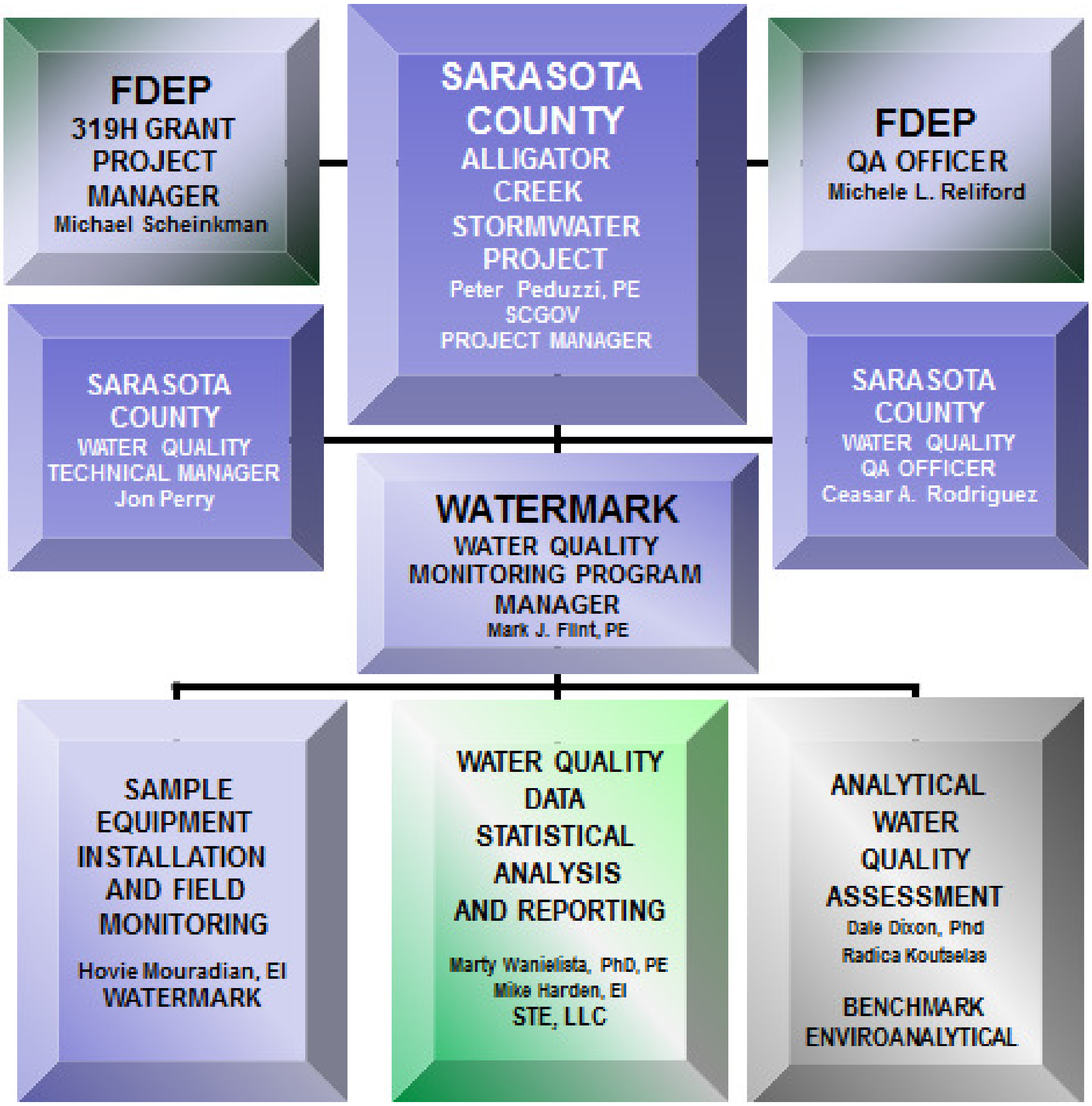


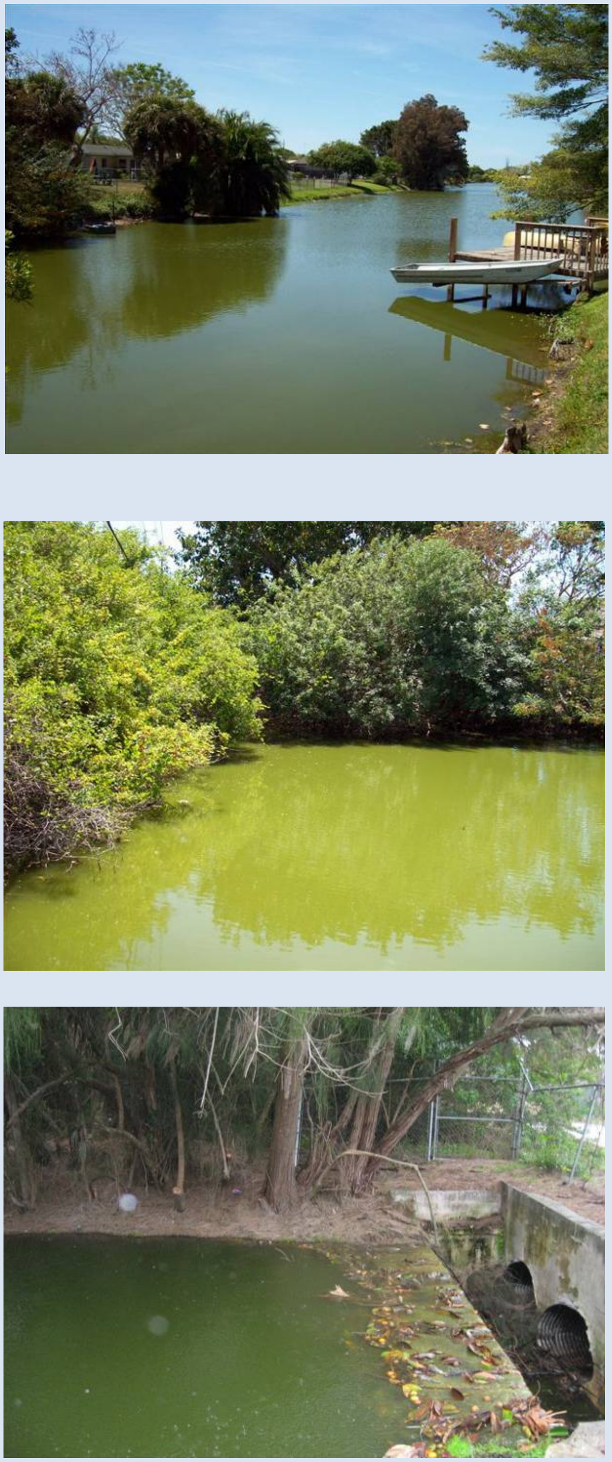
FIGURE A.4.6-1 PROJECT ORGANIZATION

A.5 PROBLEM DEFINITION & BACKGROUND

The Alligator Creek Watershed includes the Briarwood Lakes system that encompasses approximately 605 acres of area in south Sarasota County. This drainage basin includes about 65 acres of man-made canals and lakes collectively described in this document as the Briarwood Lakes System. This man-made Briarwood Lakes system serves as stormwater conveyance and treatment for Venice Gardens.

The lake system was reportedly constructed more than 30 years ago, and today it is hyper-eutrophic, exhibiting consistently poor water quality throughout both the wet and dry seasons. Portions of the lake system are believed to have hydraulic residence periods greater than one year. During significant storm events, stormwater discharges from the lake system to a discharge canal that conveys flow to Alligator Creek (See Photos A.5-1).

The Alligator Creek Stormwater Project involves the construction and operation of an innovative stormwater treatment system that incorporates passive wetland treatment processes and an integral upflow sorptive media filter system to treat stormwater on a continual or semi-continual basis. The project is located on approximately 5 acres of Sarasota County owned property known as the former Briarwoods WWTP site that involves modifications to abandoned wastewater treatment holding ponds and creation of man-made wetlands and a filter system. The treatment system is an innovative Best Management Practice (BMP) that will provide high rate stormwater treatment using variable flow pumping systems for treatment and will effectively reduce nutrient discharges to Alligator Creek.



PHOTOS A.5-1 BRIARWOOD LAKES WATER QUALITY CONDITIONS

This project is unique in that the BMP does not rely on precipitation events for treatment. During dry weather seasonal periods, water from the existing Briarwoods Lakes system is conveyed by pump station to the treatment system, and treated water is returned to the lake by an independent return pump station. In wet season conditions, the treated flow may either be returned to the lake system by the return pump station or flow may be discharged by a gravity outfall into the Alligator Creek discharge canal.

A.5.1 Site History

The Alligator Creek Stormwater Treatment Project is located on the former Briarwood WWTP property (a.k.a. Venice Gardens WWTP). This site previously served as home to interim and sub-regional wastewater treatment facilities (and expansions in capacity) that provided wastewater treatment for more than 30 years before the facilities were relocated. The abandoned WWTP site includes effluent holding ponds, an existing wastewater pump station, and abandoned pipe infrastructure.

A.5.2 Location

The Alligator Creek Stormwater Treatment Project is located on the former Briarwood WWTP property (a.k.a. former Venice Gardens WWTP).

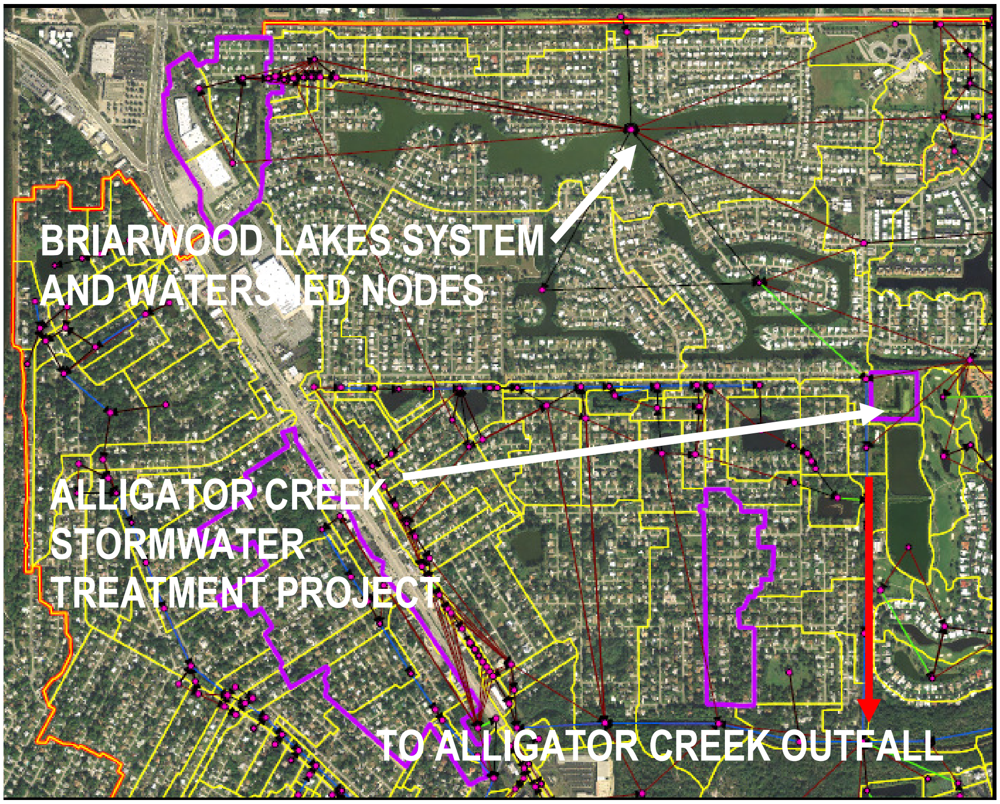


FIGURE A.5-1 LOCATION OF ALLIGATOR CREEK STORMWATER TREATMENT AND BRIARWOOD LAKES SYSTEM

The new Alligator Creek Stormwater Treatment facility site represents a true sustainable use of the abandoned public lands and optimizes stormwater treatment for the Briarwood Lakes discharge to Alligator Creek and Lemon Bay. The Alligator Creek Stormwater Treatment site is accessible at the east end of Briarwood Drive through a fenced and lock secured site. The site is not accessible to the public. The Briarwood Lakes outfall ditch is contiguous to Alligator Creek and is considered to be Waters of the US. Alligator Creek is a Group 3 Priority Water Body in the TMDL Program and is the subject of water quality improvements defined within this project.

A.5.3 Project Purpose

The Alligator Creek Stormwater Treatment monitoring program addresses the required stormwater monitoring outlined in the FDEP Grant and an expanded approach that will document the effectiveness of the Briarwoods Stormwater Treatment system and the internal effectiveness of the treatment train. The monitoring program illustrates sampling points, provides locations for installed sampling equipment, and is provided as a complete Water Quality Monitoring Plan and can be found as Attachment A.

A.6 PROJECT/TASK DESCRIPTION

The various monitoring and sampling methods that will be used to analyze processes taking place in the system are outlined in this section. Water quality, flow measurements, and area rainfall will be monitored and recorded on a continual basis over a 24-month period to evaluate system performance efficiencies. Field monitoring and sample collection will be the responsibility of WATERMARK Staff. WATERMARK staff will transfer collected samples to the designated laboratory for transportation and subsequent analysis. Sarasota County will be responsible for collection of rainfall data.

A.6.1 Stage and Flow Measurements

Stage and flow measurements of the Briarwoods Lake System outfall and the wet weather outfall (Structure ST-6 of the Treatment Facility-as shown on the Water Quality monitoring Plan) will be recorded at the Briarwoods Stormwater Treatment site using a *Greyline Industries Model OCF 5.0 or equivalent unit*) with independently dedicated remote flow sensors. The flow transponder will be temporarily installed and movable as necessary (note the sensors can be installed up to 500 ft. from the measuring point). The flow measurement will be based on an ultrasonic level measurement (within a stilling well) that will correlate stage with the discharge characteristics of the weir (or orifice). The flow meter has the capacity to digitally store continuous time based data and provides an optional 5-20 ma signal back to the portable sampling device.

A.6.2 Water Quality Samples: Stormwater Sampling

The water quality sampling process will be in accordance with the protocols set forth in the standard operating procedures DEP SOP March 31, 2008 (effective 12/3/08) for field sampling under DEP QA Rule, 62-160, F.A.C. 12/3/2008. These procedures are found under the DEP-SOP-001/01 FS 1000 March 31, 2008 (effective 12/3/08). Water quality samples will be a flow-weighted by using automated portable samplers.

A.6.3 Water Quality: *In Situ* Sampling

In situ water quality parameter (temperature, pH, conductivity, dissolved oxygen, and turbidity) readings will be collected concurrent with automatic sampler sample collection following DEP SOPs FT1100, FT1200, FT1400, FT1500, and FT1600. The multi-probe measurement will be approximately mid-stream near the bottom of the water column.

A.6.4 Rainfall

Rainfall measurements will be continuously recorded at the nearby Sarasota County Automated Rainfall Monitoring System (ARMS) No AL-1 Jacaranda Bridge-750 that is located within less than 0.50 miles from the site.

A.6.5 Project Timeline

Activity	Contract Date
Construction Complete (Substantial)	December, 2011
Submit QAPP (Draft)	September 2011
Submit QAPP (Final)	November, 2011
Equipment Installation & Calibration	December 2011
First Year of Data Collection Complete	January 31, 2013
Second Year Data Collection Complete	January 31, 2014
Submit Quarterly Reports	January, April, July, October 2012, January, April, July and October 2013, January 2014
Submit Final Report	June 2014
Retain all documents and records for five (5) years Per FDEP SOP FD1100 3.1	July 2019

A.7 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT OF DATA COLLECTION/MEASUREMENT (DQO)

A.7.1 Definition of the Problem

The problem, simply stated, is to document treatment effectiveness of the BMP. This water quality study will quantify the effectiveness of the best management practice (BMP) and various elements of the treatment train in treating stormwater runoff from the Briarwood Watershed and Lake System.

A.7.2 Corrective Action

The BWSTF was constructed to provide additional pollutant removal for Alligator Creek discharge in to Lemon Bay. Quantification of the results are needed to determine if this is a viable pollution reduction alternative for this basin as well as other urban basins. Corrective Actions will be in accordance with DEP SOP FD1000 if any failures in measurements or quality control occur.

A.7.3 Monitoring Evaluation

The monitoring project addresses the BMP evaluation element and outlines an approach to BMP monitoring that will be of value in documenting the effectiveness of cascading pond treatment systems like the Briarwoods Stormwater Facility. The BMP effectiveness evaluation phase should improve future estimates for nutrient load reductions resulting in better future management decisions. The monitoring evaluation will include data from the following equipment: Continuous water stage recorders, a continuous rainfall device, continuous velocity meters, automatic refrigerator samplers, and an appropriate laboratory to perform the analyses.

A.7.4 Errors

Errors should be kept to a minimum by collecting duplicate samples, testing water level equipment against a reference point, comparing two different water level sensors, daily monitoring of continuously collected data for proper functions, calibration of field equipment, checking equipment contamination by flushing with tested deionized distilled water when changing the tubing, as well as the many safeguards already tested by the laboratory doing the sample analyses. Should an error occur, notification and corrective action will occur per DEP SOP FD1000.

A.7.5 Quantity of Data to be Collected

There are three parts to the sampling program as described ahead in section B.1.9. The first part is background sampling, followed by treatment optimization, which is followed by bi-monthly sampling that consists of 8 independent sampling events evenly distributed during dry and wet weather conditions. Flow data for the inter-event treatment system will be collected continuously by flow recorders at the pump stations. Data will be uploaded via modem at appropriate times and used in the overall assessment of the project.

A.7.6 Quality Assurance

Quality assurance information will be discussed in Group B of this quality assurance plan in accordance with the QA Rule 62-160 and DEP SOP-001/01 March 31, 2008 (effective 12/3/08).

A.7.7 Reports

Data will be presented in a final report including tables and figures. All the data will be recorded in appendices and summary data will be included in the body of the report along with discussion and analysis. Quarterly data reports will also be produced.

A.8 SPECIAL TRAINING/CERTIFICATIONS

All employees in the water quality sampling process will be properly trained to collect and handle samples in accordance with the protocols set forth in the standard operating procedures in DEP SOP 001/01 March 31, 2008 (effective 12/3/08) for field sampling under DEP QA Rule, 62-160, Florida Administrative Code (F.A.C.) 12/3/2008. Employees will also be trained for specialized use and maintenance of YSI field instrumentation.

A.9 DOCUMENTS AND RECORDS

A.9.1 The QA Project Plan will be distributed by email, the project extranet site, postal mail, or in person to the appropriate staff.

A.9.2 The final report will be a comprehensive document that includes: executive summary, introduction, site description, BWSTF diagrams, storm flow measurements, base flow measurements, outflow measurements, water quality samples for storm and base flow events, field parameter results, comparison to water quality standards and historical water quality, statistical analysis including tests for normality, correlations, ANOVA comparison and/or other appropriate measures, summary of results, conclusions, references, and recommendations. A complete listing of the data collected will be included in appendices along with quality assurance testing.

A.9.3 The complete report, final records including field journals, data logger programs, chain-of-custody forms, raw laboratory results, invoices and all the data will be available for review and will be maintained by WATERMARK for record retention.

A.9.4 All records and documentation created by this project will be retained by the Sarasota County project manager for a minimum of five (5) years per the DEP QA Rule, 62-160.220 & .340, F.A.C. and located at the Sarasota County Project Management office. A copy of all final reports created for this project will be held in the Sarasota County office.

GROUP B. DATA GENERATION AND ACQUISITION

B.1 SAMPLING PROCESS DESIGN (EXPERIMENTAL DESIGN)

B.1.1 Study Methods

The study uses methods similar to those that were used for other successful BMP monitoring studies. The experimental design details are provided in the Scope of Work in Section A.6.

B.1.2 Rationale for Study Methods

The data and samples are generally being collected using the methods described in the ASCE/EPA publication “Urban Stormwater BMP Performance Monitoring: A Guidance Manual for Meeting the National Stormwater BMP Database Requirements.”

B.1.3 Use of Data

Data will be compared to evaluate performance efficiency and/or state water quality standards and to historical data.

B.1.4 Sampling Sites

The sampling sites were chosen to reflect the untreated volumetric flow of stormwater to the treatment system (Pump Station A-Influent), intermediate treatment processes, and discharge to either Alligator Creek (Structure ST-6) or to the Briarwood Lakes system (Pump Station B-return flow).

B.1.5 Automatic Sampling Equipment

The automatic sampling equipment records and collects flow data continuously and is used to pace the autosamplers in a flow-proportionate mode. A field technician visits the site approximately bi-weekly and more often during the rainy season, if necessary.

B.1.6 Sample Triggers

Bi-annual sampling events are not required to be triggered by storm events; rather the sampling is triggered by flow induced by pumping systems. Samples will be taken at 2 sites during the wet season and at 2 sites during the dry season. In addition to the bi-annual sampling required under the FDEP Grant, initial background conditions of the lake system will be assessed, and intermediate performance sampling of the treatment system will be accomplished. There are no meteorological triggers tied to the performance or background samples. Samples collected in composite samplers are kept on ice at 4 Degrees Celsius until analyzed in accordance with the DEP SOP FS 1000.

B.1.7 Location of Sampling Devices

Continuous Sample Probes will be installed at pump station wetwells during the sampling period at locations shown. The probes and sample lines will be extended by attachment to PVC pipes to mid depth of the wetwell sampling locations.

B.1.8 Types of Samples

There are several sample sources. All sample matrices are surface water, and may be described as raw stormwater (untreated), partially treated (process treatment phases), and final treated stormwater.

B.1.9 Elements of the Sample Collection Design

See Attachment A for details on the sample collection points for each type of sample.

B.1.9.1 Schedule A Sample Program-Background: WATERMARK will collect single background surface water quality samples (grab sample method) at five sites within the Briarwod Lakes system and one site in the Alligator Creek ditch at the outfall from the treatment system that will be correlated with predictive hydrologic conditions and representative of the rising limb hydrograph of a normal rainfall event at existing Briarwood Lakes weir prior to discharge to the existing Alligator Creek ditch. These samples will be obtained for characterization of the initial conditions present at the site.

B.1.9.2 Schedule B Sample Program- Operations Optimization: WATERMARK will establish an internal treatment optimization program for the Briarwoods Treatment System. WATERMARK will conduct a 15 day operational adjustment of the Briarwoods treatment site to evaluate the system response to batch treatment flow. In this mode of operation, the pump station controls will be programmed to fill the treatment system, allow for pre-determined retention period, and then re-pump the treated effluent back to the Briarwoods Lake system. Water quality samples will be taken at 5 day intervals to assess the performance of the batch treatment.

B.1.9.2.1 – Internal Treatment Low Flow Operations: WATERMARK will conduct a 15 day operational adjustment of the Briarwoods treatment site to allow for continuous low flow treatment (50% of maximum design flows) to evaluate treatment performance. Water quality field samples will be taken at 5 day intervals to assess the performance of the batch treatment.

B.1.9.2.2 – Internal Treatment High Storm Flow Operations: WATERMARK will conduct a 15 day operational adjustment of the Briarwoods treatment site to allow for continuous high flow (% of maximum design flows at different backwash cycles) to establish a peak treatment capacity/optimized backwash protocol. Water quality field samples will be taken at 5 day intervals to asses the performance of this treatment protocol.

B.1.9.3 Schedule C Sample Program- Bi-Monthly Sampling (319h): WATERMARK will collect field data and flow composited water samples in this sample program. Samples will be delivered to Benchmark Enviroanalytical, Inc. in accordance with the QAPP. There are eight (8) bi-monthly tasks. The inflow will be measured at BW-WQ1 for all eight events. Four outflow samples will be taken during the wet weather at BW-WQ3 and four outflow samples during dry weather at BW-WQ2.

B.1.9.3.1 One composite bottle used at each sampling location to collect the appropriate amount of water for each analysis.

B.1.9.3.2 All continuous samples are to be 24 hour composites.

B.1.9.3.3 The sample locations were selected after discussing all the possibilities and understanding representative flows, residence times and optional operational parameters. The sites were chosen to be representative and suitable for sampling equipment.

B.1.9.3.4 Field replicates and blanks are collected each time the tubing is changed on the sample cooler units and a duplicate is collected after two sampling events for quality assurance.

B.1.10 Parameters Tested

The parameters to be tested reflect common constituents in stormwater runoff. In particular, the following parameters will be sampled: ammonia nitrogen, NO_x nitrogen, TKN, total nitrogen, orthophosphorus, total phosphorus, total suspended solids and BOD.

B.2 SAMPLING METHODS

In general, all sampling procedures will follow Florida Department of Environmental Protection (FDEP) “Standard Operating Procedures for Field Activities” (DEP SOP-2008 (effective 12/3/08). A sampling

B.2.1 Flow Measurements

This project uses Greyline OCF 5.0 flow meter. Flow measurement data will be digitally recorded and stored, and available for download. This meter will be used during sampling events to correlate flows into the treatment system, and for establishing a water balance.

B.2.2 Rainfall Measurements

Rainfall data will be examined at an existing rain gauge at the Jacaranda Bridge (ARMS AL-1) maintained by Sarasota County. The ARMS site provides real time rain data to assist in anticipating a site visit, should the WATERMARK Team determine that it is necessary to observe flow responses within the treatment system. The location of the ARMS station is described in Attachment A.

B.2.3 Field Water Quality Monitoring

A YSI Environmental Monitoring System sonde (model YSI 600 XLM V2) will be used to collect *in situ* measurements of temperature, pH, dissolved oxygen (both mg/l and percent saturation), conductivity, and turbidity during autosampler sample retrieval following DEP SOPs FT 1100, FT 1200, FT 1400, FT 1500, and FT 1600. Table B.2.3 summarizes the sampling method, accuracy, expected concentration, range and resolution for each field parameter.

Table B.2.3 Analytical Methods and Quality Assurances Objectives for Field Measurements

Parameter	Method	Experimental Matrix	Expected Concentration	Accuracy	Measurement Range	Measurement Resolution
Dissolved Oxygen	SM 4500G[1] Man. Spec.[2]	S	0.0 – 10 mg/L	+/- 2%	0-050 mg/L	0.01 mg/L
Hydrogen Ion (pH)	SM4500H^+ Man. Spec.	S	6.0 – 8.0 Units	+/- 0.2 Units	0 – 14 Units	0.01 Units
Specific Conductivity	SM2510B Man. Spec.	S	100-1250 mS/cm	+/- 0.5% +0.001mS/CM	0.0 – 100 mS/cm	0.001 mS/cm
Temperature	SM2550B Man. Spec.	S	15 – 35°C	+/- 0.15°C	-5 – 50°C	0.01 °C
Turbidity	EPA 180.1[3] Man. Spec.	S	<1 – 50 NTU	+/- 2% or 0.3 NTU	0 – 1000 NTU	0.1 NTU
Water Level	Man. Spec.	S	NA	+/- 0.01 ft	0 – 30 ft	0.01 ft

S-Surface Water

EPA- Refers to methods found in EPA approved source, SM- Refers to methods found in Standard Methods, NA- Not Applicable

Notes:
1. Standard Methods for the Examination of Water and Wastewater, 19th Edition, 1995.
2. Subject to Manufacturer's specifications.
3. Methods of Chemical Analysis of Waters and Wastes, EPA 600/4 – 79-020, Revised March 1983.

4. Accuracy values represent values suggested by the equipment manufacturer rather than WATERMARK data.

B.2.4 Autosamplers

Water quality samples are collected by automatic sampling units (Teledyne ISCO Model #6712) on a flow-weighted basis (or by time composite, where deemed appropriate) whereby flow signals from the pump stations can interface with the sampler using a Model 780 module.

B.2.4.1 The composite samples collected by the automatic sampling units give an accurate picture of the dissolved and a small size particle for constituents transported in flow. The ISCO Teledyne #6712 automatic sampler gives water quality event mean concentrations that can be compared to other stormwater studies. The water quality samplers will be programmed to take multiple samples per storm/base flow event, and the amount of the frequency of sample collection is changed to reflect the volume of flow with less frequent aliquots taken during the low flow events. The samplers protect against cross contamination by purging the sample line twice before taking the sample.

B.2.4.2 Specific Sampling Procedures for Water Quality

B.2.4.2.1 Label sample containers with the project name, sample site identification, sample collection date and name of sampling personnel. Labels are provided by the laboratory with some of the information already printed, but the collection date and time will still have to be filled in with a waterproof marking pen.

B.2.4.2.2 Shake the sample composite bottle well and rinse the sampling equipment and/or container with sample water, unless the sample is a pre-washed bottle which already contains the preservative. The composite bottles are large and hard to handle, so the bottle will be shaken well and excess water poured off. As an aid to identifying how much water to save, a mark may be placed on the outside of the composite bottle. The composite bottle will be shaken well each time one of the individual bottles is filled.

B.2.4.2.3 If preservatives are required such as the bottles for nutrients and metals, add preservatives before capping and shaking leaving a small head space to facilitate mixing. Samples that require pH-adjusted preservation must be acidified on site to a pH less than 2.0. Samples requiring filtration and acid preservation are to be filtered with a 0.45 micron filter prior to the acid preservation (i.e. orthophosphate) in accordance with DEP SOP FS 1000-4. For nutrients (nitrogen and phosphorus), analytical reagent grade sulfuric acid must be added until the samples reaches a pH less than 2.0. For metals, concentrated metals grade nitric acid must be used to preserve samples until a pH less than 2.0 is reached. After many tests in the field, it has been determined that 20 drops of acid are adequate for the 500-ml nutrient bottles and 10 drops for the 250-ml metal bottles. Litmus paper to use for testing pH is available from the laboratory. Do not put the litmus paper in the sample bottle; instead pour a small amount out of the bottle onto the paper after the bottle has been thoroughly shaken.

B.2.4.2.4 Transporting samples to Sarasota County or the laboratory courier includes: Checking bottle caps to make certain they are secure, placing the sample containers in insulated coolers with ice, filling out the custody forms and placing in waterproof plastic. (The custody forms can be filled out in the laboratory when the samples are sorted by station, rechecked for accurate information and turned over to appropriate Sarasota County or laboratory personnel who signs off on the chain-of-custody sheet.)

B.2.4.2.5 A summary table which outlines the sampling protocol for each parameter, including the sampling method, expected concentration levels, accuracy, precision, MDL and preservation is provided below as Table B.2.4.2.5.

B.2.4.2.6 The composite collection bottles and other collection items such as filtering equipment, *etc*. are cleaned in the field after each sampling event by rinsing three times and scrubbing if necessary with deionized water. Cleaning of sample bottles and equipment shall be in accordance with DEP SOP FC 1001 March 31, 2008 (effective 12/3/08). Additionally, every three months and more often during the rainy season these items are brought into the laboratory and acid washed using the following procedures.

B.2.4.2.6.1 Wash bottles, caps, and other equipment with laboratory grade, biodegradable, non-phosphate detergent.

B.2.4.2.6.2 Rinse three times with tap water.

B.2.4.2.6.3 Rinse once with 1:1 nitric acid (metals grade HNO_3)

B.2.4.2.6.4 Rinse three times with ASTM Type 1 deionized water

.

B.2.4.2.6.5 Air dry.

B.2.4.2.6.6 Assemble in organic-free environment

Table B.2.4.2.5 Summary Table of Water Quality Sample Protocol

SAMPLE PARAMETER	REFERENCE ANALYSIS METHOD	SAMPLE METHODS (SEE NOTE 1)	SAMPLING SCHEDULE (SEE NOTE 2)
pH	Method 150.1	TYPE 1,2, 3	SCHEDULES A, B, C
Temperature	Method 170.1	TYPE 1,2, 3	SCHEDULES A, B, C
Specific Conductance	Method 120.1	TYPE 1,2, 3	SCHEDULES A, B, C
Dissolved Oxygen	Method 360.1	TYPE 1,2, 3	SCHEDULES A, B, C
Chlorophyll a	SM 10200 H (modified)	TYPE 1,2, 3	SCHEDULES A, B, C
Total Organic Carbon	SM 5310 B	TYPE 1,2, 3	SCHEDULES A, B, C
BOD	SM5210B	TYPE 1,2, 3	SCHEDULES A, B, C
Dissolved Org. N	Method 351.2 (filtered)	TYPE 1,2, 3	SCHEDULES A, B, C
Nitrate + Nitrite	Method 353.2	TYPE 1,2, 3	SCHEDULES A, B, C
Ammonia	Method SM4500NH3C	TYPE 1,2, 3	SCHEDULES A, B, C
Total Kjeldahl Nitrogen	Method 351.2	TYPE 1,2, 3	SCHEDULES A, B, C
Total Nitrogen	Methods 351.1 plus 353.2	TYPE 1,2, 3	SCHEDULES A, B, C
Total Phosphorus	Method 365.1/365.4	TYPE 1,2, 3	SCHEDULES A, B, C
Ortho Phosphorus	Method 365.3	TYPE 1,2, 3	SCHEDULES A, B, C
Alkalinity	SM 2320 B	TYPE 1,2, 3	SCHEDULES A, B, C
Copper	USEPA 200.7	TYPE 1,2, 3	SCHEDULES A, B, C
Zinc	USEPA 200.7	TYPE 1,2, 3	SCHEDULES A, B, C
Turbidity (Lab)	Method 180.1	TYPE 1,2, 3	SCHEDULES A, B, C
Total Suspended Solids	SM 2540 D	TYPE 1,2, 3	SCHEDULES A, B, C
NOTE NO. 1:			NOTE NO. 2:
SAMPLING SCHEDULE A	BWL-WQ1, BWL-WQ2, BWL-WQ3,BWL-WQ4,BWL-WQ5, AGR-WQ1		TYPE 1-GRAB SAMPLE
SAMPLING SCHEDULE B	BWL-OPT1, BWL-OPT2, BWL-OPT3,BWL-OPT4,BWL-OPT5		TYPE 2-COMPOSITE SAMPLE
SAMPLING SCHEDULE C	BW-WQ1, BW-WQ2 (0R) BW-WQ3		TYPE 3- FLOW MONITORING

B.3 SAMPLE HANDLING AND CUSTODY

B.3.1 **Benchmark EnviroAnalytical Laboratory**. The chain-of-custody is described in their Quality Manual (attached as Appendix A). The sample handling procedures will adhere to the DEP SOP-001/01, March 31, 2008 (effective 12/3/08).

B.3.1.1 Sample custody begins when field personnel pack bottles instead of the laboratory personnel. BEA marks their bottles and then packs each site in its own plastic bag and places those bags in coolers that makes it easy to sort the bottles necessary for the sample locations.

B.3.1.2 Chain-of-custody labels (example attached as Appendix A-1) provided by the BEA laboratory are specific to the project and are enclosed with each sampling kit.

B.3.1.3 Each sample bottle is identified with the project UID number, sampling site identification, initials of the sample person, time and date. The date and time of collection are recorded on the chain-of-custody sheet (example attached as Appendix A-2) along with any other pertinent information.

B.3.1.4 Each sampling site has a unique UID number that is assigned by the Department recorded on the sample bottle.

B.3.1.5 The collected samples are processed as outlined above (Section B.2.4.2), placed on ice until transported to the BEA laboratory usually on the same day as collected.

B.3.1.6 Sampling personnel complete a chain-of-custody form, which is included when samples are turned into the laboratory, and lab personnel sign-off and use the form as sample custody log .

B.3.1.7 Ultimate disposal is taken care of by the laboratory personnel and that procedure is explained in their attached Quality Manual.

B.3.2 **WATERMARK ENGINEERING GROUP, INC.**

B.3.2.1 Field records must be maintained by WATERMARK. This information may be recorded in bound notebooks or field sheets that have been designed for a specific purpose. All loose records shall be unequivocally linked to the sampling event by code, facility name and/or client name and address. Field sampling records should include:

B.3.2.1.1 Names of all personnel and visitors on site during sampling.

B.3.2.1.2 Date and time of sample collection.

B.3.2.1.3 Ambient field condition, to include, but not limited to information such as weather, tides, *etc*.

B.3.2.1.4 Specific description of sample location including site name and address. The specific sampling point must be further identified (station number, ID number, reference to site plan, *etc*.).

B.3.2.1.5 Field ID# for each sample container and parameters to be analyzed.

B.3.2.1.6 Field measurement data (*e.g.* pH, specific conductance, *etc*.)

B.3.2.1.7 Sample sequence – identify the order in which each sample is taken (time of sample collection is acceptable).

B.3.2.1.8 Preservation and pH verification if applicable.

B.3.2.1.9 Sampling equipment used (ID# if applicable).

B.3.2.1.10 Field decontamination performed. All field-sampling equipment decontamination, whether performed in the field, on site or in a headquarters facility or laboratory, must be documented and in accordance with DEP SOP March 31, 2008 (effective 12/3/08).

B.3.2.1.11 Types of quality control (QC) samples collected. The QC samples should include the following information: when and where collected, preservative (if applicable) and type (*e.g.* trip blank, equipment blank, duplicate, *etc*.) in concurrence with DEP SOP March 31, 2008 (effective 12/3/08). QC samples must be documented in the same manner as all other samples.

B.3.2.1.12 Signature of sampler(s).

B.4 ANALYTICAL METHODS

Most of this summary information is taken from the exhaustive Quality Manual that has already been approved for the laboratory. Water quality analysis is to be conducted in accordance with DEP SOPs March 31, 2008 (effective 12/3/08) for analytical activities.

B.4.1 Laboratory Procedures - Benchmark EnviroAnalytical, Inc.

B.4.1.1 A list of the parameters being measured, their detection limits, the specific Standard Method or EPA methods used for analysis, and performance criteria can be found in Table B.2.4.2.5 of this document.

B.4.1.2 Quality control requirements are listed in Section 9 of BEA's Quality Manual. In summary, a series of QC checks are performed on applicable parameters, including analysis of method reagent blanks, duplicate samples, reagent water spike samples, and matrix spike samples. Standards are prepared daily from primary stock using the manufacturer's instructions.

B.4.1.3 Instrument calibration and verification for each instrument is listed in the BEA Quality Manual. Calibration records are printed out with each run performed and the final data reviewed by the Laboratory Q.A. Officer, then the Laboratory Manager, before maintained.

B.4.1.4 Calibration and maintenance of instruments. Section 7 of the BEA Quality Manual lists the preparation of standards and calibration of instruments. Section 8 of the BEA Quality Manual lists preventive maintenance. Frequency of each activity is also listed.

B.4.1.5 Corrective Action. Corrective actions may be initiated as a result of any QA activity, including: (1) Performance audits; (2) Systems audits; (3); QA project audits conducted by DOH. The QA officer will work with the Laboratory Manager and FDEP to initiate any corrective action, which may be necessary.

B.4.2 Field Procedures

A list of field instrument analytical methods and calibration procedures is provided in Table B.4.2.

B.5 QUALITY CONTROL FOR FIELD SAMPLING

B.5.1 Field Instruments

B.5.1.1 **Flow Meter** (Greyline Model OCF 5.0).

B.5.1.1.1 An independent outside staff gauge will be set and surveyed in and used as the base water level gauge.

B.5.1.1.2 Compare the water level recorded by the ultrasonic sensor, ADCP, established reference points (RP) and staff gauges for agreement.

B.5.1.1.3 Discrepancies between the staff gauge and the recorder at each station will be noted and will indicate the immediate need for corrective action. A RP shall be marked and surveyed at each station to allow for this field comparison.

B.5.1.1.4 The stage and velocity data shall be uploaded approximately daily to the project website. The stage and velocity data will be reviewed approximately daily to look for potential problems and corrective measures required.

B.5.1.2 **Rain gauge** - This project shall utilize the data from the closest existing rain gauge station ARMS AL-1 Jacaranda Bridge-750.

Table B.2.3 Analytical Methods and Quality Assurances Objectives for Field Measurements

Instrument	Calibration Procedure	Frequency of Calibration	Standards		References[1,2]	Acceptance Criteria
YSI Environmental Monitoring System Sonde	Per Manufacturer's Manual	Before and After each Use	pH	Certified buffer solutions which bracket the range of samples	FT 1100	+/- 0.2 standard pH units of buffer or more stringent program criteria
			Specific Conductivity	KCl solution	FT 1200	+/- 5% of standard value
			Dissolved Oxygen	Saturated air-water	FT 1500	+/- 0.3 mg/L of Theoretical value
			Temperature	NBS Thermometer	FT 1400	+/- 0.2°C of NIST-traceable value; verification over range of values
			Turbidity	Certified buffer solutions which bracket the range of samples	FT 1600	+/- 2% of standard value
Automatic Samplers	Per Manufacturer's Manual	Prior to field deployment, semi-annually thereafter	Volume measured with a graduated cylinder		FT 1800	+/- 5% of programmed sample volume

NA- Not Applicable

Notes: 1. FDEP SOP-001/01. FDEP Standard Operating Procedures for Field Activities (February 2004).

2. Also includes general requirements outline in FT 1000, FS 1000, FS 2000 and FS 2100.

B.5.1.2.1 The County shall compare data from the Romp TR 4-2 station to other station in close proximity such as The Venice South Rain Gauge (County maintained) and Romp TR 4-1 Caspersen rain gauge (SWFWMD maintained), which is located within the drainage basin. See Figure B.2.2 for existing rain gauge locations.

B.5.1.2.2 The County shall visually inspect the rainfall data on a daily basis.

B.5.1.3 Automatic Water Quality Samplers (Model #6712 TELEDYNE ISCO)

B.5.1.3.1 Change the tubing, desiccant, and back up batteries on a regular schedule or when indicated. Acid wash the collection bottle in the lab approximately every three months.

B.5.1.3.2 Calibrate the sample by using the calibration sequence available on the instrument to precisely calibrate sample volume. Storm event data are discarded when there are error messages for hydrology and/or missed samples.

B.5.1.4 **Water Quality Sampling**. The Quality Manual for the BEA laboratory lists their protocol in detail. This QAPP will only list field tests conducted to validate water quality sampling techniques.

B.5.1.4.1 Duplicate samples. A duplicate sample is taken during every second sampling event.

B.5.1.4.2 Deionized water samples taken through the equipment tubing is the method used for testing contaminated equipment. This test is performed about every three months when the tubing is changed. It also tests the procedure for acid washing the composite bottles.

B.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Much of this has been addressed in the previous elements, but field check lists and field journals are used to remind the technicians of what needs to be done and when.

B.6.1 ISCO Automatic Portable Samplers

A certain amount of preventive maintenance will keep it functioning properly.

B.6.1.1 Cleaning the controller, top cover, center section, retaining ring, and tub. Clean the top cover, center section, retaining ring, and tub with warm soapy water or by spraying them with a hose. Avoid using a high-pressure hose to clean the controller, especially around the control panel. Extreme pressures may force water past the control-panel seal. When cleaning the controller and top cover, cap the connectors at the back of the controller tightly. Keep a power source connected to the power-source connector, or replace the protective cap (shipped with the sampler) over the power source connector, to protect the pins from moisture damage. Make sure the two pump drain holes (located on the bottom right-hand side of the pump, beneath the pump band) are open and free of debris or buildup.

B.6.1.2 Clean the sample bottles. The sample bottles have a wide mouth to facilitate cleaning. Wash them with a brush and soapy water, or use a dishwasher. You can autoclave the glass bottles.

B.6.1.3 Clean the suction line, pump tube, and discharge tube. Clean the suction line, pump tube, and discharge tube by placing the end of the suction line in a cleaning solution and pumping it through the delivery system. Rinse with clean water. If these items are severely contaminated, discard them. For critical sampling applications, refer to the following sections.

B.6.1.4 Strainer. Clean the strainer with a brush and soapy water.

B.6.1.5 Replace suction line. The suction line should be replaced about every three months or more often if warranted.

B.7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

B.7.1 Greyline Ultrasonic Flow Meters

B.7.1.1 All meters will be tested bi-monthly according to the manufacturer’s recommendations. The results of these tests will be logged and available for inspection.

B.7.2 Field Instrumentation

It is recommended that calibration of the sonde be done in the lab, according to manufacturer’s recommendations. However, for convenience, the 600XL allows for field calibration of pH, Dissolved Oxygen (DO), and Oxidation Reduction Potential (ORP). Field calibrations are stored in the sampler, NOT the sonde, and are used to modify readings from the sonde until a new sonde is connected. When a sonde is moved to another sampler, it will retain calibration constants set in the lab, but will not retain any that were set in the field. Although field calibration is limited to three parameters, you can validate any of the available parameters. Validation allows you to immerse the sonde in a known solution, note the readings, and see if the sonde is functioning properly. The validation process does not modify any readings like calibration does; it merely alerts you to inaccurate ones. No data will be stored, nor will enable conditions be updated, while calibrations or validations are being performed.

B.8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

B.8.1 The laboratory keeps a good supply of bottles and other consumables on hand. In our experience this has never been a problem.

B.8.2 Keep extra supplies in trucks.

B.8.3 Order marking pens, field journals, refrigerator tubing, and other supplies and keep them in stock, so this has never been a problem. The field technicians are responsible for keeping supplies stocked.

B.9 NON-DIRECT MEASUREMENTS

B.9.1 A water budget is calculated from the data to validate flow numbers.

B.9.2 Literature values are used to compare data and to determine if water quality numbers are reasonable.

B.9.3 Statistical analysis is used to determine if data are normally distributed.

B.9.4 Correlations identify abnormal values to be checked further, but numbers are not eliminated or changed unless there is a compelling reason to do so.

B.9.5 Constituent concentrations in the water are graphed and compared to other stations at the site or unusual events to determine if readings are reasonable.

B.10 DATA MANAGEMENT

All data management activities shall use the documentation procedures referenced in the QA rule and in FDEP SOP FD 1000.

B.10.1 Concentration Water Quality Data

B.10.1.1 Entered into Excel spreadsheets by paraprofessionals.

B.10.1.2 Put into tables and checked by the technicians who collected the data and some graphs are constructed.

B.10.1.3 Laboratory comments and any unusual field conditions are noted.

B.10.1.4 Outliers are investigated and laboratory notes reviewed.

B.10.1.5 Principal investigator checks the data and puts into form for the data report and appendix of the final report and summarizes the data for the body of the report.

B.10.1.6 Base flow and storm flow are put into separate tables.

B.10.1.7 Statistical analysis will be used to determine significant difference between sampling locations.

B.10.1.8 Concentrations will be compared to state water quality standards.

B.10.1.9 Percent efficiency will be calculated once samples are converted to loads.

B.10.1.10 Data will be analyzed and compared over a two-year period.

B.10.2 Flow, Level and Rainfall Data

B.10.2.1 Data are downloaded into a template so that all figures and tables will be in same format for the final report.

B.10.2.2 Data are uploaded during the sampling event.

B.10.2.3 WATERMARK checks all the calculations to make certain they are correct.

B.10.2.4 Monthly water levels and rainfall are graphed and checked for discrepancies.

B.10.2.5 Water levels are checked against the reference point readings.

B.10.2.7 A water budget is constructed to test for reasonable flows compared to each other and to rainfall.

B.10.2.9 Rainfall characteristics are calculated and put into a table format that includes date, storm start time, storm stop time, duration of storm, amount of rain, intensity of the storm, the maximum intensity experienced for a 15 minute period and the inter-event dry period.

B.10.3 Data Sonde Data

B.10.3.1 The data are uploaded after each event and the data stored in Excel spreadsheets.

B.10.3.2 Each parameter is graphed in a separate figure and stations are compared to each other on the same graph.

B.10.3.3 The data are summarized and compared to all data collected in the body of the report.

B.10.4 Statistical Analysis

B.10.4.1 The entire data set will be combined for statistical analysis. It will include: rainfall amount, rainfall characteristics, and constituent concentrations for each location and volume data for each location for each event.

B.10.4.2 Summary statistics will be entered into a table and graphs.

B.10.4.3 Correlation analysis will identify relationships between variables.

B.10.4.4 Regression analysis will be used to investigate some of the more interesting correlations.

GROUP C. ASSESSMENT AND OVERSIGHT

C.1 ASSESSMENT AND RESPONSE ACTIONS

This is a small project with only a few people involved therefore:

C.1.1 The principal investigator interacts with field personnel at least weekly and is in telephone contact if questions arise.

C.1.2 The principal investigator does the final quality assurance of the data processing and analysis.

C.1.3 The principal investigator accompanies field personnel to study site to assess site conditions and observe monitoring techniques.

C.2 REPORTS TO MANAGEMENT

C.2.1 Quarterly reports are submitted to Sarasota County showing progress on the project and including any new data that have been processed.

C.2.2 Applicable water quality data may be submitted in appropriate format to FDEP by the County for upload to DEP’s STORET database.

C.2.3 Invoices are reviewed and approved for work done.

C.2.4 Field journals are kept to document any problems in the field; and recommended solutions.

C.2.5 The final report will include comments on how this project’s results compare with other BMP evaluation projects.

GROUP D. DATA VALIDATION AND USABILITY

D.1 DATA REVIEW, VERIFICATION, AND VALIDATION

D.1.1 All data are viewed with respect to information in the field journal and a decision made about its validity.

D.1.2 All water quality data is checked against the problems that were identified on data sheets by the lab.

D.1.3 Field data are checked against duplicate samples, DI water samples, and the running bar graphs showing trends in samples when compared sequentially.

D.14 A more complete check is performed on data points that do not make sense from the expected correlation analysis.

D.1.5 Outliers are given special scrutiny, but are not eliminated unless there is a good reason for doing this.

D.1.6 Water budget information for flow validates these numbers and sometimes when weirs become obstructed estimates have to be made.

Estimates are made by:

D.1.6.1 Flow recorder at each pump station that record continuous flow data.

D.1.6.2 Using the actual calculated flow but providing an explanation.

D.2 VERIFICATION AND VALIDATION METHODS

D.2.1 Enough samples are usually collected that if the data are not deemed reliable that event is not used and an additional sample will be collected.

D.2.2 Description of how results will be conveyed to data users.

D.2.2.1 This project will result in a detailed report

D.2.2.2 The raw data will be provided in an appropriate format for DEP STORET upload.

D.2.2.3 The combined data used in the statistical analysis will be provided in electronic form to Sarasota County.

D.3 RECONCILIATION WITH USER REQUIREMENTS

D.3.1.1 The data can be used to characterize stormwater pollution.

D.3.1.2 The data are suitable for models.

D.3.1.3 The data are suitable for use in the calculation of TMDLs**.**

D.3.1.4 The data can be used to compare to similar studies.

D.3.1.5 The data can be used to evaluate similar treatment systems for pollution removal.

GROUP E REFERENCES

E.1 QUALITY MANUALS (Appendix A)

Benchmark EnviroAnalytical, Inc.
1711 12th Street East
Palmetto, Florida 34221
Phone: (941) 723-9986

E.2 HANDBOOKS

Burton & Pitt. 2002.
Stormwater Effects Handbook
Lewis Publishers
Boca Raton, Florida

Urban Stormwater BMP Performance Monitoring
ASCE/EPA
EPA-821-B-02-001

E.3 OPERATING MANUALS (Appendix A)

Greyline Instruments, Inc.
Model Open Channel Flow (OFC) 5.0
105 Water Street
Massena, NY 13662
Phone: (888) 473-9546

E.4 SPECIFICATIONS (Appendix A)

ISCO Specifications
6712 Portable Samplers
4700 Superior Street
Lincoln, Nebraska 68528
Phone: (402) 464-0231

Pine Environmental Services, Inc.
YSI 600 XLM V2
Specifications
3902 Corporex Park Drive
STE 450
Tampa, FL 33619
Phone: (813) 620-1001

LITERATURE CITED

APHA/AWWA/WEF. 1995. *Standard Methods for the Examination of Water and Wastewater*, 19th Edition.

ASCE/EPA. *Urban Stormwater BMP Performance Monitoring.* EPA-821-B-02-001.

EPA. 1983. *Methods for Chemical Analysis of Water and Wastes*. EPA 600/4-79-020.

Florida Department of Environmental Protection *Standard Operating Procedures for Field Activities*, DEP-SOP-001/01 (March 31, 2008), Florida Department of Environmental Protection, Standards and Assessment Section. 2600 Blair Stone Road, Tallahassee, FL 32399-2400

SAS (Statistical Analysis System). (2000). SAS/STAT User's Guide. Release 6.03. SAS Institute, Cary, North Carolina, 494 pp.

USGS TWRI *Calibration and Maintenance of Vertical Axis Type Current Meters*, G.F. Smoot and C.E. Novak.

USGS TWRI *Computation of Continuous Streamflow Records*, E.J. Kennedy

USGS TWRI *Discharge Measurements at Gaging Stations*, T. J. Buchanan and W.P. Somers

USGS Water Supply Paper 2175 *Measurement and Computation of Streamflow: Volume 1. Measurement of Stage and Discharge*, S.E. Rantz

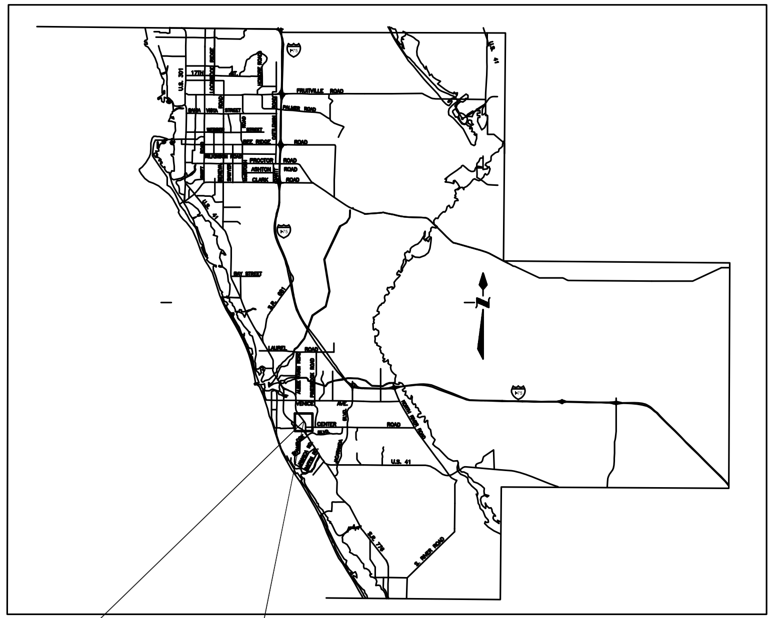
USGS Water Supply Paper 2175 *Measurement and Computation of Streamflow: Volume 2. Computation of Discharge*, S.E. Rantz

ATTACHMENT A

ATTACHMENT A
ALLIGATOR CREEK
STORMWATER TREATMENT, EQUIPMENT INSTALLATION, AND SAMPLING SCHEDULES

SARASOTA COUNTY GOVERNMENT
CAPITAL MANAGEMENT SERVICES

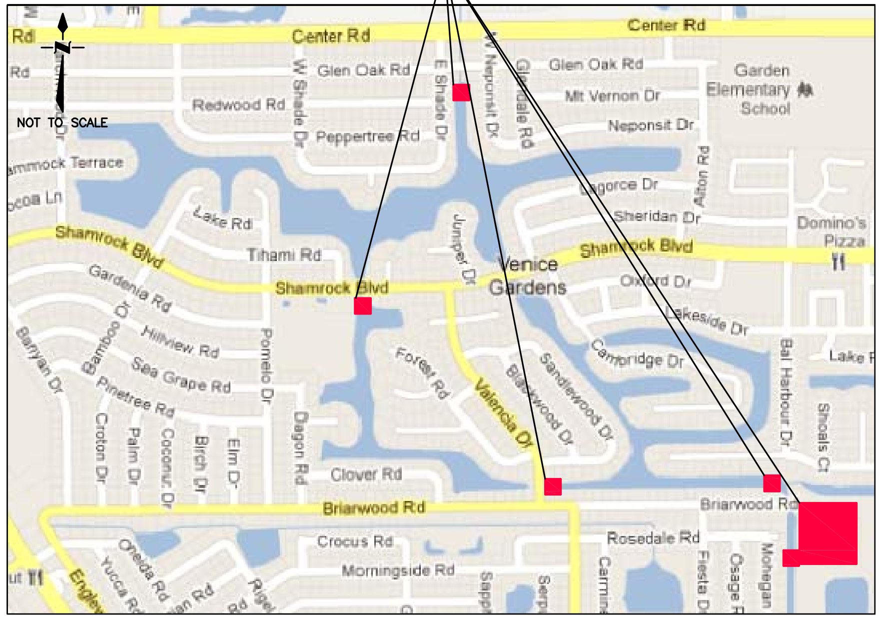
SECTIONS 20-23, TOWNSHIP 39S, RANGE 19E
SARASOTA COUNTY, FLORIDA



LOCATION MAP

SAMPLING LOCATION

SAMPLING LOCATIONS



VICINITY MAP

INDEX OF SHEETS

WATER QUALITY SHEETS

	DATE	*BY*

ENVIRONMENTAL SERVICES, UTILITIES
TELEPHONE CONTACT NUMBERS

ENGINEERING
PHONE: 1-941-861-0562
FAX: 1-941-861-0589

OPERATIONS
PHONE: 1-941-861-0573
FAX: 1-941-861-0591

WATERMARK
ENGINEERING GROUP INC.

Integrated Engineering Solutions for Florida's Water Environments
1718 MAIN STREET, SARASOTA, FL. 34236 TEL (941) 951-2301 FAX (941) 954-8917
1422 APOLLO BEACH BLVD, APOLLO BEACH, FL 33572 TEL (813) 641-1200 FAX (813) 641-1204
COMPANY CERTIFICATE OF AUTHORIZATION 25990

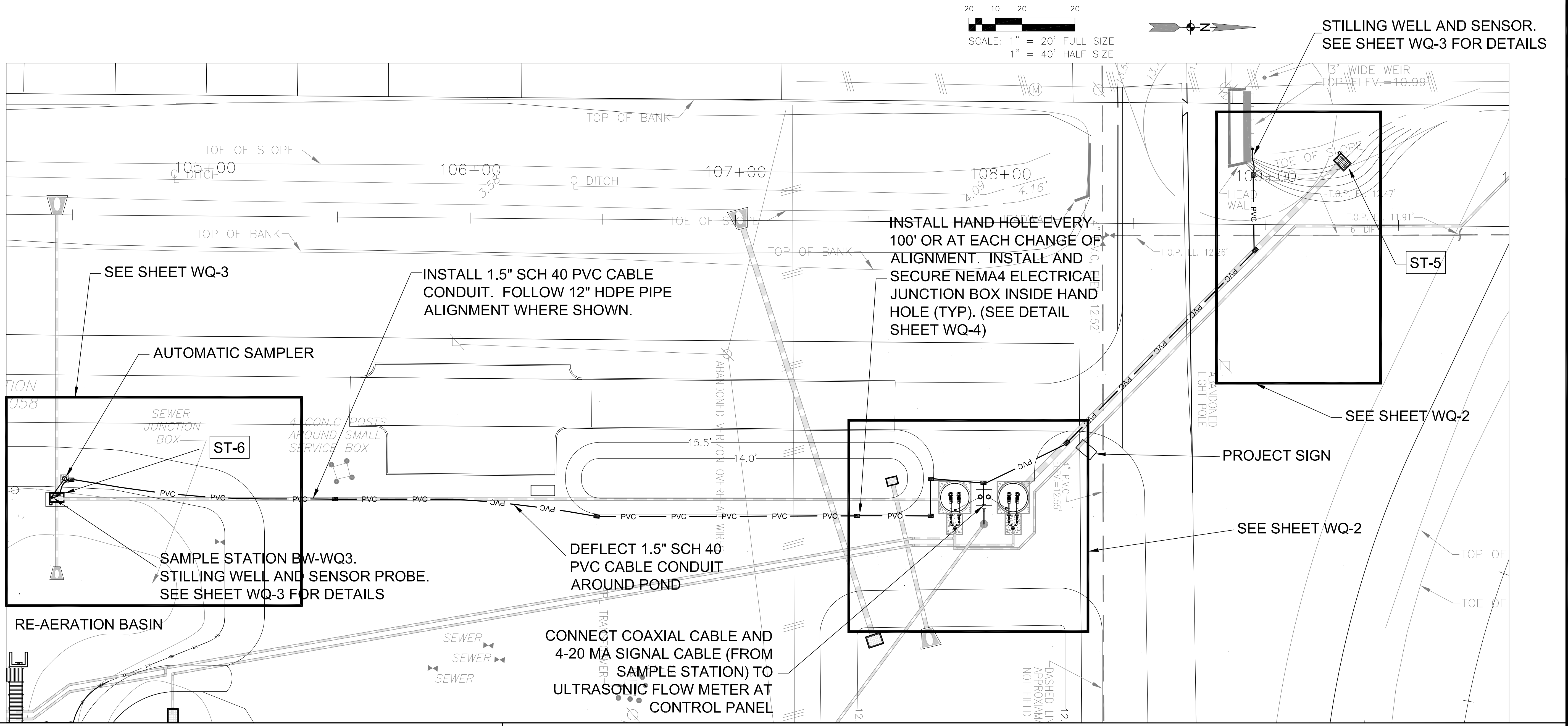
PROJECT MANAGER: MARK FLINT, P.E.		DRAWN BY: HCL
	DATE: OCTOBER 19, 2011	DESIGNED BY: MJF
	PROJ.# 609004	CHECKED BY: AS
		DESIGN ENGINEER: MJF

Sarasota County

DEPARTMENT OF ENVIRONMENTAL PROTECTION
FLORIDA

MARK FLINT, P.E. #38627 ENGINEER OF RECORD

COVER



STILLING WELL AND SENSOR. SEE SHEET WQ-3 FOR DETAILS

INSTALL HAND HOLE EVERY 100' OR AT EACH CHANGE OF ALIGNMENT. INSTALL AND SECURE NEMA4 ELECTRICAL JUNCTION BOX INSIDE HAND HOLE (TYP). (SEE DETAIL SHEET WQ-4)

SEE SHEET WQ-3

INSTALL 1.5" SCH 40 PVC CABLE CONDUIT. FOLLOW 12" HDPE PIPE ALIGNMENT WHERE SHOWN.

AUTOMATIC SAMPLER

SEE SHEET WQ-2

PROJECT SIGN

SEE SHEET WQ-2

SAMPLE STATION BW-WQ3. STILLING WELL AND SENSOR PROBE. SEE SHEET WQ-3 FOR DETAILS

DEFLECT 1.5" SCH 40 PVC CABLE CONDUIT AROUND POND

CONNECT COAXIAL CABLE AND 4-20 MA SIGNAL CABLE (FROM SAMPLE STATION) TO ULTRASONIC FLOW METER AT CONTROL PANEL

NOTES

1. CONTRACTOR SHALL FURNISH AND INSTALL ALL CABLES, HAND HOLES, JUNCTION BOXES, AND CONNECTIONS FOR THE FLOW METER, SENSORS, AND PORTABLE SAMPLERS.
2. A RG62AU COAXIAL CABLE SHALL BE USED FOR CONNECTION BETWEEN THE FLOW SENSOR AND THE FLOW METER.
3. A 4-20 MA SIGNAL CABLE SHALL BE USED FOR CONNECTION BETWEEN FLOW METER AND PORTABLE SAMPLER AT SAMPLE STATION WQ-3 (FOR WET WEATHER FLOW MONITORING).
4. COAXIAL CABLE AND SIGNAL CABLE SHALL BE INSTALLED INSIDE THE 1.5" SCH 40 PVC CONDUIT.
5. 1.5" SCH 40 CONDUIT PIPE SHALL CONFORM TO NEMA TC 2, UL 651.
6. BW-WQ3 AUTOMATIC SAMPLER CAN BE CONTROLLED FROM 4-20 MA SIGNAL FROM FLOW METER (AT CONTROL PANEL).

SUMMARY OF QUANTITIES

ITEM NO.	ITEM DESCRIPTION	UNIT MEASURE	NO UNITS
1	FURNISH AND INSTALL 1.5 INCH SCHEDULE 40 SOLVENT WELD PVC CONDUIT AND FITTINGS	FT	
2	FURNISH AND INSALL 10 INCH PVC STILLING WELL PIPE WITH SS FASTENERS AND ANCHORS	FT	20
3	FURNISH AND INSTALL COAXIAL CABLE FOR FLOW SENSORS (FROM PANEL AND FLOWMETER INSTALLATION)	FT	535
4	FURNISH AND INSTALL 4-20 MA SIGNAL CABLE FOR SAMPLE CONTROLS (FROM BW-WQ3 TO FLOW METER IN PANEL)	FT	370
5	FURNISH AND INSTALL HAND HOLES WITH NEMA4 JUNCTION BOXES	EA	10
5	FURNISH AND INSTALL POURED IN PLACE REINFORCED CONCRETE SAMPLE PAD WITH EYE BOLT ANCHORS AND CHAINS	LS	1
6	FURNISH AND INSTALL GREYLINE MODEL OCF-5 FLOWMETER SENSOR AND CABLE	EA	1
7	FURNISH AND INSTALL USGS-STYLE A STAFF GUAGE (10.16-13.52)- AT ST-5	EA	1
8	FURNISH AND INSTALL USGS-STYLE A STAFF GUAGE (6.76-10.12) AT ST-6	EA	1
9	FURNISH AND INSTALL FIBERGLASS V NOTCH WEIR AT ST-6 (BW-WQ3)	EA	1

REVISIONS

NO.	BY	DATE	DESCRIPTION
2	HCL	08-03-11	STORMWATER UTILITY ADJUSTMENT

DESIGNED BY: HCL
DRAWN BY: HCL
DATE: AUGUST 03, 2011
CHECKED BY: MJF
APPROVED BY: MJF
JOB NO.: 609004

THESE PLANS MAY NOT BE COPIED OR MODIFIED WITHOUT WRITTEN PERMISSION FROM WATERMARK ENGINEERING GROUP, INC.

NOT VALID UNLESS SIGNED & EMBOSSED BY A REGISTERED ENGINEER

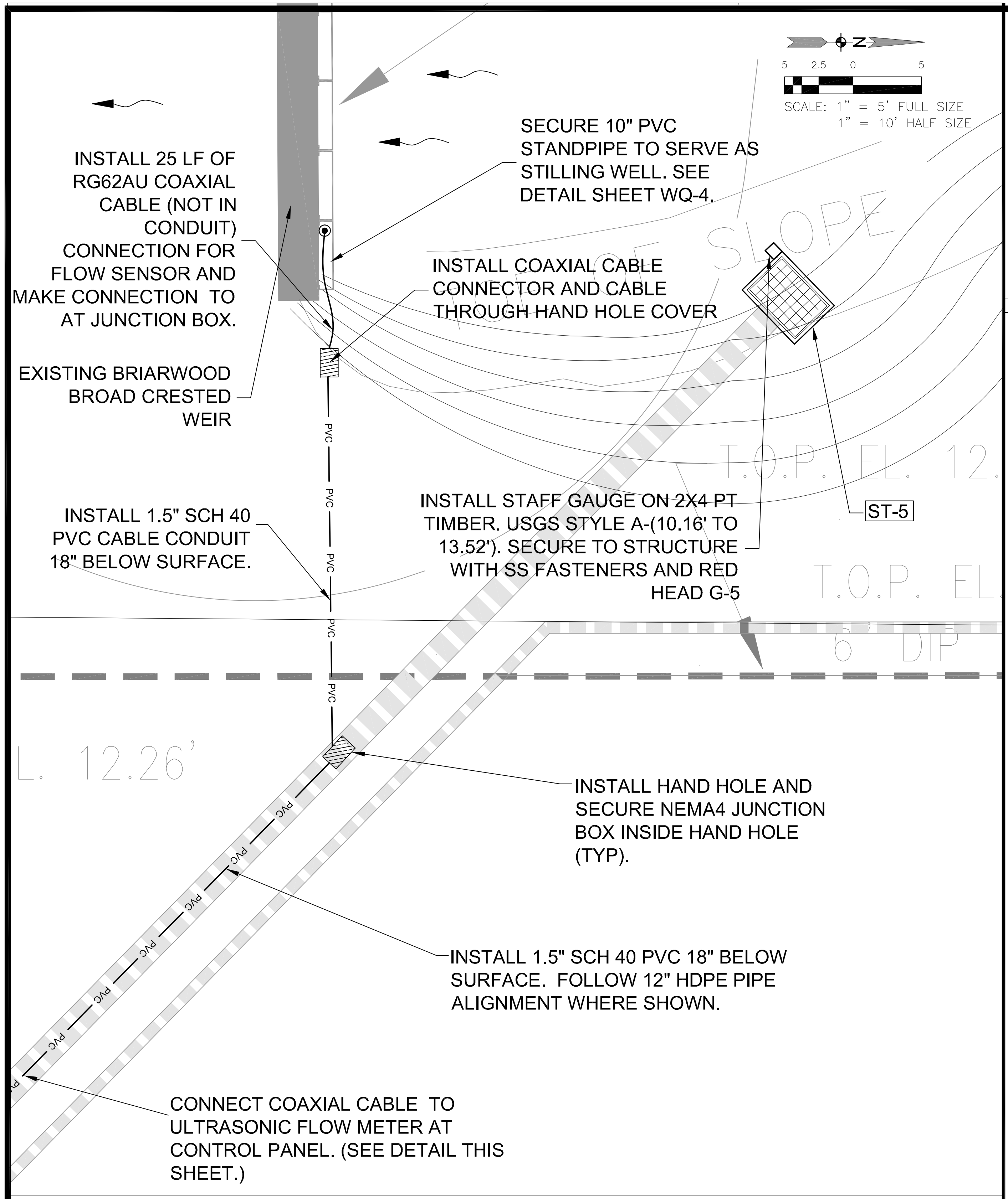
MARK J. FLINT, P.E. #38627 ENGINEER OF RECORD

OVERALL FLOW METER AND SAMPLING PLAN

SOUTH COUNTY ALLIGATOR CREEK STORMWATER TREATMENT PROJECT

WATERMARK ENGINEERING GROUP, INC.
1718 MAIN STREET, SARASOTA, FL. 34236
TEL: (941) 951-2301 FAX: (941) 954-8917
CERTIFICATE OF AUTHORIZATION 25990

WQ-1



INSTALL 25 LF OF RG62AU COAXIAL CABLE (NOT IN CONDUIT) CONNECTION FOR FLOW SENSOR AND MAKE CONNECTION TO AT JUNCTION BOX.

SECURE 10" PVC STANDPIPE TO SERVE AS STILLING WELL. SEE DETAIL SHEET WQ-4.

INSTALL COAXIAL CABLE CONNECTOR AND CABLE THROUGH HAND HOLE COVER

EXISTING BRIARWOOD BROAD CRESTED WEIR

INSTALL STAFF GAUGE ON 2X4 PT TIMBER. USGS STYLE A-(10.16' TO 13.52'). SECURE TO STRUCTURE WITH SS FASTENERS AND RED HEAD G-5

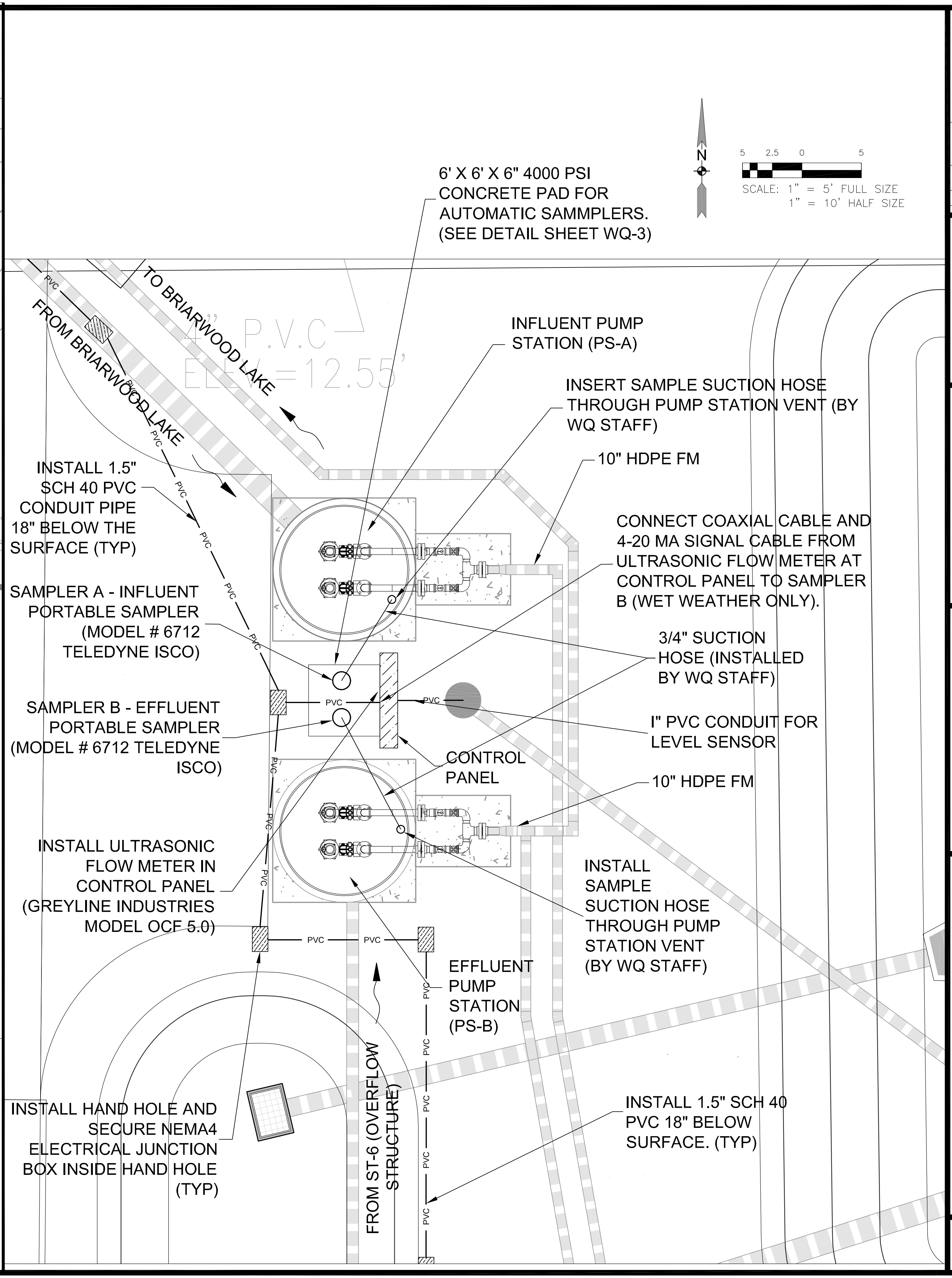
INSTALL 1.5" SCH 40 PVC CABLE CONDUIT 18" BELOW SURFACE.

INSTALL HAND HOLE AND SECURE NEMA4 JUNCTION BOX INSIDE HAND HOLE (TYP).

INSTALL 1.5" SCH 40 PVC 18" BELOW SURFACE. FOLLOW 12" HDPE PIPE ALIGNMENT WHERE SHOWN.

CONNECT COAXIAL CABLE TO ULTRASONIC FLOW METER AT CONTROL PANEL. (SEE DETAIL THIS SHEET.)

THIS WATER QUALITY MONITORING PLAN IS FURNISHED PER REQUIREMENTS OF FDEP AND IS ADDED AS A SUPPLEMENT TO THE CONSTRUCTION PLAN



6' X 6' X 6" 4000 PSI CONCRETE PAD FOR AUTOMATIC SAMMPLERS. (SEE DETAIL SHEET WQ-3)

INFLUENT PUMP STATION (PS-A)

INSERT SAMPLE SUCTION HOSE THROUGH PUMP STATION VENT (BY WQ STAFF)

10" HDPE FM

CONNECT COAXIAL CABLE AND 4-20 MA SIGNAL CABLE FROM ULTRASONIC FLOW METER AT CONTROL PANEL TO SAMPLER B (WET WEATHER ONLY).

INSTALL 1.5" SCH 40 PVC CONDUIT PIPE 18" BELOW THE SURFACE (TYP)

SAMPLER A - INFLUENT PORTABLE SAMPLER (MODEL # 6712 TELEDYNE ISCO)

3/4" SUCTION HOSE (INSTALLED BY WQ STAFF)

SAMPLER B - EFFLUENT PORTABLE SAMPLER (MODEL # 6712 TELEDYNE ISCO)

I" PVC CONDUIT FOR LEVEL SENSOR

CONTROL PANEL

10" HDPE FM

INSTALL ULTRASONIC FLOW METER IN CONTROL PANEL (GREYLINE INDUSTRIES MODEL OCF 5.0)

INSTALL SAMPLE SUCTION HOSE THROUGH PUMP STATION VENT (BY WQ STAFF)

EFFLUENT PUMP STATION (PS-B)

FROM ST-6 (OVERFLOW STRUCTURE)

INSTALL HAND HOLE AND SECURE NEMA4 ELECTRICAL JUNCTION BOX INSIDE HAND HOLE (TYP)

INSTALL 1.5" SCH 40 PVC 18" BELOW SURFACE. (TYP)

REVISIONS			
NO.	BY	DATE	DESCRIPTION
2	HCL	08-03-11	STORMWATER UTILITY ADJUSTMENT

DESIGNED BY: HCL
DRAWN BY: HCL
DATE: AUGUST 03, 2011
CHECKED BY: MJF
APPROVED BY: MJF
JOB NO.: 609004

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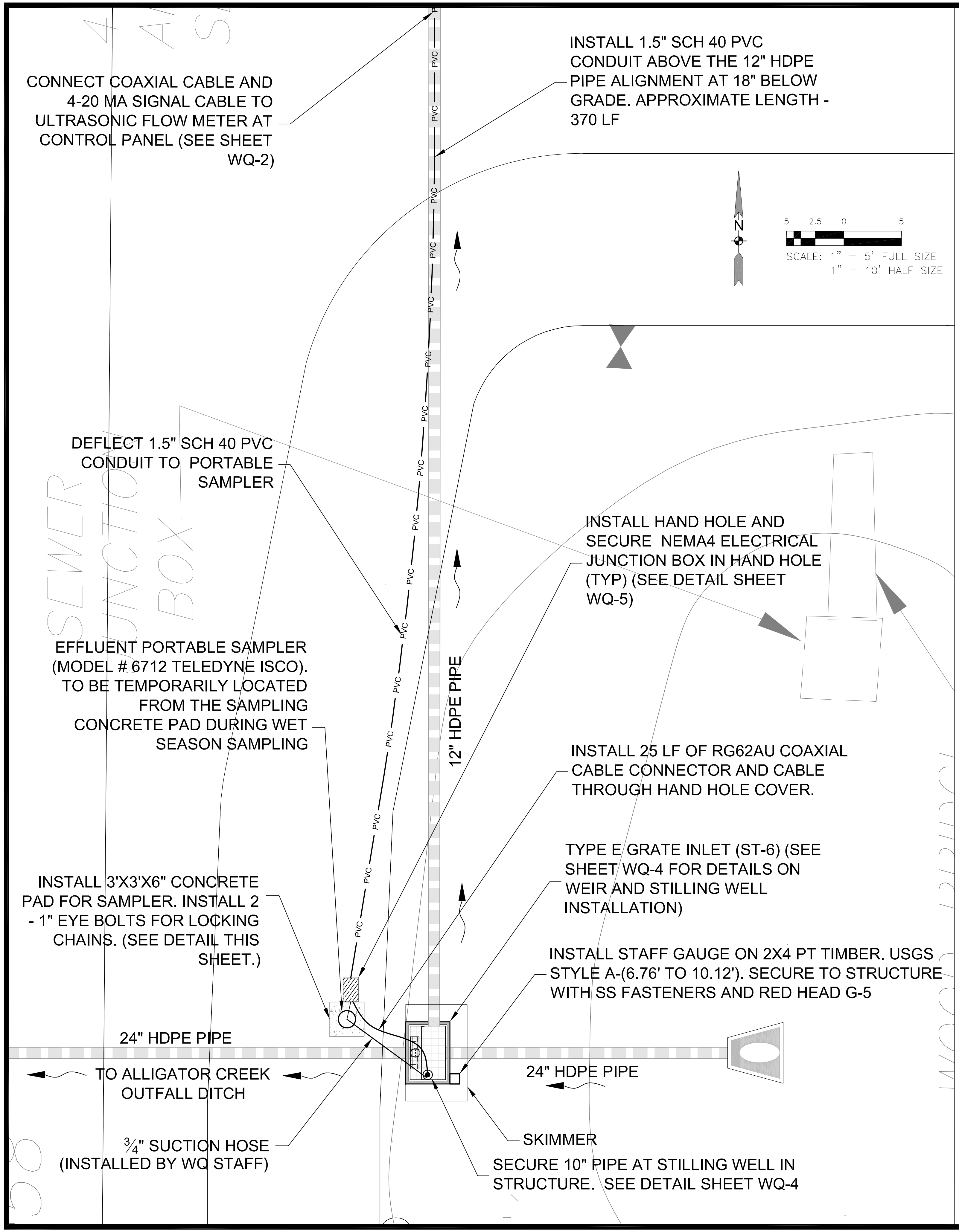
MARK J. FLINT, P.E. #38627 ENGINEER OF RECORD

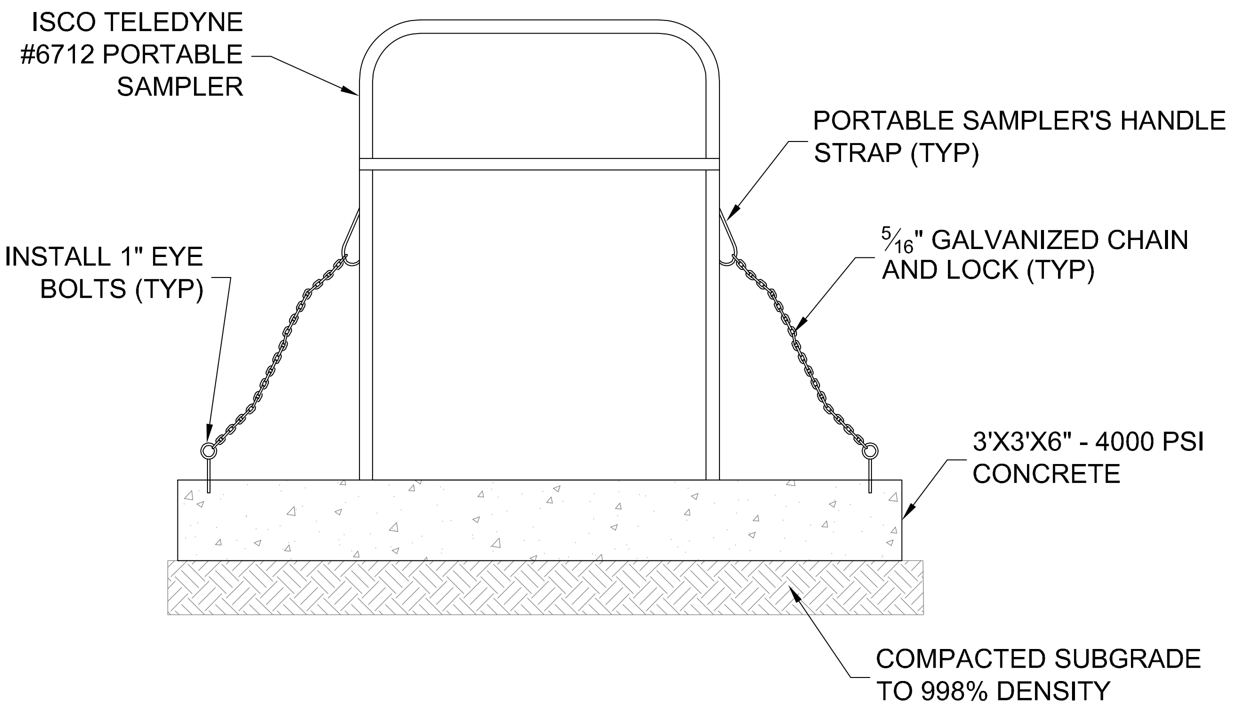
FLOW METER AND SAMPLING PLAN AT EXISTING WEIR AND PUMP STATION

SOUTH COUNTY ALLIGATOR CREEK STORMWATER TREATMENT PROJECT

WATERMARK ENGINEERING GROUP, INC.
1718 MAIN STREET, SARASOTA, FL. 34236
TEL: (941) 951-2301 FAX: (941) 954-8917
CERTIFICATE OF AUTHORIZATION 25990

WQ-2





CONCRETE PAVEMENT NOTES:

1. CONCRETE TO BE PLACED OVER COMPACTED SUBGRADE, (98% T-180, LBR 40 MINIMUM.)
2. CONCRETE TO BE 6" THICK, 4000 PSI, FIBER MESH REINFORCED.
3. CONCRETE TO BE PLACED AT 3" SLUMP (± ½")
4. WATER/MIST CURE CONCRETE FOR 7 DAYS AFTER PLACEMENT.
5. PROVIDE SAWCUT JOINTS AT 10 FEET ON CENTER MAXIMUM EACH WAY. SAWCUT JOINT DEPTH TO BE ⅓ THE THICKNESS OF THE CONCRETE. CUT AS SOON AS POSSIBLE AFTER PLACED. EXPANSION JOINTS SHALL BE A MAXIMUM OF 75 FEET APART. THE CONTRACTOR SHALL PREPARE AND SUBMIT A JOINT PLAN, INCLUDING EXPANSION JOINTS, TO THE ENGINEER FOR APPROVAL PRIOR TO INSTALLATION OF CONCRETE PAVEMENT.
6. ALL CONCRETE SHALL HAVE A MEDIUM BROOM FINISH TO PROVIDE A NON-SLIP SURFACE UNLESS DIRECTED OTHERWISE BY THE COUNTY.

AUTOMATIC SAMPLERS' CONCRETE PAD DETAIL

NTS

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FLOW METER AND SAMPLING PLAN AT STRUCTURE ST-6

SOUTH COUNTY ALLIGATOR CREEK STORMWATER TREATMENT PROJECT

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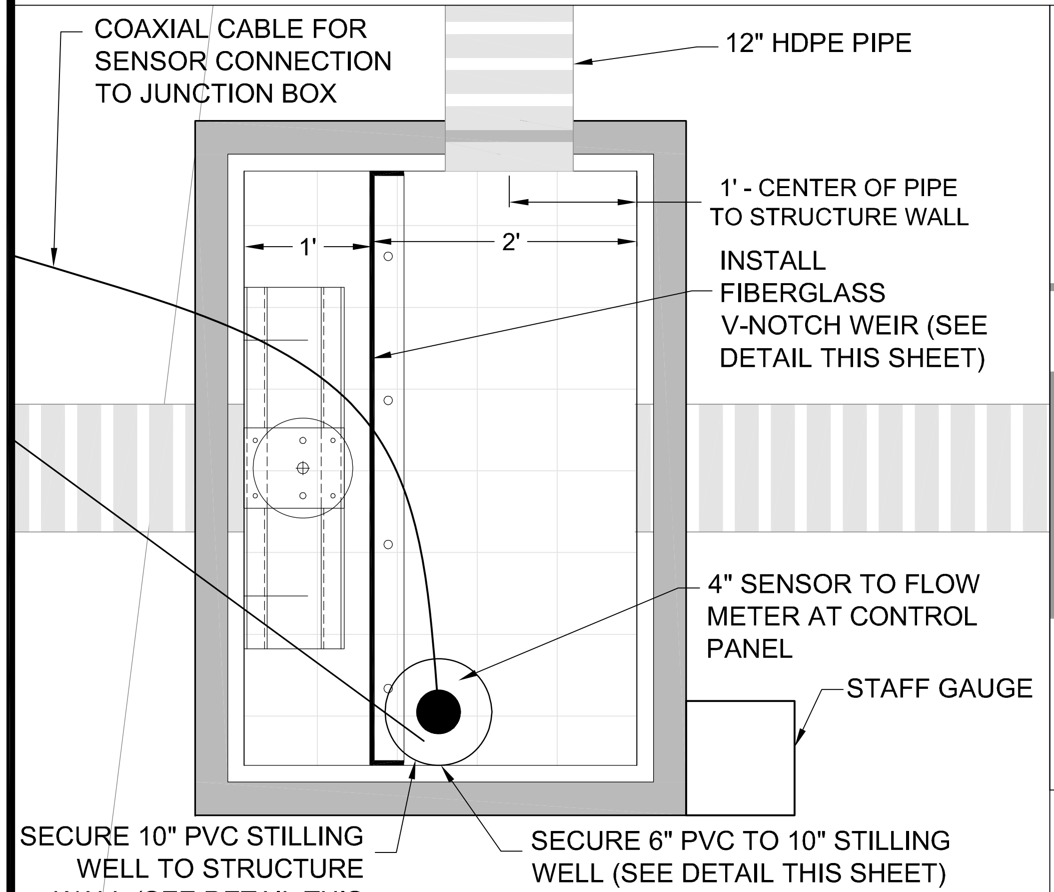
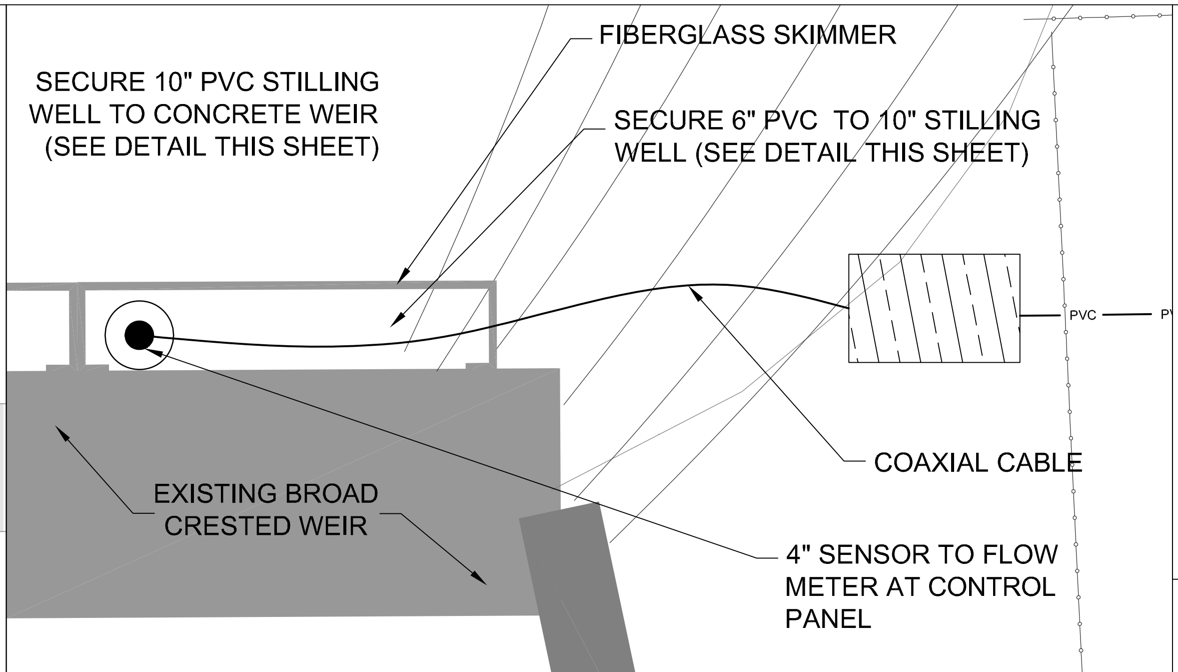
WQ-3



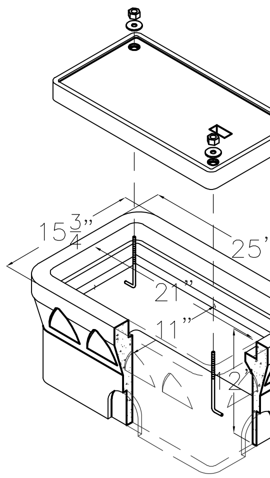
STRUCTURE ST-6 DETAIL - FLOW METER AND WEIR INSTALLATION

NTS



EXISTING BROAD CRESTED WEIR DETAIL - FLOW METER INSTALLATION

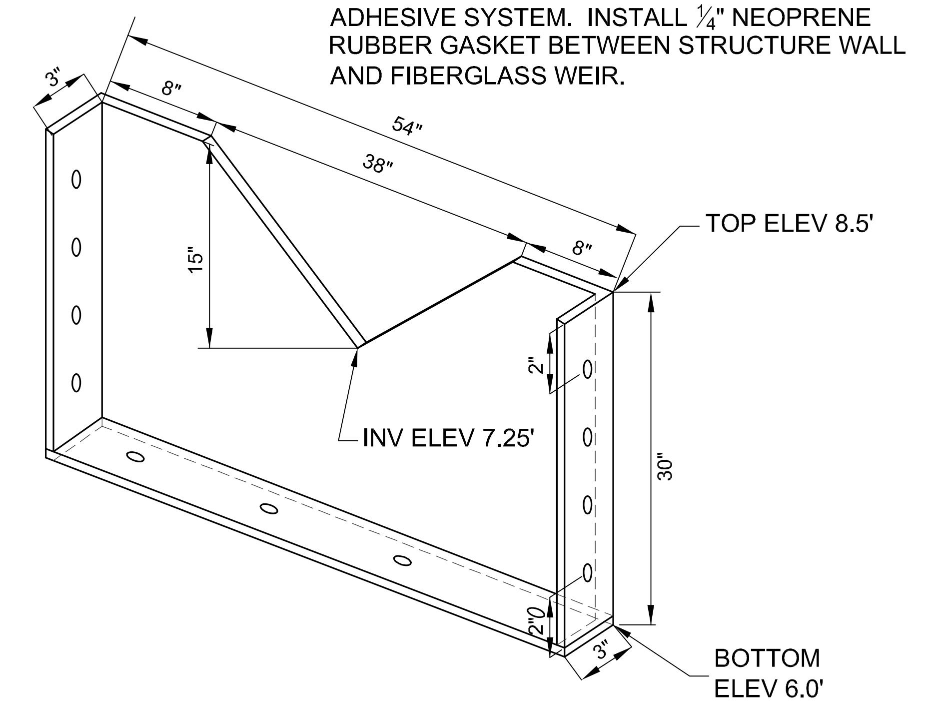
NTS



HAND HOLE DETAIL

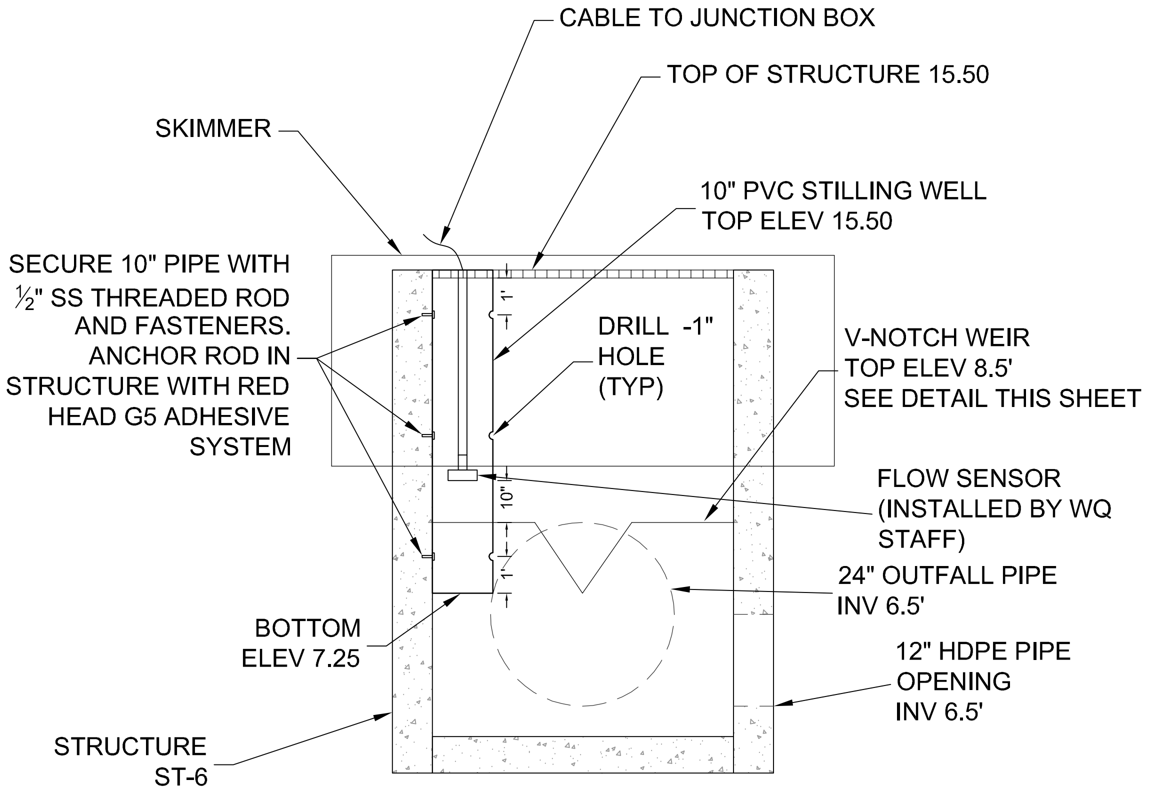
NTS

NOTE: SECURE WEIR TO STRUCTURE WALL WITH ½" ASTM 6593-304 SS THREADED ROD AND FASTENERS. ANCHOR THREADED ROD IN PRECAST STRUCTURE WITH RED HEAD G5 ADHESIVE SYSTEM. INSTALL ¼" NEOPRENE RUBBER GASKET BETWEEN STRUCTURE WALL AND FIBERGLASS WEIR.



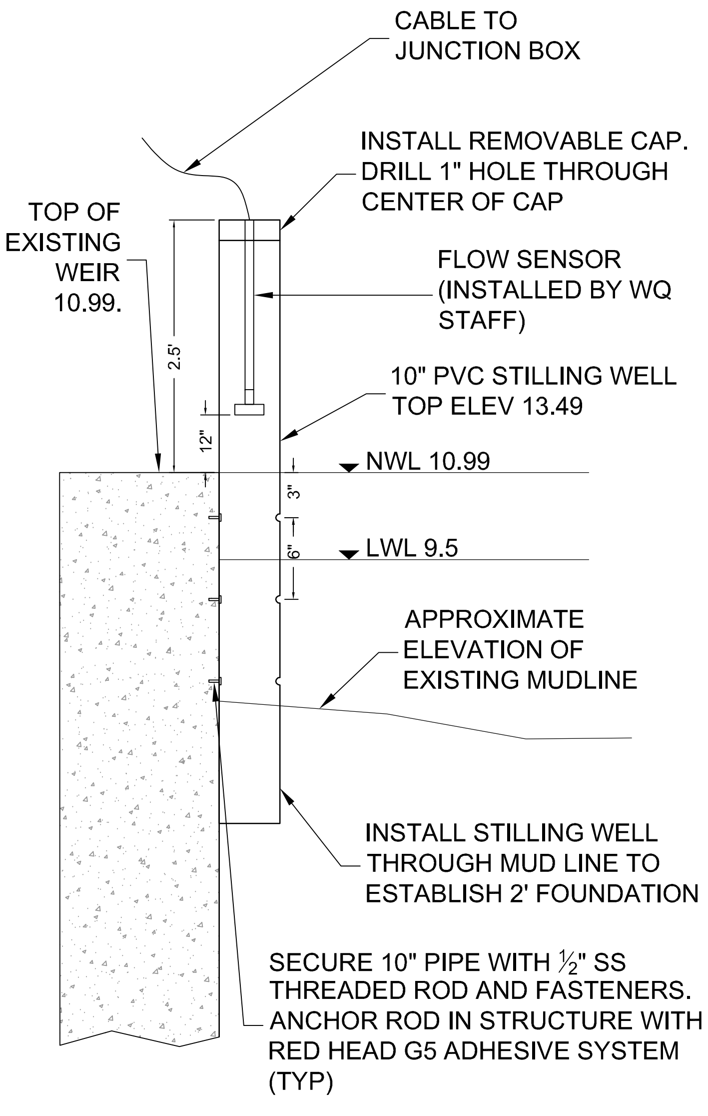
FIBERGLASS V-NOTCH WEIR DETAIL

NTS



10" STILLING WELL INSTALLATION DETAIL FOR ST-6

NTS



10" STILLING WELL INSTALLATION DETAIL FOR EXISTING BROADCRESTED WEIR

NTS

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SAMPLING PLAN DETAILS

SOUTH COUNTY ALLIGATOR CREEK STORMWATER TREATMENT PROJECT

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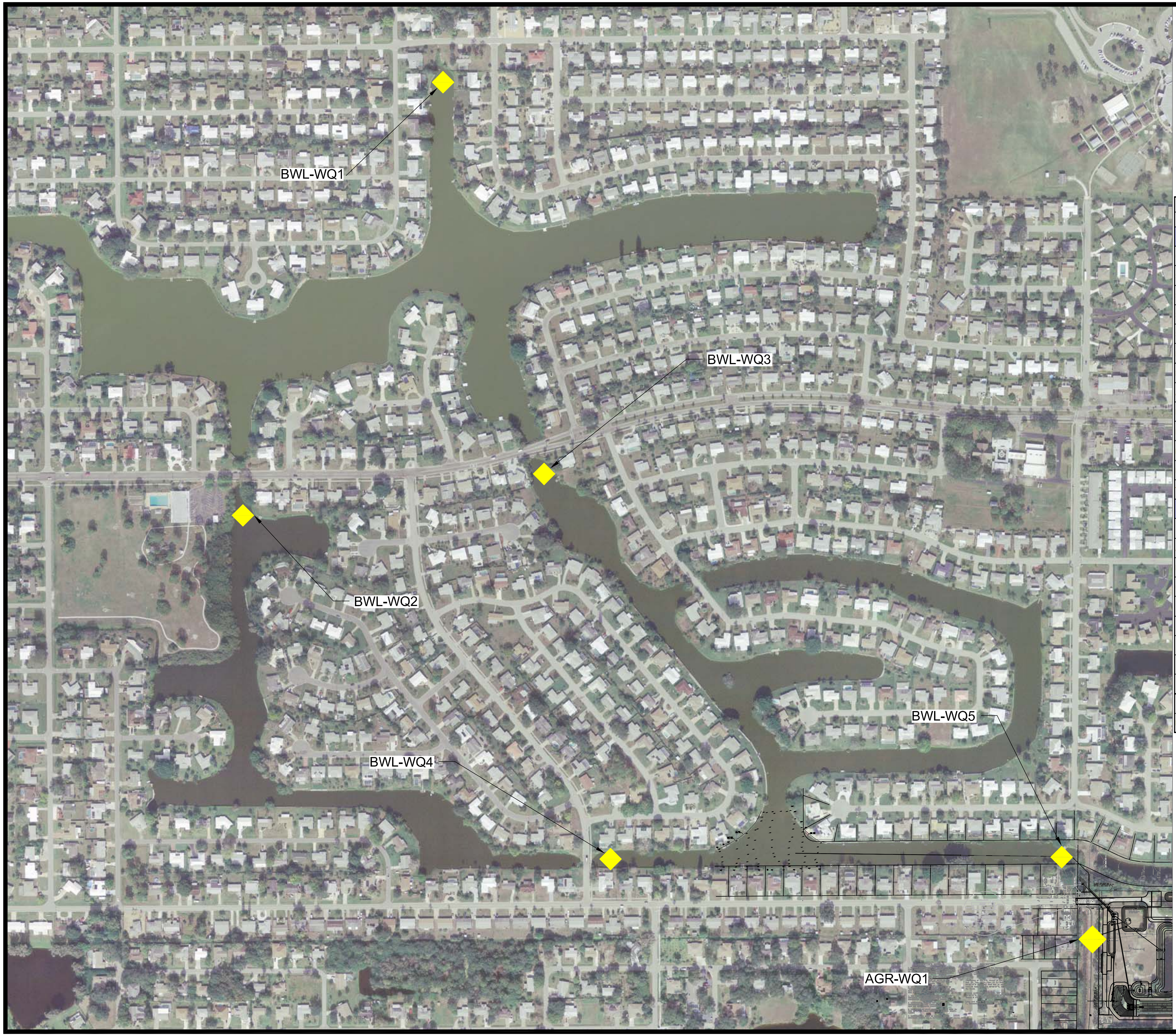
WQ-4



200 100 0 200

SCALE: 1” = 200’ FULL SIZE
1” = 400’ HALF SIZE

N

ALLIGATOR CREEK STORMWATER TREATMENT PROJECT

SCHEDULE A-BACKGROUND BRIARWOOD LAKES WQ

COLLECTION METHOD	GRAB
SAMPLE MATRIX	SURFACE WATER
SPECIAL COLLECTION NEEDS	BOAT
SAMPLE FREQUENCY	ONE TIME EVENT
SAMPLE PERIOD	SINGLE EVENT FALL 2011
NUMBER OF SAMPLE POINTS	6
FIELD EQUIPMENT (IN SITU)	YSI 600XLM
AUTO SAMPLER REQUIREMENT	NONE
FLOW MEASUREMENT	VISUAL DISCHARGE AT WEIR
FDEP GRANT REQUIREMENTS	NOT REQUIRED
EQUIPMENT BLANKS	1
FIELD BLANKS	1
TRAVEL BLANKS	NOT REQUIRED

SAMPLE PROCEDURES FOLLOW FDEP SOP-2008 AND QAPP

A. CORRELATE SAMPLE EVENT WITH WEIR DISCHARGE AT BRIARWOOD

B. DEPLOY FIELD SAMPLE EQUIPMENT

C. COMPLETE SAMPLING EVENT AT THESE LOCATIONS

- C.1 GRAB COLLECTION AT BWL-WQ1
- C.2 GRAB COLLECTION AT BWL-WQ2
- C.3 GRAB COLLECTION AT BWL-WQ3
- C.4 GRAB COLLECTION AT BWL-WQ4
- C.5 GRAB COLLECTION AT BWL-WQ5
- C.6 GRAB COLLECTION AT AGR-WQ1

D. PRESERVE SAMPLES AND TRANSFER TO ANALYTICAL LAB

REVISIONS

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SCHEDULE A - WQ
BACKGROUND
SAMPLING LOCATIONS

SOUTH COUNTY
ALLIGATOR CREEK
STORMWATER TREATMENT
PROJECT

WATERMARK ENGINEERING
GROUP, INC.
1718 MAIN STREET, SARASOTA, FL. 34236
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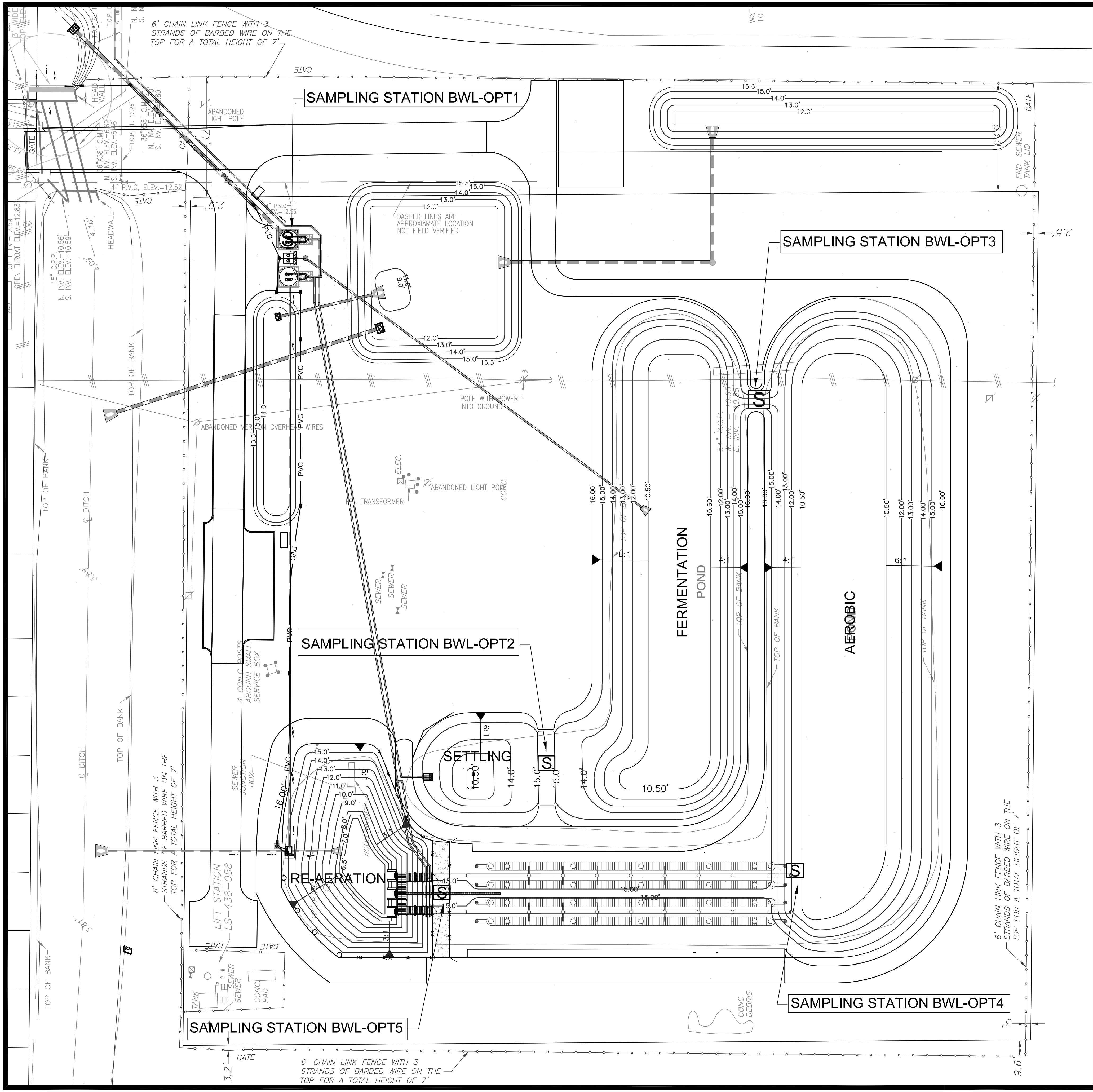
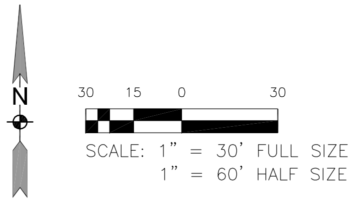
WQ-5





SCALE: 1" = 30' FULL SIZE
1" = 60' HALF SIZE

ALLIGATOR CREEK STORMWATER TREATMENT PROJECT	
SCHEDULE B-PERFORMANCE OPTIMIZATION SAMPLING PROGRAM	
COLLECTION METHOD	GRAB
SAMPLE MATRIX	SURFACE WATER
SPECIAL COLLECTION NEEDS	NONE
SAMPLE FREQUENCY	REPEATED AT 5 DAY INTERVALS
SAMPLE PERIOD	THREE EVENTS PRE-DETERMINED
NUMBER OF SAMPLE POINTS	5
FIELD EQUIPMENT (IN SITU)	YSI 600XLM
AUTO SAMPLER REQUIREMENT	NONE
FLOW MEASUREMENT	PS A AND PS B FLOWS
FDEP GRANT REQUIREMENTS	NOT REQUIRED
EQUIPMENT BLANKS	1
FIELD BLANKS	1
TRAVEL BLANKS	NOT REQUIRED
SAMPLE PROCEDURES FOLLOW FDEP SOP-2008 AND QAPP	
A. CORRELATE SAMPLE EVENT WITH OPERATIONAL PROTOCOLS	
B. DEPLOY FIELD SAMPLE EQUIPMENT	
C. COMPLETE SAMPLING EVENT AT THESE LOCATIONS	
C.1 5 CONSECUTIVE GRAB COLLECTION AT BWL-OPT1 (THREE EVENTS)	
C.2 5 CONSECUTIVE GRAB COLLECTION AT BWL-OPT2 (THREE EVENTS)	
C.3 5 CONSECUTIVE GRAB COLLECTION AT BWL-OPT3 (THREE EVENTS)	
C.4 5 CONSECUTIVE GRAB COLLECTION AT BWL-OPT4 (THREE EVENTS)	
C.5 5 CONSECUTIVE GRAB COLLECTION AT BWL-OPT4 (THREE EVENTS)	
D. PRESERVE SAMPLES AND TRANSFER TO ANALYTICAL LAB	

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SCHEDULE B - PERFORMANCE OPTIMIZATION SAMPLING LOCATIONS

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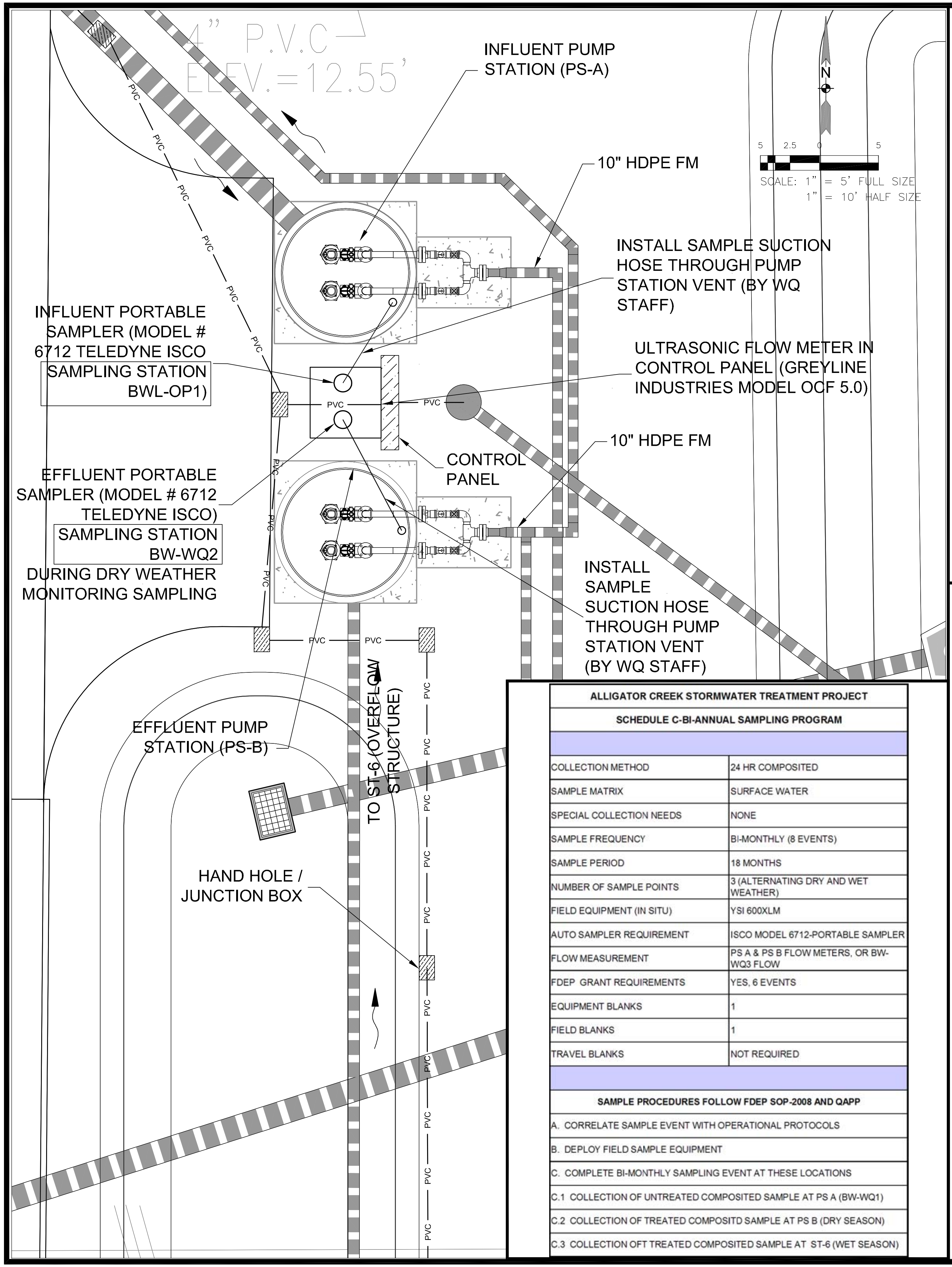
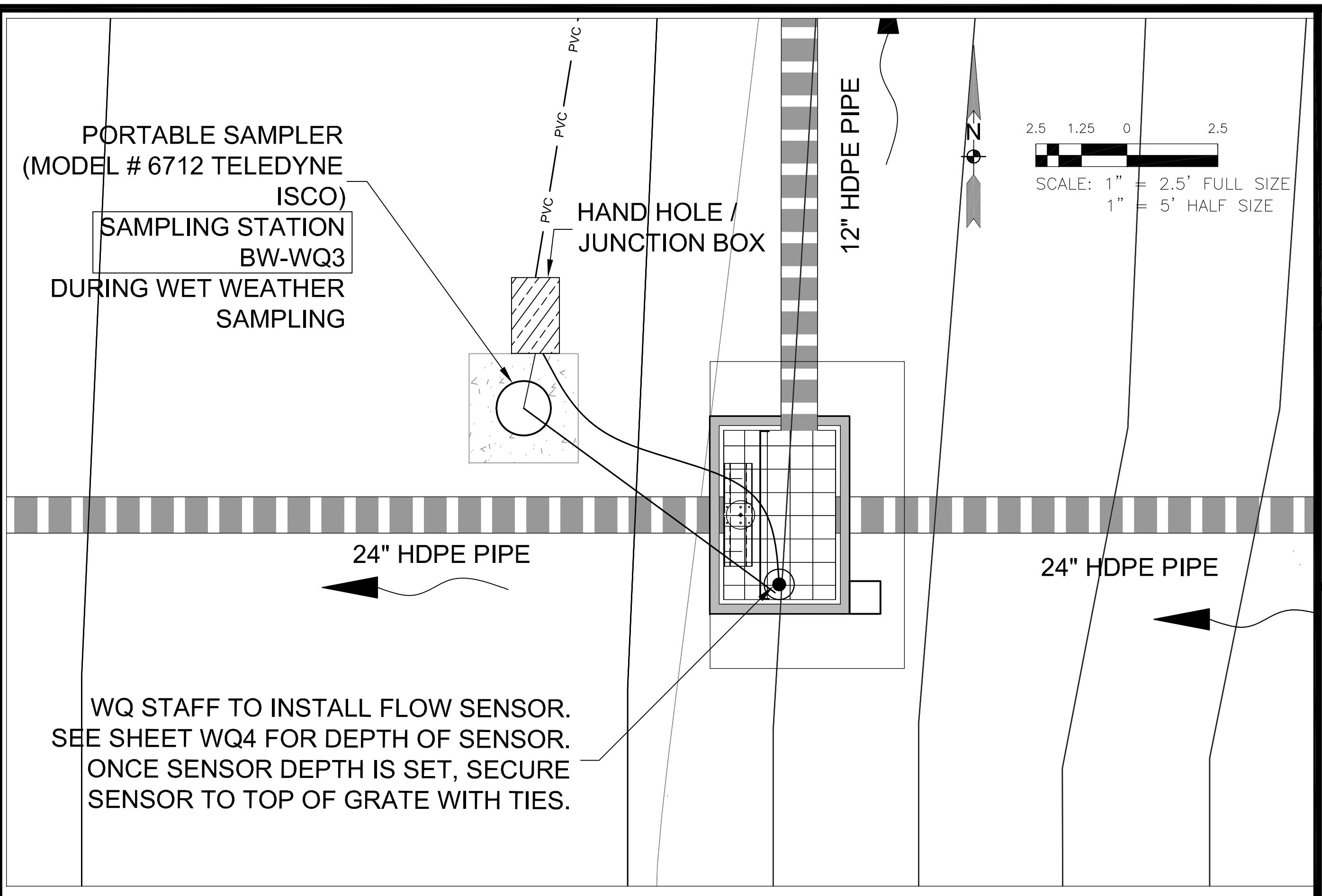
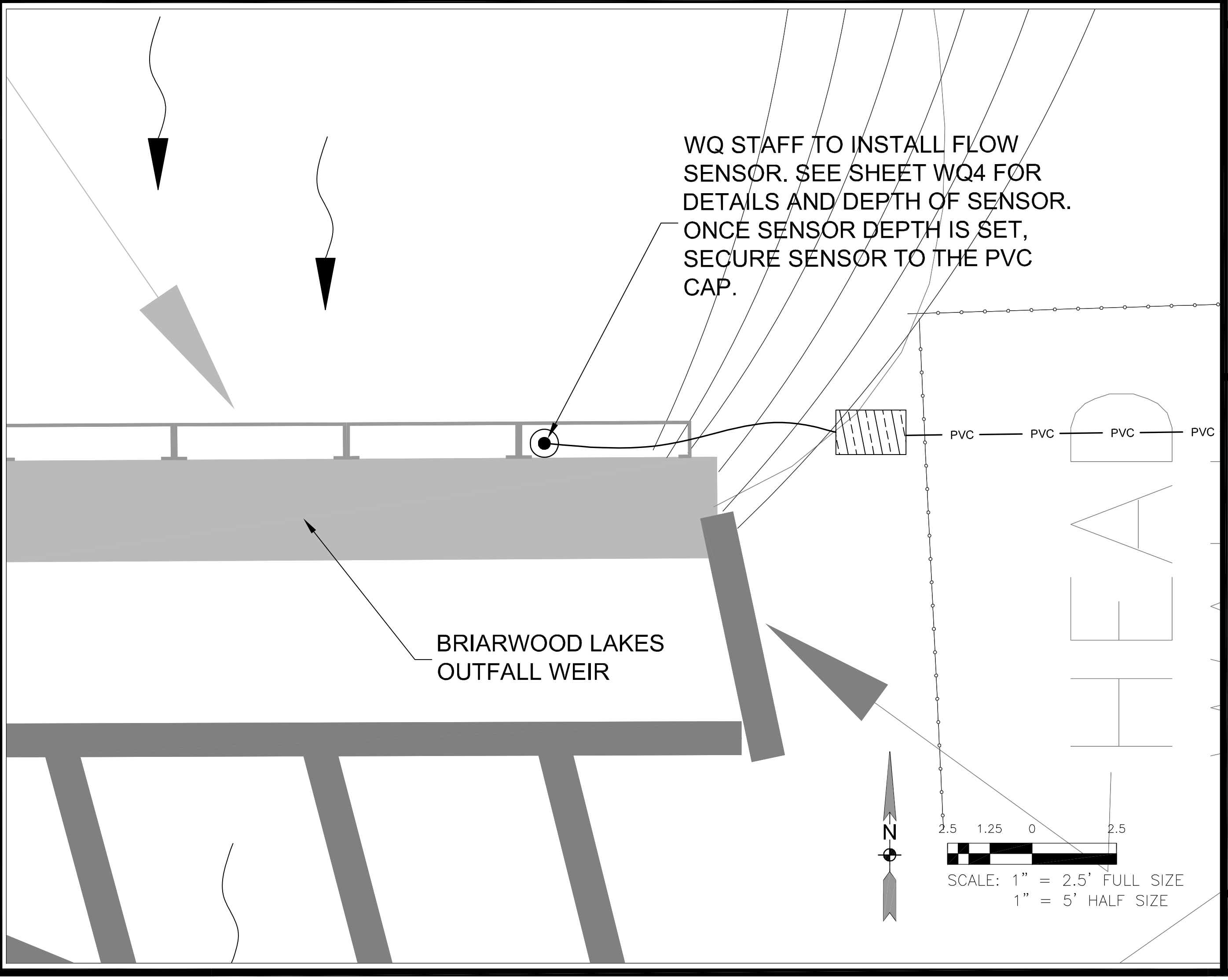
WQ-6



ALLIGATOR CREEK STORMWATER TREATMENT PROJECT	
SCHEDULE C-BI-ANNUAL SAMPLING PROGRAM	
COLLECTION METHOD	24 HR COMPOSITED
SAMPLE MATRIX	SURFACE WATER
SPECIAL COLLECTION NEEDS	NONE
SAMPLE FREQUENCY	BI-MONTHLY (8 EVENTS)
SAMPLE PERIOD	18 MONTHS
NUMBER OF SAMPLE POINTS	3 (ALTERNATING DRY AND WET WEATHER)
FIELD EQUIPMENT (IN SITU)	YSI 600XLM
AUTO SAMPLER REQUIREMENT	ISCO MODEL 6712-PORTABLE SAMPLER
FLOW MEASUREMENT	PS A & PS B FLOW METERS, OR BW-WQ3 FLOW
FDEP GRANT REQUIREMENTS	YES, 6 EVENTS
EQUIPMENT BLANKS	1
FIELD BLANKS	1
TRAVEL BLANKS	NOT REQUIRED
SAMPLE PROCEDURES FOLLOW FDEP SOP-2008 AND QAPP	
A. CORRELATE SAMPLE EVENT WITH OPERATIONAL PROTOCOLS	
B. DEPLOY FIELD SAMPLE EQUIPMENT	
C. COMPLETE BI-MONTHLY SAMPLING EVENT AT THESE LOCATIONS	
C.1 COLLECTION OF UNTREATED COMPOSITED SAMPLE AT PS A (BW-WQ1)	
C.2 COLLECTION OF TREATED COMPOSITD SAMPLE AT PS B (DRY SEASON)	
C.3 COLLECTION OFT TREATED COMPOSITED SAMPLE AT ST-6 (WET SEASON)	





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SCHEDULE C - BI-ANNUAL SAMPLING LOCATIONS

SOUTH COUNTY ALLIGATOR CREEK STORMWATER TREATMENT PROJECT

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TEL: (941) 951-2301 FAX: (941) 954-8917
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WQ-7

APPENDICES
A.1 QUALITY MANUALS
A.2 HANDBOOKS
A.3 OPERATING MANUALS

DEP – SOP-001/01

FS 2100 SURFACE WATER SAMPLING

FS 2100. SURFACE WATER SAMPLING

See also the following Standard Operating Procedures:

- FA 1000 Administrative Procedures
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000Documentation Procedures
- FM 1000 Field Planning and Mobilization
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FS 2000 General Aqueous Sampling
- FS 2400 Wastewater Sampling
- FT 1000 – FT 2000 Field Testing and Calibration Procedures

1. INTRODUCTION AND SCOPE

1.1. This section presents standard operating procedures to be used to consistently collect representative surface water samples. Each collection event must be performed so that samples are neither contaminated nor altered from improper handling.

1.2. The following topics include acceptable equipment selection and equipment construction materials; and standard grab, depth-specific and depth-composited surface water sampling techniques. Information regarding sample types and flow- or time-weighted aqueous sampling is found in FS 2420.

2. GENERAL CAUTIONS

2.1. When using watercraft, take samples near the bow, away and upwind from any gasoline outboard engine. Orient watercraft so that bow is positioned in the upstream direction.

2.2. When wading, collect samples upstream from the body.

2.3. Avoid disturbing sediments in immediate area of sample collection.

2.4. Collect water samples prior to taking sediment samples when obtaining both from the same area (site).

2.5. Consider the representativeness of selected sampling locations, for example, when attempting to characterize a water body that may be stratified or heterogeneous.

2.6. Unless dictated by permit, program or order, sampling at or near structures (e.g., dams, weirs or bridges) may not provide representative data because of unnatural flow patterns.

2.7. Collect surface water samples from downstream towards upstream.

3. EQUIPMENT AND SUPPLIES

3.1. Use sampling equipment constructed of materials consistent with the analytes of interest. Refer to FS 1000, Tables 1000-1 and 1000-2 for material selection. Select equipment based on the analytes of interest, the specific equipment use and the available equipment. Refer to FS 1000, Table 1000-3 for selection of appropriate equipment.

3.2. For information on sample container size and construction, preservation and holding time requirements, see FS 1000, Tables 1000-4, 1000-5, 1000-8, 1000-9 and 1000-11.

3.3. For information on sampling equipment cleaning requirements, see FC 1000.

3.4. For information on documentation requirements, see FD 1000.

FS 2110. SURFACE WATER SAMPLING TECHNIQUES

Use the following protocols when collecting surface water samples. Adhere to all general protocols applicable to aqueous sampling detailed in FS 2000 when following the surface water sampling procedures addressed below.

1. MANUAL SAMPLING: Use manual sampling for collecting grab samples for immediate in-situ field analyses. Also use manual sampling in lieu of automatic equipment over extended periods of time for composite sampling, especially when it is necessary to observe and/or note unusual conditions.

1.1. Surface Grab Samples

See FS 2000, section 1.2. for discussions concerning the appropriate uses of grab samples.

Collect surface grab samples within the top 12 inches of the water column. Avoid skimming the surface of the water during collection unless specifically required by the sampling plan. Very shallow water bodies require careful techniques of sample collection to avoid disturbing sediments

Where practical, use the actual sample container as the collection device (direct grab). Sample containers attached to poles are also considered direct grabs.

The use of unpreserved sample containers is encouraged since the same container can be submitted for laboratory analysis after appropriate preservation. This procedure reduces sample handling and potential loss of analytes or contamination of the sample from other sources (e.g., additional sampling equipment, environment, etc.).

1.1.1. Direct Grab Technique

1.1.1.1. Using an unpreserved sample container to collect the sample:

- Remove the container cap and slowly submerge the container, opening first, into the water.
- Invert the bottle so the opening is upright and pointing towards the direction of water flow (if applicable). Allow water to run slowly into the container until filled.
- Return the filled container quickly to the surface.
- Pour out a small volume of sample away from and downstream of the sampling location. This procedure allows for addition of preservatives and sample expansion. Do not use this step for volatile organics or other analytes where headspace is not allowed in the sample container.
- Add preservatives, if required, securely cap container, label and complete field notes.

1.1.1.2. Using a sample container with premeasured preservative to collect the sample. (An unpreserved sample container may also be used with this technique.)

- Submerge the unopened sample container to the appropriate level.
- Turn the container so that the opening is upright and towards the direction of water flow (if applicable).
- Open the container and allow the water to run into the container almost full (leave an air space).
- Cap the container and return to the surface.

1.1.1.3. If preservatives have been added, invert the container several times to ensure sufficient mixing of sample and preservatives.

1.1.1.4. Check preservation of the sample and adjust pH with additional preservative, if necessary. When a pH adjustment is made and a prepreserved container was used to collect the sample, always check all containers for proper preservation.

1.1.2. Sampling with an Intermediate Vessel or Container: If the sample cannot be collected directly into the sample container to be submitted to the laboratory use an unpreserved sample container or an intermediate vessel (e.g., beakers, buckets or dippers) to obtain the sample. These vessels must be appropriately cleaned and constructed including any poles or extension arms used to access the sample location.

1.1.2.1. Rinse the intermediate vessel with ample amounts of site water prior to collecting the first sample. Discard rinsate away from or downstream of the sampling location.

1.1.2.2. After adequate rinsing, fill the intermediate vessel with sample water. Minimize agitation of the sample.

1.1.2.3. Fill sample containers from the intermediate vessel. Minimize agitation during filling. Do not touch the sample container with the intermediate vessel.

1.1.2.4. Leave adequate headspace in the sample container. This procedure allows for addition of preservatives (if required) and sample expansion. Do not use this step for volatile organics or other analytes where headspace is not allowed in the sample container.

1.1.2.5. Add preservatives if required, securely cap container, label and complete field notes.

1.1.2.6. Invert the container several times to ensure sufficient mixing of sample and preservatives.

1.1.2.7. Check preservation of the sample and adjust pH with additional preservative, if necessary.

1.1.3. Pump and Tubing: Use appropriate pumps, equipment, and tubing. (See restrictions listed in FS 1000 Tables FS 1000-1 through 1000-3).

Do not collect oil & grease, TRPH or FL-PRO samples with a pump. See FS 2000 for proper collection procedures for extractable organics and volatile organic compounds.

1.1.3.1. Lower tubing to a depth 6-12 inches below water surface, where possible.

1.1.3.2. Pump several tubing volumes through the system to flush the tubing prior to collecting the first sample.

1.1.3.3. Fill individual sample bottles via the discharge tubing, being careful not to remove the inlet tubing from the water.

1.1.3.4. Do not touch the discharge tubing to the sample container.

1.1.3.5. Leave adequate headspace in the sample container. This procedure allows for addition of preservatives (if required) and sample expansion. Do not use this step for volatile organics or other analytes where headspace is not allowed in the sample container.

1.1.3.6. Add preservatives if required, securely cap container, label and complete field notes.

1.1.3.7. Invert the container several times to ensure sufficient mixing of sample and preservatives.

1.1.3.8. Check preservation of the sample and adjust pH with additional preservative, if necessary.

1.2. Depth Grab Samples: Examples of equipment that may be used for depth grab sampling include Kemmerer, Niskin, Van Dorn and similar samplers; pumps with tubing and double check-valve bailers. See restrictions listed in FS 1000 Tables 1000-1, 1000-2 and 1000-3. Do not collect oil & grease, TRPH or FL-PRO samples with a pump. See FS 2000 for proper collection procedures for extractable organics and volatile organic compounds.

1.2.1. Kemmerer, Niskin and Van Dorn Type Devices

1.2.1.1. Many of these samplers are constructed of plastic and rubber that preclude their use for all volatile and extractable organic sampling. Some newer devices are constructed of stainless steel or are all Teflon or Teflon-coated. These are acceptable for all analyte groups without restriction.

1.2.1.2. Measure the water column to determine maximum depth and sampling depth prior to lowering the sampling device.

1.2.1.3. Mark the line attached to the sampler with depth increments so that the sampling depth can be accurately recorded.

1.2.1.4. Lower the sampler slowly to the appropriate sampling depth, taking care not to disturb the sediments.

1.2.1.5. At the desired depth, send the messenger weight down to trip the closure mechanism.

1.2.1.6. Retrieve the sampler slowly.

1.2.1.7. Rinse the sampling device with ample amounts of site water prior to collecting the first sample. Discard rinsate away from and downstream of the sampling location.

1.2.1.8. Fill the individual sample bottles via the discharge tube. Sample bottles must be handled as described in sections 1.1.3.3 – 1.1.3.8 above.

1.2.2. Double Check-Valve Bailers: Collect samples using double check-valve bailers if the data requirements do not necessitate a sample from a strictly discrete interval of the water column. Bailers with an upper and lower check-valve can be lowered through the water column and water will continually be displaced through the bailer until the desired depth is reached, at which point the bailer is retrieved.

1.2.2.1. Sampling with this type of bailer must follow the same protocols outlined in section 1.2.1 above except that a messenger weight is not applicable.

1.2.2.2. Although not designed specifically for this kind of sampling, a bailer is acceptable when a mid-depth sample is required.

1.2.2.3. Note: This sampler does not perform as well as the devices described above or the pump and tubing described in section 1.2.3 below.

1.2.2.4. As the bailer is dropped through the water column, water is displaced through the body of the bailer. The degree of displacement depends upon the check-valve ball movement to allow water to flow freely through the bailer body.

1.2.2.5. Slowly lower the bailer to the appropriate depth. Upon retrieval, the two check-valves seat, preventing water from escaping or entering the bailer.

1.2.2.6. Rinse the sampling device with ample amounts of site water prior to collecting the first sample.

1.2.2.7. Fill the individual sample bottles via the discharge tube. Sample bottles must be handled as described in sections 1.1.3.3 – 1.1.3.8 above.

1.2.3. <u>Pump and Tubing</u>: Use appropriate pumps, equipment and tubing. (See restrictions listed in FS 1000 Tables 1000-1, 1000-2 and 1000-3). Do not collect oil & grease, TRPH or FL-PRO samples with a pump. See FS 2000 for proper collection procedures for extractable organics and volatile organic compounds.

1.2.3.1. Measure the water column to determine the maximum depth and the sampling depth.

1.2.3.2. Tubing will need to be tied to a stiff pole or be weighted down so the tubing placement will be secure. Do not use a lead or metallic weight if collecting metals samples. Any dense, non-contaminating, non-interfering material will work (brick, stainless steel weight, etc.). Tie the weight with a lanyard (braided or monofilament nylon, etc.) so that it is located below the inlet of the tubing.

1.2.3.3. Pump several tubing volumes through the system to flush the tubing prior to collecting the first sample.

1.2.3.4. Fill the individual sample bottles via the discharge tube, being careful not to remove the inlet tubing from the water. Do not touch the discharge tubing to the sample container.

1.2.3.5. Leave adequate headspace in the sample container. This procedure allows for addition of preservatives (if required) and sample expansion. Do not use this step for volatile organics or other analytes where headspace is not allowed in the sample container.

1.2.3.6. Add preservatives if required, securely cap container, label and complete field notes.

1.2.3.7. Invert the container several times to ensure sufficient mixing of sample and preservatives.

1.2.3.8. Check preservation of the sample and adjust pH with additional preservative, if necessary.

2. AUTOMATIC SAMPLERS: Use automatic samplers when several sites are to be sampled at frequent intervals or when a continuous sample is required. Composite samplers can be used

to collect time composite or flow proportional samples (see FS 2000, section 1.3 for discussions on types of composite and appropriate used of composite sampling). Use appropriate equipment and tubing. (See restrictions listed in FS 1000 Tables 1000-1, 1000-2 and 1000-3). Do not collect oil & grease, TRPH or FL-PRO samples with automatic samplers unless required by the sampling plan. See FS 2000 for proper collection procedures for extractable organics and volatile organic compounds.

The use of automatic samplers for collecting surface water samples will more frequently run into situations where sampling equipment is deployed on-site for a long term or dedicated to the site.

2.1. <u>Installing and Programming the Composite Sampler</u>

2.1.1. Use all new or precleaned pump tubing each time the sampler is brought to the field and set up. If the automatic sampler is deployed in the field for extended periods, it is recommended to replace the tubing at a minimum of every six months. Other replacement schedules may be required, depending on the specific installation and project requirements. Inspect the tubing each time the composite-sample container is picked up. If there is evidence of loss of elasticity or discoloration or other conditions that would impact the quality of the sample (such as algal growth), or the pumping flow rate, then replace the tubing. Select the tubing for the pump head and sampling train according to the analytes of interest and the allowable construction materials specified in FS 1000 Table FS 1000-1, 1000-2 and 1000-3.

2.1.1.1. Cut the proper length of precleaned Teflon or Tygon tubing.

2.1.1.2. <u>Equipment Blanks:</u> Collect equipment blanks each time the tubing is changed or at a frequency of 5% of the tubing changes, whichever is less. Collect a minimum of one blank each year. Collect the blank by passing analyte-free water through the equipment that is exposed to the sample.

- Composite sample containers may be cleaned either in the field or in a fixed base operation. Demonstrate cleaning effectiveness by collecting equipment blanks on the composite sample containers according to the frequency specified in FQ 1000. Collect sample container equipment blanks by adding analyte-free water to the cleaned sample container, mix the water thoroughly within the container and then pour off an aliquot for analysis.

2.1.1.3. Put the collection sieve and tubing in the appropriate sample location, using conduit if necessary to hold it in place. Ensure the supporting conduit does not contaminate the incoming sample water.

2.1.1.4. Program the sampler per manufacturer's directions and as required in the permit or work plan conditions.

2.1.1.5. Automatic Sampler Security: Place a lock or seal on the sampler to prevent or detect tampering. This procedure, however, does not prevent tampering with the sampler tubing. See additional discussions on sample security in FS 2410, section 2.3.2.

2.2. <u>Sample Acquisition</u>

2.3.1. At the end of each sampling period, stir the contents of the composite jug and transfer the contents into the respective containers. If the sampler was configured to collect discrete samples ensure that the contents of each container are adequately mixed while pouring the sample into the sample container.

2.3.2. Immediately preserve the sample, if required, securely cap container, label and complete field notes.

2.3. Long Term Deployment of Automatic Composite Samplers: In certain sampling situations, automatic composite samplers are permanently installed at surface water stations and remain in the field for months or even years. Under these conditions, there are specific sampling issues that need to be addressed.

2.3.1. Sample Preservation

2.3.1.1. If the only analyte of interest is Total Phosphorus and the project is unrelated to an NPDES permit, the sample must be chemically preserved with sulfuric acid (H_2SO_4) but it need not be cooled to 4°C with wet ice.

- The acid must be in the container prior to drawing the first composite sample into the container.

  When using large (i.e., 3 gallon) composite sample containers, and there is potential for the sample size to vary greatly due to variable flow rates at the site, the volume of acid for preservation should be small (e.g., 1 to 2 mL of 50% H_2SO_4). **Do not over acidify the sample**. Upon sample pick-up, if needed, add additional acid to achieve the proper pH adjustment for preservation.

- If parameters other than total phosphorus are to be analyzed, appropriate additional preservation (e.g., cooling with ice or refrigeration) is required.

2.3.1.2. Deviations from these SOPs concerning preservation and holding times relating to remote and long term deployments due to site specific considerations must be agreed upon by project management.

2.3.2. Cleaning Requirements

2.3.2.1. Clean composite sampler containers after collection of each composite sample using cleaning solutions and procedures specified in FC 1140, sections 5 through 9.

2.3.2.2. Composite sample containers may be cleaned either in the field or in a fixed based operation. Demonstrate cleaning effectiveness by collecting equipment blanks on the composite sample containers according to the frequency specified in FQ 1000. Collect sampler container equipment blanks by adding analyte-free water to the cleaned sample container, mix the water thoroughly within the container and then pour off an aliquot for analysis.

2.3.2.3. Inspect and replace tubing at a minimum of every six months or when applicable, as discussed in section 2.1.1 above. Collect equipment blanks as specified in section 2.1.1.2 above. If the tubing is being replaced for multiple autosamplers at the same time, one equipment blank may be collected on the entire length of replacement tubing. Collect this equipment blank by passing analyte-free water through the entire length of new tubing.

BENCHMARK ENVIROANALYTICAL, INC.

QUALITY MANUAL

BENCHMARK ENVIROANALYTICAL, INC.

Quality Manual

Revision 12/29/10

LABORATORY NAME: Benchmark EnviroAnalytical, Incorporated

LABORATORY ADDRESS:
1711 12th Street East
Palmetto, FL 34221

Responsible Individual:
Dale D. Dixon
Laboratory Director
1711 12th Street East
Palmetto, FL 34221
(941) 723-9986

Laboratory Manager: Robert Sullivan

Quality Assurance Officers:
Radica Koutselas
Jennifer Jordan

Technical Directors:
Robert Sullivan
Tülay Tanrisever
Margaret Clague

Dale Dixon
Laboratory Director — Date 12/29/10

Robert Sullivan
Laboratory Manager and Technical Director — Date 12/29/10

Radica Koutselas
Quality Assurance Officer — Date 12/29/10

Quality Assurance Officer — Date 12/29/10

Technical Director and Lab Supervisor — Date 12/29/10

Margaret W. Clague
Technical Director and Lab Supervisor — Date 12/29/10

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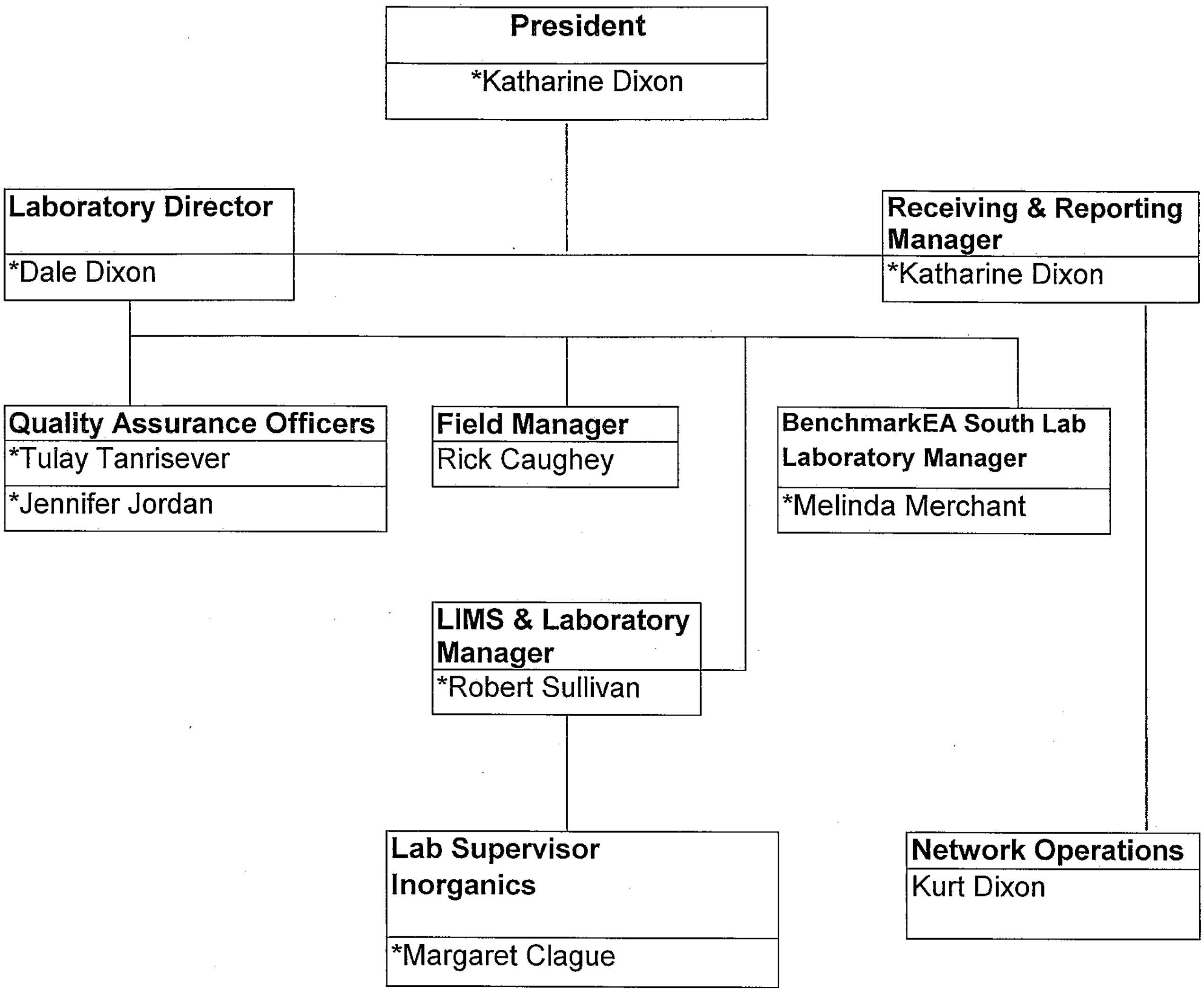
Table 1.3 LIST OF TABLES

2.1 B E A Laboratory Organization



NOTE: Names with * are signatories.

2.2 Job Description of Key Staff

Specific job descriptions are available for all positions and include minimum requirements for the position. A three ring binder containing job descriptions is kept in the Laboratory Director's office. Electronic copies are located at Z:\ADMINISTRATION\BEA N.E.L.A.C. SYSTEM -- DON'T MOVE OR RENAME\8) Job Descriptions

1) Dale D. Dixon, Ph.D. - Laboratory Director.

   Responsible for management of all laboratory functions. Approves all final reports. Directly supervises technical operations and implementation of the quality plan, including corrective actions and changes to the quality plan.

2) Katharine A. Dixon & Bettina Beilfuss - Receiving and Reporting.

   Responsible for managing sample kit preparation and delivery, sample pick-ups, sample custody procedures and construction of final analytical reports.

3) Robert Sullivan - Laboratory Manager

   Responsible for laboratory analytical operations and for LIMS & Network operations. Also responsible for electronic reporting systems.

4) Radica Koutselas & Jennifer Jordan - Quality Assurance Officers.

   Responsible for data validation, data acceptance, corrective action, compilations of control charts, production of quality control reports and maintaining the quality manual.

5) Job descriptions of other personnel are summarized in 2.1 BEA Laboratory Organization. Specific job descriptions are kept on file.

3.0 STATEMENT OF QUALITY POLICY

Benchmark EnviroAnalytical, Inc.'s policies and procedures have been established in order to meet the requirements of the NELAC Standards. Benchmark EnviroAnalytical, Inc. is committed to producing the most accurate and precise results possible. It is also committed to using this document to provide QA/QC procedures to produce accurate results.

We at Benchmark EnviroAnalytical, Inc. will "do the job right the first time" by following the four absolutes of quality provided below:

#1: Quality is defined as conformance to requirements. It is not a subjective view of what is "good" or "not good".

#2: The system for causing quality is prevention, not appraisal.

#3: The desired performance standard is "zero defects", not "that's close enough".

#4: The measurement of quality is the price of nonconformance, not indexes.

Benchmark's management endorses the N.E.L.A.C. quality system. The technical staff and the support staff share this endorsement. Implementation of the quality system is a team effort performed as a shared objective of management, technical staff and support services.

4.0 ORGANIZATION ABILITIES

Table 4.1 List of Certified Analytes

Laboratory Scope of Accreditation

Attachment to Certificate #: E84167-20, expiration date June 30, 2011. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E84167 EPA Lab Code: FL00289 (941) 723-9986

E84167
Benchmark EnviroAnalytical, Inc.
1711 12th Street East
Palmetto, FL 34221

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
1,1,1-Trichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
1,1,2,2-Tetrachloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
1,1,2-Trichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
1,1-Dichloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
1,1-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
1,1-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
1,2,3-Trichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
1,2,4-Trichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
1,2,4-Trimethylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1	Synthetic Organic Contaminants	NELAP	4/20/2009
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504.1	Synthetic Organic Contaminants	NELAP	4/20/2009
1,2-Dichlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
1,2-Dichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
1,2-Dichloropropane	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
1,3,5-Trimethylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
1,3-Dichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
1,3-Dichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
1,4-Dichlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
2,2-Dichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
2-Chlorotoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
4-Chlorotoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
4-Isopropyltoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Alkalinity as CaCO3	SM 2320 B	Primary Inorganic Contaminants	NELAP	5/25/2004
Aluminum	EPA 200.7	Secondary Inorganic Contaminants	NELAP	5/25/2004
Antimony	SM 3113 B	Primary Inorganic Contaminants	NELAP	1/3/2002
Arsenic	SM 3113 B	Primary Inorganic Contaminants	NELAP	1/3/2002
Barium	EPA 200.7	Primary Inorganic Contaminants	NELAP	5/25/2004
Benzene	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
Beryllium	EPA 200.7	Primary Inorganic Contaminants	NELAP	5/25/2004
Bromate	EPA 300.1	Primary Inorganic Contaminants	NELAP	11/21/2008
Bromide	EPA 300.0	Primary Inorganic Contaminants	NELAP	5/25/2004
Bromoacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	4/20/2009
Bromobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Bromochloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Bromodichloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005

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Ana M. Viamonte Ros, M.D., M.P.H.
State Surgeon General

Laboratory Scope of Accreditation

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State Laboratory ID: E84167 EPA Lab Code: FL00289 (941) 723-9986

E84167
Benchmark EnviroAnalytical, Inc.
1711 12th Street East
Palmetto, FL 34221

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Bromoform	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Cadmium	EPA 200.7	Primary Inorganic Contaminants	NELAP	5/25/2004
Calcium	EPA 200.7	Primary Inorganic Contaminants	NELAP	5/25/2004
Carbon tetrachloride	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
Chlorate	EPA 300.1	Secondary Inorganic Contaminants	NELAP	11/21/2008
Chloride	EPA 300.0	Secondary Inorganic Contaminants	NELAP	5/25/2004
Chlorite	EPA 300.1	Primary Inorganic Contaminants	NELAP	11/21/2008
Chloroacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	4/20/2009
Chlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
Chloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Chloroform	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Chromium	EPA 200.7	Primary Inorganic Contaminants	NELAP	5/25/2004
cis-1,2-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
cis-1,3-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Color	SM 2120 B	Secondary Inorganic Contaminants	NELAP	7/31/2007
Conductivity	SM 2510 B	Primary Inorganic Contaminants	NELAP	5/25/2004
Copper	EPA 200.7	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	5/25/2004
Dibromoacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	4/20/2009
Dibromochloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Dibromomethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Dichloroacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	4/20/2009
Dichlorodifluoromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Dichloromethane (DCM, Methylene chloride)	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
Dissolved organic carbon (DOC)	SM 5310 B	Primary Inorganic Contaminants	NELAP	11/21/2008
Escherichia coli	READYCULT	Microbiology	NELAP	5/25/2004
Escherichia coli	SM 9223 B	Microbiology	NELAP	1/3/2002
Ethylbenzene	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
Fluoride	EPA 300.0	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	5/25/2004
Heterotrophic plate count	SM 9215 B	Microbiology	NELAP	5/25/2004
Hexachlorobutadiene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Iron	EPA 200.7	Secondary Inorganic Contaminants	NELAP	5/25/2004
Isopropylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Lead	SM 3113 B	Primary Inorganic Contaminants	NELAP	1/3/2002
Magnesium	EPA 200.7	Primary Inorganic Contaminants	NELAP	5/25/2004

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Palmetto, FL 34221

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Manganese	EPA 200.7	Secondary Inorganic Contaminants	NELAP	5/25/2004
Mercury	EPA 245.1	Primary Inorganic Contaminants	NELAP	1/3/2002
Methyl bromide (Bromomethane)	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Methyl chloride (Chloromethane)	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Methyl tert-butyl ether (MTBE)	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Naphthalene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
n-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Nickel	EPA 200.7	Primary Inorganic Contaminants	NELAP	5/25/2004
Nitrate	EPA 353.2	Primary Inorganic Contaminants	NELAP	1/3/2002
Nitrate as N	EPA 300.0	Primary Inorganic Contaminants	NELAP	5/25/2004
Nitrite as N	EPA 300.0	Primary Inorganic Contaminants	NELAP	5/25/2004
Nitrite as N	EPA 353.2	Primary Inorganic Contaminants	NELAP	5/25/2004
Nitrobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
n-Propylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Odor	EPA 140.1	Secondary Inorganic Contaminants	NELAP	1/3/2002
pH	SM 4500-H+-B	Secondary Inorganic Contaminants	NELAP	7/31/2007
Potassium	EPA 200.7	Secondary Inorganic Contaminants	NELAP	5/25/2004
sec-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Selenium	SM 3113 B	Primary Inorganic Contaminants	NELAP	1/3/2002
Silica as SiO2	EPA 200.7	Primary Inorganic Contaminants	NELAP	5/25/2004
Silver	EPA 200.7	Secondary Inorganic Contaminants	NELAP	5/25/2004
Sodium	EPA 200.7	Primary Inorganic Contaminants	NELAP	5/25/2004
Styrene	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
Sulfate	EPA 300.0	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	5/25/2004
Surfactants - MBAS	SM 5540 C	Secondary Inorganic Contaminants	NELAP	1/3/2002
tert-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Tetrachloroethylene (Perchloroethylene)	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
Thallium	EPA 200.9	Primary Inorganic Contaminants	NELAP	1/3/2002
Toluene	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
Total coliforms	READYCULT	Microbiology	NELAP	5/25/2004
Total coliforms	SM 9222 B	Microbiology	NELAP	1/3/2002
Total coliforms	SM 9223 B	Microbiology	NELAP	1/3/2002
Total dissolved solids	SM 2540 C	Secondary Inorganic Contaminants	NELAP	7/31/2007
Total haloacetic acids (HAA5)	EPA 552.2	Synthetic Organic Contaminants	NELAP	4/20/2009
Total nitrate-nitrite	EPA 300.0	Primary Inorganic Contaminants	NELAP	5/25/2004

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Benchmark EnviroAnalytical, Inc.
1711 12th Street East
Palmetto, FL 34221

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Total nitrate-nitrite	EPA 353.2	Primary Inorganic Contaminants	NELAP	1/3/2002
Total organic carbon	SM 5310 B	Primary Inorganic Contaminants	NELAP	5/25/2004
Total trihalomethanes	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
trans-1,2-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
trans-1,3-Dichloropropylene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
Trichloroacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	10/14/2010
Trichloroethene (Trichloroethylene)	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
Trichlorofluoromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/28/2005
UV 254	SM 5910 B	Primary Inorganic Contaminants	NELAP	11/21/2008
Vinyl chloride	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
Xylene (total)	EPA 524.2	Other Regulated Contaminants	NELAP	9/28/2005
Zinc	EPA 200.7	Secondary Inorganic Contaminants	NELAP	5/25/2004

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HEALTH

Ana M. Viamonte Ros, M.D., M.P.H.
State Surgeon General

Laboratory Scope of Accreditation

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State Laboratory ID: E84167 EPA Lab Code: FL00289 (941) 723-9986

E84167
Benchmark EnviroAnalytical, Inc.
1711 12th Street East
Palmetto, FL 34221

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,1,1-Trichloroethane	EPA 624	Volatile Organics	NELAP	8/29/2006
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,1,2,2-Tetrachloroethane	EPA 624	Volatile Organics	NELAP	8/29/2006
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,1,2-Trichloroethane	EPA 624	Volatile Organics	NELAP	8/29/2006
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,1-Dichloroethane	EPA 624	Volatile Organics	NELAP	8/29/2006
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,1-Dichloroethylene	EPA 624	Volatile Organics	NELAP	8/29/2006
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,2,4-Trichlorobenzene	BEI VOC-EPA624-1.0/GC-MS	Volatile Organics	NELAP	8/29/2006
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1	Volatile Organics	NELAP	4/20/2009
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504.1	Volatile Organics	NELAP	4/20/2009
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,2-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	8/29/2006
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,2-Dichloroethane	EPA 624	Volatile Organics	NELAP	8/29/2006
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,2-Dichloropropane	EPA 624	Volatile Organics	NELAP	8/29/2006
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,3-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	8/29/2006
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	9/28/2005
1,4-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	8/29/2006
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	9/28/2005
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	9/28/2005
2-Chloroethyl vinyl ether	EPA 624	Volatile Organics	NELAP	8/29/2006

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State Laboratory ID: E84167 EPA Lab Code: FL00289 (941) 723-9986

E84167
Benchmark EnviroAnalytical, Inc.
1711 12th Street East
Palmetto, FL 34221

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	9/28/2005
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	9/28/2005
2-Hexanone	EPA 8260	Volatile Organics	NELAP	9/28/2005
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	9/28/2005
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	9/28/2005
Acetone	EPA 8260	Volatile Organics	NELAP	9/28/2005
Acrolein (Propenal)	EPA 624	Volatile Organics	NELAP	8/29/2006
Acrylonitrile	EPA 624	Volatile Organics	NELAP	8/29/2006
Alkalinity as CaCO3	SM 2320 B	General Chemistry	NELAP	5/25/2004
Aluminum	EPA 200.7	Metals	NELAP	5/25/2004
Aluminum	EPA 6010	Metals	NELAP	5/25/2004
Ammonia as N	SM 4500-NH3C	General Chemistry	NELAP	7/31/2007
Antimony	EPA 200.7	Metals	NELAP	5/25/2004
Antimony	EPA 6010	Metals	NELAP	5/25/2004
Antimony	SM 3113 B	Metals	NELAP	7/31/2007
Arsenic	EPA 200.7	Metals	NELAP	5/25/2004
Arsenic	EPA 6010	Metals	NELAP	5/25/2004
Arsenic	SM 3113 B	Metals	NELAP	7/31/2007
Barium	EPA 200.7	Metals	NELAP	5/25/2004
Barium	EPA 6010	Metals	NELAP	5/25/2004
Benzene	EPA 624	Volatile Organics	NELAP	8/29/2006
Benzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
Beryllium	EPA 200.7	Metals	NELAP	5/25/2004
Beryllium	EPA 6010	Metals	NELAP	5/25/2004
Beryllium	SM 3113 B	Metals	NELAP	7/31/2007
Biochemical oxygen demand	SM 5210 B	General Chemistry	NELAP	1/3/2002
Boron	EPA 200.7	Metals	NELAP	5/25/2004
Boron	EPA 6010	Metals	NELAP	5/25/2004
Bromide	EPA 300.0	General Chemistry	NELAP	5/25/2004
Bromobenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	9/28/2005
Bromodichloromethane	EPA 624	Volatile Organics	NELAP	8/29/2006
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	9/28/2005
Bromoform	EPA 624	Volatile Organics	NELAP	8/29/2006
Bromoform	EPA 8260	Volatile Organics	NELAP	9/28/2005
Cadmium	EPA 200.7	Metals	NELAP	5/25/2004

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Benchmark EnviroAnalytical, Inc.
1711 12th Street East
Palmetto, FL 34221

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Cadmium	EPA 6010	Metals	NELAP	5/25/2004
Cadmium	SM 3113 B	Metals	NELAP	7/31/2007
Calcium	EPA 200.7	Metals	NELAP	5/25/2004
Calcium	EPA 6010	Metals	NELAP	5/25/2004
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	9/28/2005
Carbon tetrachloride	EPA 624	Volatile Organics	NELAP	8/29/2006
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	9/28/2005
Carbonaceous BOD (CBOD)	SM 5210 B	General Chemistry	NELAP	1/3/2002
Chemical oxygen demand	EPA 410.4	General Chemistry	NELAP	1/3/2002
Chloride	EPA 300.0	General Chemistry	NELAP	5/25/2004
Chlorobenzene	EPA 624	Volatile Organics	NELAP	8/29/2006
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
Chloroethane	EPA 624	Volatile Organics	NELAP	8/29/2006
Chloroethane	EPA 8260	Volatile Organics	NELAP	9/28/2005
Chloroform	EPA 624	Volatile Organics	NELAP	8/29/2006
Chloroform	EPA 8260	Volatile Organics	NELAP	9/28/2005
Chlorophylls	EPA 445	General Chemistry	NELAP	1/3/2002
Chlorophylls	SM 10200 H	General Chemistry	NELAP	5/25/2004
Chromium	EPA 200.7	Metals	NELAP	5/25/2004
Chromium	EPA 6010	Metals	NELAP	5/25/2004
Chromium	SM 3113 B	Metals	NELAP	7/31/2007
Chromium VI	SM 3500-Cr B (20th/21st Ed.)/UV-VIS	General Chemistry	NELAP	4/20/2009
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	9/28/2005
cis-1,3-Dichloropropene	EPA 624	Volatile Organics	NELAP	8/29/2006
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	9/28/2005
Cobalt	EPA 200.7	Metals	NELAP	5/25/2004
Cobalt	EPA 6010	Metals	NELAP	5/25/2004
Color	SM 2120 B	General Chemistry	NELAP	7/31/2007
Conductivity	SM 2510 B	General Chemistry	NELAP	6/25/2004
Copper	EPA 200.7	Metals	NELAP	5/25/2004
Copper	EPA 6010	Metals	NELAP	5/25/2004
Copper	SM 3113 B	Metals	NELAP	7/31/2007
Dibromochloromethane	EPA 624	Volatile Organics	NELAP	8/29/2006
Dibromomethane	EPA 8260	Volatile Organics	NELAP	9/28/2005
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	9/28/2005
Enterococci	EPA 1600	Microbiology	NELAP	1/3/2002

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State Surgeon General

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E84167
Benchmark EnviroAnalytical, Inc.
1711 12th Street East
Palmetto, FL 34221

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Escherichia coli	SM 9223 B /QUANTI-TRAY	Extractable Organics,Microbiology	NELAP	11/21/2008
Ethylbenzene	EPA 624	Volatile Organics	NELAP	8/29/2006
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
Fecal coliforms	SM 9221 E	Microbiology	NELAP	6/8/2006
Fecal coliforms	SM 9222 D	Microbiology	NELAP	1/3/2002
Fecal streptococci	SM 9230 C	Microbiology	NELAP	1/3/2002
Fluoride	EPA 300.0	General Chemistry	NELAP	5/25/2004
Hardness	SM 2340 B	General Chemistry	NELAP	7/31/2007
Hardness	SM 2340 C	General Chemistry	NELAP	7/31/2007
Hardness (calc.)	EPA 200.7	Metals	NELAP	5/25/2004
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	9/28/2005
Hydrogen sulfide, un-ionized (calculation)	SM 4500-S H	General Chemistry	NELAP	11/21/2008
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	9/28/2005
Iron	EPA 200.7	Metals	NELAP	5/25/2004
Iron	EPA 6010	Metals	NELAP	5/25/2004
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
Kjeldahl nitrogen - total	EPA 351.2	General Chemistry	NELAP	1/3/2002
Lead	EPA 200.7	Metals	NELAP	5/25/2004
Lead	EPA 6010	Metals	NELAP	5/25/2004
Lead	SM 3113 B	Metals	NELAP	7/31/2007
Magnesium	EPA 200.7	Metals	NELAP	5/25/2004
Magnesium	EPA 6010	Metals	NELAP	5/25/2004
Manganese	EPA 200.7	Metals	NELAP	5/25/2004
Manganese	EPA 6010	Metals	NELAP	5/25/2004
Mercury	EPA 245.1	Metals	NELAP	1/3/2002
Methyl bromide (Bromomethane)	EPA 624	Volatile Organics	NELAP	8/29/2006
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	9/28/2005
Methyl chloride (Chloromethane)	EPA 624	Volatile Organics	NELAP	8/29/2006
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	9/28/2005
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	9/28/2005
Methylene chloride	EPA 624	Volatile Organics	NELAP	8/29/2006
Methylene chloride	EPA 8260	Volatile Organics	NELAP	9/28/2005
Molybdenum	EPA 200.7	Metals	NELAP	5/25/2004
Molybdenum	EPA 6010	Metals	NELAP	5/25/2004
Naphthalene	EPA 8260	Volatile Organics	NELAP	9/28/2005
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005

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State Surgeon General

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E84167
Benchmark EnviroAnalytical, Inc.
1711 12th Street East
Palmetto, FL 34221

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Nickel	EPA 200.7	Metals	NELAP	5/25/2004
Nickel	EPA 6010	Metals	NELAP	5/25/2004
Nickel	SM 3113 B	Metals	NELAP	7/31/2007
Nitrate as N	EPA 300.0	General Chemistry	NELAP	5/25/2004
Nitrate as N	EPA 353.2	General Chemistry	NELAP	1/3/2002
Nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	1/3/2002
Nitrite as N	EPA 300.0	General Chemistry	NELAP	5/25/2004
Nitrite as N	SM 4500-NO2 B	General Chemistry	NELAP	1/3/2002
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
Oil & Grease	EPA 1664A	General Chemistry	NELAP	1/3/2002
Organic nitrogen	TKN minus AMMONIA	General Chemistry	NELAP	11/21/2008
Orthophosphate as P	EPA 300.0	General Chemistry	NELAP	5/25/2004
Orthophosphate as P	EPA 365.3	General Chemistry	NELAP	1/3/2002
pH	SM 4500-H+-B	General Chemistry	NELAP	7/31/2007
Phosphorus, total	EPA 365.3	General Chemistry	NELAP	1/3/2002
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	9/28/2005
Potassium	EPA 200.7	Metals	NELAP	5/25/2004
Potassium	EPA 6010	Metals	NELAP	5/25/2004
Residual free chlorine	SM 4500-Cl G	General Chemistry	NELAP	7/31/2007
Residue-filterable (TDS)	SM 2540 C	General Chemistry	NELAP	7/31/2007
Residue-nonfilterable (TSS)	SM 2540 D	General Chemistry	NELAP	7/31/2007
Residue-volatile	EPA 160.4	General Chemistry	NELAP	11/21/2008
Residue-volatile	SM 2540 E	General Chemistry	NELAP	8/29/2006
Salinity	SM 2520 B	General Chemistry	NELAP	6/25/2004
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
Selenium	EPA 200.7	Metals	NELAP	5/25/2004
Selenium	EPA 6010	Metals	NELAP	5/25/2004
Selenium	SM 3113 B	Metals	NELAP	7/31/2007
Silica as SiO2	EPA 200.7	Metals	NELAP	5/25/2004
Silica as SiO2	SM 4500-SiO2 C (20th/21st Ed.)	General Chemistry	NELAP	7/31/2007
Silver	EPA 200.7	Metals	NELAP	5/25/2004
Silver	EPA 6010	Metals	NELAP	5/25/2004
Silver	SM 3113 B	Metals	NELAP	7/31/2007
Sodium	EPA 200.7	Metals	NELAP	5/25/2004
Sodium	EPA 6010	Metals	NELAP	5/25/2004
Specific Oxygen Uptake Rate (SOUR)	SM 2710 B	General Chemistry	NELAP	1/3/2002

Clients and Customers are urged to verify the laboratory's current certification status with the Environmental Laboratory Certification Program. Issue Date: 10/14/2010 Expiration Date: 6/30/2011

Laboratory Scope of Accreditation

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E84167
Benchmark EnviroAnalytical, Inc.
1711 12th Street East
Palmetto, FL 34221

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Strontium	EPA 200.7	Metals	NELAP	5/25/2004
Styrene	EPA 8260	Volatile Organics	NELAP	9/28/2005
Sulfate	EPA 300.0	General Chemistry	NELAP	5/25/2004
Sulfide	SM 4500-S D/UV-VIS	General Chemistry	NELAP	5/25/2004
Surfactants - MBAS	SM 5540 C	General Chemistry	NELAP	1/3/2002
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	9/28/2005
Tetrachloroethylene (Perchloroethylene)	EPA 624	Volatile Organics	NELAP	8/29/2006
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	9/28/2005
Thallium	EPA 200.7	Metals	NELAP	5/25/2004
Thallium	EPA 200.9	Metals	NELAP	11/21/2008
Thallium	EPA 6010	Metals	NELAP	5/25/2004
Tin	EPA 200.7	Metals	NELAP	5/25/2004
Tin	EPA 6010	Metals	NELAP	5/25/2004
Titanium	EPA 200.7	Metals	NELAP	5/25/2004
Titanium	EPA 6010	Metals	NELAP	5/25/2004
Toluene	EPA 624	Volatile Organics	NELAP	8/29/2006
Toluene	EPA 8260	Volatile Organics	NELAP	9/28/2005
Total coliforms	SM 9221 B	Microbiology	NELAP	1/3/2002
Total coliforms	SM 9222 B	Microbiology	NELAP	1/3/2002
Total coliforms	SM 9223 B /QUANTI-TRAY	Extractable Organics,Microbiology	NELAP	11/21/2008
Total nitrate-nitrite	EPA 300.0	General Chemistry	NELAP	5/25/2004
Total organic carbon	SM 5310 B	General Chemistry	NELAP	5/25/2004
Total Petroleum Hydrocarbons (TPH)	EPA 1664A	General Chemistry	NELAP	1/3/2002
Total phenolics	EPA 420.1	General Chemistry	NELAP	1/3/2002
Total, fixed, and volatile residue	SM 2540 G	General Chemistry	NELAP	1/3/2002
trans-1,2-Dichloroethylene	EPA 624	Volatile Organics	NELAP	8/29/2006
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	9/28/2005
trans-1,3-Dichloropropylene	EPA 624	Volatile Organics	NELAP	8/29/2006
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	9/28/2005
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	9/28/2005
Trichloroethene (Trichloroethylene)	EPA 624	Volatile Organics	NELAP	8/29/2006
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	9/28/2005
Trichlorofluoromethane	EPA 624	Volatile Organics	NELAP	8/29/2006
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	9/28/2005
Turbidity	EPA 180.1	General Chemistry	NELAP	1/3/2002
Un-ionized Ammonia	DEP SOP 10/03/83	General Chemistry	NELAP	1/3/2002

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Vanadium	EPA 200.7	Metals	NELAP	5/25/2004
Vanadium	EPA 6010	Metals	NELAP	5/25/2004
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	9/28/2005
Vinyl chloride	EPA 624	Volatile Organics	NELAP	8/29/2006
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	9/28/2005
Xylene (total)	EPA 8260	Volatile Organics	NELAP	9/28/2005
Zinc	EPA 200.7	Metals	NELAP	5/25/2004
Zinc	EPA 6010	Metals	NELAP	5/25/2004

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Palmetto, FL 34221

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aluminum	EPA 6010	Metals	NELAP	5/25/2004
Ammonia as N	SM 4500-NH3C	General Chemistry	NELAP	7/31/2007
Antimony	EPA 6010	Metals	NELAP	5/25/2004
Arsenic	EPA 6010	Metals	NELAP	5/25/2004
Barium	EPA 6010	Metals	NELAP	5/25/2004
Beryllium	EPA 6010	Metals	NELAP	5/25/2004
Boron	EPA 6010	Metals	NELAP	5/28/2004
Cadmium	EPA 6010	Metals	NELAP	5/25/2004
Calcium	EPA 6010	Metals	NELAP	5/25/2004
Chromium	EPA 6010	Metals	NELAP	5/25/2004
Cobalt	EPA 6010	Metals	NELAP	5/25/2004
Copper	EPA 6010	Metals	NELAP	5/25/2004
Fecal coliforms	SM 9221 E	Microbiology	NELAP	11/21/2008
Iron	EPA 6010	Metals	NELAP	5/25/2004
Kjeldahl nitrogen - total	EPA 351.2	General Chemistry	NELAP	9/11/2006
Lead	EPA 6010	Metals	NELAP	5/25/2004
Magnesium	EPA 6010	Metals	NELAP	5/25/2004
Manganese	EPA 6010	Metals	NELAP	5/25/2004
Mercury	EPA 7471	Metals	NELAP	1/3/2002
Molybdenum	EPA 6010	Metals	NELAP	5/28/2004
Nickel	EPA 6010	Metals	NELAP	5/25/2004
Phosphorus, total	EPA 365.3	General Chemistry	NELAP	9/11/2006
Potassium	EPA 6010	Metals	NELAP	5/25/2004
Residue-fixed	SM 2540 G	General Chemistry	NELAP	9/11/2006
Residue-total	SM 2540 G	General Chemistry	NELAP	9/11/2006
Residue-volatile	SM 2540 G	General Chemistry	NELAP	9/11/2006
Selenium	EPA 6010	Metals	NELAP	5/25/2004
Silver	EPA 6010	Metals	NELAP	5/25/2004
Sodium	EPA 6010	Metals	NELAP	5/25/2004
Strontium	EPA 6010	Metals	NELAP	5/25/2004
Thallium	EPA 6010	Metals	NELAP	5/25/2004
Tin	EPA 6010	Metals	NELAP	5/28/2004
Total nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	9/11/2006
Vanadium	EPA 6010	Metals	NELAP	5/28/2004
Zinc	EPA 6010	Metals	NELAP	5/25/2004

Table 4.2

FIELD ANALYTES

METHOD NO.	MATRIX	ANALYTE / COMPONENT
SM4500Cl-G	WW, SW, GW, DW, HW, SA	Residual Chlorine
SM4500-OC	WW, SW, GW, DW, HW, SA	Dissolved Oxygen
SM4500H+B	WW, SW, GW, DW, HW, SA	pH
SM2510B	WW, SW, GW, DW, HW, SA	Specific Conductance
EPA 170.1	WW, SW, GW, DW, HW, SA	Temperature
EPA 180.1	WW, SW, GW, DW, HW, SA	Turbidity

Table 4.3
Laboratory Instrumentation and Equipment

Equipment	Lab I.D. Number	Manufacturer	Model Number	Serial Number	Current Location
AA Spec-EDL Power Supply	4	Perkin Elmer	EDL System 2	420188	ML
AA Spectrophotometer	50	Perkin Elmer	4100XL	6322	ML
AA Spectrophotometer	93	Perkin Elmer	AAnalyst 600	6207	ML
Analyzer, Mercury	73	Cetac Technologies	M-6000A	019603MAS	GL
Autoanalyzer	99	Technicon	AAII	PR0130/ PG00944	GL
Autoanalyzer	24	Technicon	AAII	PR1951/ C60388	GL
Autoanalyzer, Discrete	53	Seal	AQ 2	090272	GL
Autoanalyzer, Discrete	65	Seal	AQ 2 E	090388	GL
Autoclave	6	Market Forge	STM-E	17981	Micro
Autosampler	103	O-I-Analytical Eclipse	4551-A	E92545E162	OL
Autosampler	104	O-I-Analytical Eclipse	4551-A	E92545E163	OL
Autosampler	109	Shimadzu	AS1-V	H52104201008SA	GL
Autotitrator	20	Schott Instruments	Titronic basic	00530426	GL
Balance, Analytical	14	Mettler	AJ100	M57237	GL
Balance, Analytical	70	Mettler	AE100	SV-23315	GL
Balance, Top Loading	11	Mettler	BB2440	M69177	Micro
Blender	85	Hamilton Beach	57199 Type B02	B-230013012	Micro
Centrifuge	32	Becton Dickinson	DYNAC 420102	22355	GL
Centrifuge	34	Becton Dickinson	DYNAC 420101	271127	GL
Chiller	50A	Perkin Elmer	N0772026	G32124	ML
Colony Counter, Dark Field	39	Reichert Jung	QUEBEC	11228-1	Micro
Conductivity Meter	19	Orion	016000	22945024	GL
Culture Incubator (Environmental)	2	Blue M, Electric Co.	200A	---	Micro
Culture Incubator (Drinking Water)	69	Lab-Line Instruments	600	0485-0006	Micro
Desiccator, Cabinet	35	Labconco Auto Dry	1342	232587C	SL
Desiccator, Cabinet	36	Labconco Auto Dry	1342	232587C	SL
Desiccator, Cabinet	8	Labconco Auto Dry	---	0003929	SL
Desiccator, Cabinet	38	Labconco Auto Dry	---	---	SL
Desiccator, Micro	78	NIKKO	---	---	Micro
Digester(Reactor), COD	31	HACH	45600-00	920600007365	GL
Digester, Cyanide (Hot Block)	112	Env. Express	SC6002	5873DIS1031	GL
Digester, Metals (Hot Block)	26	Env. Express	SC154	944CEC0978	ML
Digester, TKN	25	Technicon	CD40	---	GL
Digester, Heat Block, TKN	89	Scientific Instruments	AD-4020	---	GL
Digestion/Distillation Apparatus	42	Electrothermal	MQ3868	10016111	GL
Distillation Apparatus	90	Boekel	1494	01073	GL
Fluorometer	21	Turner Designs	TD-700	7-0114	GL
Furnace, Muffle	15	Thermolyne	F30400	5449205863694	SL

Equipment	Lab I.D. Number	Manufacturer	Model Number	Serial Number	Current Location
Gas Chrom (ECD)	28	HP	5890	2750A18894	OL
Gas Chrom (M.S.)	33	HP	5890	2750A18638	OL
Gas Chrom (M.S.)	37	HP	5890 II Plus	3336A50594	OL
Gas Chrom (M.S.)	106	HP	5890 II	3336A53486	OL
Hot Plate	55	Corning	PC-500	528C LR33491	ML
Hot Plate	56	Corning	PC-101	528C LR33491	ML
I.C. (Ion Chromatograph)	54	Dionex	----	---	GL
I.C. Absorbance Detector	54A	Dionex	AD-20	97060244D	GL
I.C. Autosampler	54B	Dionex	AS-50	98120478	GL
I.C. Chrom Compartment	54C	Dionex	AS-50	99050476	GL
I.C. Conductivity Detector	54D	Dionex	CD-20	C98120462D	GL
I.C. Gradient Pump	54E	Dionex	GP-50	98070372D	GL
I.C. Dionex	64	Dionex	DX-120	98070237	GL
I.C. Dionex	76	Dionex	LC20-1	98120580	GL
ICP Autosampler	57	Perkin Elmer	AS93 Plus	93052080123	ML
ICP Heat Exchanger	52	Perkin Elmer	Poliscichiller	G32124	ML
ICP Spectrophotometer	51	Perkin Elmer	Optima 2000DV	080N2041501	ML
Incubator, BOD	7	VWR Scientific	2020	1201791	GL
Incubator, BOD (low-temperature)	74	Precision Scientific	MFU20F3GW1	WB81030345	GL
Nessler Tubes Rack	67	---	---	---	---
Mass. Spec.	105	HP	5972	3341A01001	OL
Mass. Spec.	59	HP	5972	3329A00810	OL
Mercury Analyzer, Cold Vapor	18	Coleman	MAS-50B	XE5059	GL
Meter, Chlorine	68	HF Scientific	CP-15B	---	Field Cabinet
Meter, Dissolved Oxygen	40	YSI	58	95L43679	Field Cabinet
Meter, Dissolved Oxygen	17	YSI	58	95L43679	GL
Meter, Field Depth to Water	96	Heron Instruments	WATERMARK	06055	Field Cabinet
Meter, Field Depth to Water	97	Heron Instruments	WATERMARK	06754	Field Cabinet
Meter, pH	12	Orion	611	66475	GL
Meter, pH/ISE	43	Orion	0920AO	002319	GL
Meter, pH, Pocket Sized	94	Hanna	---	4KF20	GL
Meter, pH, Pocket Sized	95	Hanna	---	HI98103	GL
Oven	9	VWR Scientific	1370GD	0701692	SL
Oven	10	VWR Scientific	1370GD	0701592	SL
Oven	47	Fisher Scientific	751 F	107N0144	SL
Oven	71	Sheldon Manufacturing	1350FM	0202104	SL
Peristaltic Pump	98	Cole Parmer	Masterflex L\S 7533-40	E06003856	Field Cabinet
Pocket Colorimeter II	92	HACH	5953000	09010E118187	Field Cabinet
Portable Turbidimeter	62	HACH	2100P	040300034967	Field Cabinet

Equipment	Lab I.D. Number	Manufacturer	Model Number	Serial Number	Current Location
Pump, Cabinet	79	Cole Palmer	7533-40	JS006081	Field Cabinet
Pump, Cabinet	80	Cole Palmer	7533-40	M01001016	Field Cabinet
Pump, Vacuum	45	Gast	522V4BG180DX	0692	GL
Purge and Trap	101	O-I-Analytical Eclipse	4660	E924466713E	OL
Purge and Trap	102	O-I-Analytical Eclipse	4660	E924466709E	OL
Quanti-Tray Sealer	193	IDEXX	89-10894-04	6097	Micro
Refrigerator	5	Gerald	GR-65	910900270	Micro
Refrigerator Unit	22	Evans	Double Door	81	GL
Sampler, Composite	81	ISCO	2910	08677-033	Field Cabinet
Sampler, Composite	82	ISCO	3700	07612-025	Field Cabinet
Sampler, Composite	83	American Sigma	1350	F06937795	Field Cabinet
Spectrophotometer	44	Milton Roy	Spectronic 501	1183116G	GL
Spectrophotometer	16	Milton Roy	Spectronic 20D	3322114040	GL
Spectrophotometer, UV-VIZ	48	Milton Roy	1201	3720166003	GL
Spectrophotometer	63	Milton Roy	1201	3724208001	GL
Tachometer	84	VWR Scientific	8000	72483278	Micro
Thermocouple Thermometer Type J	87	Digi-Sense	60010-00	450646	GL
Thermocouple Thermometer Type J	88	Barnant	600-1000	---	GL
Thermometer, Nist Traceable	58	VWR Scientific	4000	---	Office
Thermometer, Digital	85	RESTEK	---	---	OL
Thermometer, Digital	86	RESTEK	---	---	OL
Thermometer, Digital	100	Cole Parmer	Workhorse 91210-45	90943897	GL
Thermometer, Digital	110	Control Company	4126	101782485	OL
Thermometer, Digital	111	Control Company	4126	101782480	OL
Thermometer, COD Block	107	---	---	HBIO1995	GL
Titrator	75	Schott Instruments	Titronic universal	00695751	GL
Total Organic Carbon Analyzer	108	Shimadzu	TOC-V CPH	H51304235054CS	GL
Turbidimeter	30	HACH	18900-00	920700006543	GL
Walk-in Cooler	60	Eskimo Panels	2000	---	GL
Water Bath	3	Lindberg/Blue M	MW1110A-1	MW6990	Micro
Water Bath	77	Lindberg/Blue M	MW1110A-1	MW6990	Micro
Water Bath, Circulating constant Temp.	1	VWR Scientific	1265PC	0700191	Micro
Water Meter, Totalizer	91	KENT	PSMT 15mmx114mm	16002048	Field Cabinet
Water Meter, Totalizer	92	KENT	PSMT 15mmx114mm	16002070	Field Cabinet
WQMS (Water Quality MonitoringSystem)	61	Hydrolab	Quanta	QD1113	Field Cabinet
WQMS (Water Quality MonitoringSystem)	66	Hydrolab	Quanta	QD02916	Field Cabinet

(Field Cabinet): Field Equipment Cabinet
(GL): General Laboratory Area
(Micro): Microbiological Laboratory Area
(ML): Metals Laboratory Area
(OL): Organic Laboratory Area
(SL): Solids Laboratory Area

Table 4.4 (A & B)
REFERENCE MEASUREMENT STANDARDS & CALIBRATION SERVICES

A. REFERENCE MEASUREMENT STANDARDS

NO.	REFERENCE STANDARDS	MANUFACTURER	MODEL	SERIAL NO.	CALIBRATED BY:
R-1.	NIST Reference Thermometer	ERCTO	1007-FC	D97-227	Ever Ready Thermometer Co.
R-2.	Class S Equivalent Weights	Troemner	1Kg – Calibration Weight	13626	Mettler Toledo
R-3.	Class S-1 Equivalent Weights	Troemner	Weight Set	16792	Mettler Toledo

B. CALIBRATION SERVICES

SERVICE PROVIDER	REPRESENTITIVE	PHONE NO.	ACCOUNT NO.	EQUIPMENT SERVICED:
Mettler Toledo	Tim Burke	(800) METTLER (800) 786-0034x7127 Fax: (614) 438-4525	011533	Class “S” Weights
Purification Technologies	Jane Coldiron	(813) 620-3922	32080	De-ionized Water System
Perkin Elmer	Carlos L. Huertas	(800) 762-4000 Fax: (813) 741-0152	Not applicable	AA, ICP, Balances, Ion Chromatographs, GCs (ECD & MS), and TOC Analyzer

5.0 SAMPLE CUSTODY AND DOCUMENTATION

The following discussions outline the minimum record keeping requirements as they relate to sample collection, sample handling and sample analysis activities. The protocols and requirements outlined in this section emphasize the use of unequivocal, accurate and methodical records to document all activities affecting sample data.

There are two levels of custody: 1) Sample custody or tracking and 2) Legal or evidentiary chain of custody.

1. Sample custody or tracking is required. It includes all records and documentation necessary to trace a sample from point of origin through final report and sample disposal. Sample custody requires that each event or procedure to which the sample is subjected be documented. These include, but are not limited to: sample collection, field preservation, sample receipt and log in, sample preparation, sample analysis and sample disposal. In addition, those tasks or activities that relate to each of the above-mentioned events (e.g. reagent preparation, calibration, preventative maintenance, quality control measures, etc.) must be documented. The history of the sample must be readily understood through the documentation. The required documentation that is associated with sample custody is outlined in Sections 5.1 through 5.5.

2. Legal or Evidentiary Chain of Custody (COC) is a special type of sample custody which requires that the physical possession, transport and storage of a sample be documented in writing. The records must account for all periods of time from sample container acquisition through sample disposal. COC protocols are not required, but are recommended. If implemented, the minimum documentation requirements outlined in Section 5.6 must be followed.

5.1 GENERAL REQUIREMENTS FOR CUSTODY AND DOCUMENTATION

5.1.1 RECORD KEEPING SYSTEM DESIGN - GENERAL REQUIREMENTS

The laboratory shall design and maintain a record keeping system that is succinct and efficient:

1. All records shall be maintained in a manner which facilitates documentation tracking and allows historical reconstruction of all analytical events and ancillary procedures that produced the resultant sample analytical data.

2. The system shall unequivocally link all documentation associated with a sampling event from sample collection through the final analytical result and sample disposal. This may be accomplished through either direct or cross-references to specific documentation.

3. The system shall be straightforward and shall facilitate the retrieval of all working files and archived records for inspection and verification purposes.

4. Final reports, data summaries, or other condensed versions of data that have been prepared by external parties shall be linked to internal records by an unequivocal cross-referencing mechanism (usually field and/or laboratory ID numbers).

5.1.2 DOCUMENTATION CRITERIA

1. The history of a sample must be clearly evident from the retained records and documentation. Copies or originals of all documentation which are associated with the analysis or sample collection event must be kept. This includes the documentation that is sent to or received from all sampling and analysis organizations.

2. All applicable documentation specified in this section shall be available for inspection during any sampling-site, facility (laboratory or offices) or data audit conducted by authorized representatives of compliance agencies.

3. The records must contain enough information so that excessive clarifications, interpretations or explanations of the data are not required from the originator.

4. All documentation and record entries shall clearly indicate the nature and intent of each entry.
    a. All documentation entries shall be signed or initialed by responsible staff. The reason for the signature or initials shall be clearly indicated in the records (e.g. sampled by; prepared by; reviewed by, etc.).
    b. Often, documentation requirements can be met by making brief references to procedures written in internal SOPs or approved methodology promulgated by external sources. If these standard procedures are routinely repeated in your operations (e.g., sample preparation procedures, decontamination protocols, analytical method, etc.), then citing these references may be appropriate. Such citations must specifically identify the document, method or SOP (e.g. sample preparation by 3010; field decontamination per internal SOP for Teflon sampling equipment, etc.), and must include the revision number or revision date. Copies of all revisions must be retained as part of the laboratory documentation.

5.1.3 RECORD-KEEPING PROTOCOLS

1. Entries into all records shall be made with waterproof ink.

2. Entries on records shall not be obliterated by erasures or markings. All corrections to record-keeping errors shall be made by one line marked through the error. The individual making the correction shall sign (or initial) and date the correction.

3. All laboratory records must be kept for a period of 5 years; this includes any NELAC related documentation.

5.2 CONTENT REQUIREMENTS FOR SAMPLING KIT DOCUMENTATION

The contents of each prepared sampling kit (see Appendix A for definition) shall be documented. A packing list or similar record shall be transmitted to the receiving party with the sampling kit and a copy or other record shall be retained by the preparing party.

5.2.1.1 The following information shall be transmitted to the receiving party:
- a. Quantity, description and material composition of all containers, container closures or closure liners (if method specified) and all sampling equipment
- b. Intended application for each container type indicated by approved analytical method or method group
- c. Type and concentration of preservative added to clean sample containers and/or shipped as additional preservative
- d. Intended use of any additional preservatives or reagents
- e. Description of any analyte-free water (i.e. deionized, organic-free, etc.)
- f. Types and number of any quality control blanks (e.g., trip blanks)
- g. Date of kit preparation
- h. Description and material composition of all reagent transfer implements, i.e. pipettes, shipped in the kit.

This information may be in the form of a packing slip (e.g., 6-125 ml plastic containers for metals, 12 VOC vials for 601/602, etc.) or included on the chain of custody.

5.2.1.2 In addition to maintaining records of the above information, the preparing party shall maintain records or cross reference links of the following information:

a. Lot numbers of any commercially obtained sources of analyte-free water (if provided)
b. Material composition of all reagent and analyte-free water containers (if provided)
c. A code or reference (i.e. lot numbers) to dates in container and/or equipment cleaning logs;
d. A code or reference that links preservatives to preparation logs for preservatives or vendor lots
e. Name of receiver of kit
f. Project name for kit use, if known
g. Name of individual(s) preparing the kit
h. Date the kit was shipped or provided

5.2.1.3 If the sampling kits are prepared for internal use (i.e. they will not be shipped to any external party, including branch offices of the same organization) and the sampling kits are used for collecting routine (i.e. daily, weekly or monthly monitoring) samples, the records in 5.2.1.1 and 5.2.1.2 may be reduced to the following:

a. The cleaning records for sampling equipment and/or sample containers shall indicate who received the cleaned containers or equipment and the date of receipt.
b. The preservation and/or reagent preparation records shall indicate that the preservative or reagent was prepared for use in the field.

5.2.2 DOCUMENTATION FOR PRESERVATIVES

Sample preservatives and other reagent preparations shall be traceable to preparation dates and vendor sources and/or lot numbers.

5.3 CUSTODY AND DOCUMENTATION REQUIREMENTS

5.3.1 GENERAL PROTOCOLS

1. Copies of all COC forms (if applicable) or sample transmittal forms shall be maintained with project records. If the sampling and analysis activities are performed by the same organization at the same physical location (e.g. wastewater sampling and analysis) and if all records are maintained in a central location, a single copy of the COC form (if used) or the laboratory transmittal form may be retained.

2. Entries into all field records shall be made with waterproof ink.

3. Errors in all documents shall be deleted with one line then initialed and dated by the person making the correction (see Section 5.1.3.2).

4. All documentation/logs shall be signed/initialed by the appropriate personnel.

5. All time shall be recorded using 24 hour notation (i.e., 2:00 PM is 1400 hours).

5.3.2 REQUIRED INFORMATION

5.3.2.1 Sample Transmittal Records

All samples that are submitted to a laboratory must be accompanied by a sample transmittal or Chain of Custody record (see Section 5.6). This record may be designed as individual forms for each sample or a summary form for a set of samples. AT A MINIMUM, the information transmitted to the laboratory shall include:

1. Client name, address and phone number
2. Sample identification (i.e. site name)
3. Sample location (i.e. specific address or field #)
4. Date and time of collection
5. Collector's name and phone number

6. Preservation type
7. Sample type (sample matrix)
8. Number of samples
9. Intended analyses
10. Any special remarks concerning the sample (i.e. exceptions)

5.3.3 SAMPLE TRANSPORT:

1. All sample transmittal forms shall be placed in waterproof bags and sealed in the transport containers with the samples.
2. If shipped by common carrier, transport containers should be securely sealed with strapping tape or other means to prevent lids from accidentally opening. COC Seals (if used) shall be applied after containers have been secured.
3. All shipping bills from common carriers shall be kept with the COC or transmittal forms.

5.4 SAMPLE CUSTODY TRACKING AND DATA DOCUMENTATION FOR LABORATORY OPERATIONS

5.4.1 INITIAL CHECK OF SAMPLES AND DOCUMENTATION

When samples are received by the laboratory the following checks shall be made upon receipt:

1. Verify the integrity and condition of all sample containers.
    a. Check for leakage, cracked or broken closures or containers, evidence of grossly contaminated container exteriors or shipping cooler interiors, and obvious odors, etc.
    b. Check for air headspace or bubbles in VOC containers.
2. Verify receipt of complete documentation for each container. At a minimum the following shall be included:
    A. A unique identifier that can be cross-referenced with the COC or sample transmittal form (site name, specific address or field #). If a container can not be cross-referenced with the COC, then it will be rejected.
    B. Date and time of collection
    C. Collector's name
    D. Intended analyses
    E. Preservation type
3. All information on sample containers must be in indelible ink and labels (if applicable) must be water-resistant.
4. Samples must be received in sufficient quantity for analysis. Reference Table 5.5.

5.4.2 VERIFICATION OF SAMPLE PRESERVATION

1. Samples that require chemical preservation shall be checked upon arrival. In some cases, it may be the choice of the laboratory to issue sample containers without preservative (for the safety of the customer). In this case, the laboratory must preserve the sample container upon arrival. Reference Table(s) 5.1, 5.2, 5.3 and 5.4 of this manual for type of preservation. If proper preservation can not be established the sample will be rejected.

2. Samples which require thermal preservation shall be considered acceptable if the arrival temperature is within +/-2°C of the required temperature. Reference Table(s) 5.1, 5.2, 5.3 and 5.4 of this manual for preservation temperatures. Samples that are hand delivered to the laboratory immediately after collection may not meet these criteria. In these cases, the samples shall be considered acceptable if there is evidence that the chilling process has begun. The following alternate techniques may be used to verify the actual sample temperature:

    a. The temperature may be verified by determining the temperature of a surrogate water sample which has been shipped with the samples or placed in the transport containers with the samples after arrival in the laboratory. In the latter case, the surrogate sample must be allowed to equilibrate to the temperature of the samples in the cooler.

b. The temperature of incoming samples may also be verified by a non-invasive temperature probe.

c. The temperature of the melted ice water in the cooler may also be used as an indicator of proper temperature.

UNDER NO CONDITIONS SHALL A THERMOMETER OR OTHER TEMPERATURE MEASURING DEVICE BE PLACED INTO THE COLLECTED SAMPLE CONTAINER.

5.4.3 REJECTION OF RECEIVED SAMPLES

1. Rejection Criteria - Samples shall be rejected according to the following criteria.
   a. Samples do not arrive with in the approved holding time.
   b. The integrity of sample containers is compromised as described in 5.4.1
   b. The identification of a container cannot be verified
   c. The proper preservation of the container cannot be established
   d. VOC vials contain bubbles of sizes greater than 1% of the vial volume (usually a bubble size of 5 mm in diameter). Note: the presence of any bubbles in VOC vials must be documented and reported with the final results.

2. The laboratory shall obtain concurrence or further instruction from the sample submitter regarding any proposed rejection. All correspondence and/or conversations concerning the final disposition of the samples shall be documented in the appropriate exception log.

3. Any decision to proceed with the analysis of compromised samples shall be fully documented including correspondence with the customer.
   a. The condition of these samples shall be noted in all documentation associated with the sample.
   b. The analysis data shall be appropriately qualified as estimated on all internal documentation and on the final report (see Data Qualifiers, Table 10.2).

4. Rejected samples shall be logged in the laboratory sample receipt log per Section 5.4.4 below with appropriate comments.

5. See also SOP# GM-1, Sample Acceptance Policy.

5.4.4 SAMPLE RECEIPT LOGGING

1. The laboratory shall employ a logical system for assigning a unique identification code to EACH SAMPLE CONTAINER received in the laboratory. Multiple aliquots of a sample that have been received for different analytical tests (e.g., nutrients, metals, VOCs, etc.) shall be assigned a different ID code.
   a. This laboratory code shall maintain an unequivocal link with the unique field ID assigned each container.
   b. The identification of containers by container shape or size is not adequate.
   c. Sample containers will be labeled with the unique code upon assignment of the code.
   d. The unique code must consist of:
      1) The submission number:
         A) The year (i.e. 2006 as 6).
         B) The month in two digits (i.e. January as 01).
         C) A consecutive number starting with 000 1 at the beginning of each month.

2) Sub-categories to the submission number:
   - A) Each sample identified in numerical order.
   - B) Each bottle identified by preservative in alphabetical order.
   - C) Each analyte identified by full name or accepted abbreviation (Reference Table 5.5).

2. A sample receipt log shall be employed to document receipt of all sample containers. The following information will be recorded in the laboratory sequential log:
   - a. Client name, address and phone number
   - b. Sample identification (i.e. site name)
   - c. Sample location (i.e. specific address or field #)
   - d. Date and time of collection c
   - e. Collector's name and phone number
   - f. Preservation type
   - g. Sample type (sample matrix)
   - h. Number of samples
   - i. Intended analyses, including method number
   - j. Any special remarks concerning the sample (i.e. exceptions)
   - k. Received date and time
   - l. Laboratory sample submission number
   - m. Field ID code supplied by sample submitter
   - n. Signature or initials of logger
   - o. Comments or references resulting from sample integrity inspection (Section 5.4.1) or sample rejection (Section 5.4.3).
   - p. Sampling kit code (if applicable)

3. Smaller laboratories whose function is to analyze on-site samples that have been collected by the laboratory staff (e.g. in-house domestic wastewater treatment laboratories) may use the sample transmittal forms as the sample log provided:
   - a. The information in 5.4.4.2 above is included on the forms; and
   - b. The sheets are maintained in chronological order as a permanent laboratory record.

In these cases, the laboratory ID number may be the same as the field ID number, subject to the requirements listed in Sections 5.4.4.1 and 5.4.4.2 above.

4. Retain all documentation that is transmitted to the laboratory by the sample transmitter for a period of five years.

5.4.5 SAMPLE STORAGE

1. Parent samples, sample replicates and subsamples received in the laboratory shall be stored under approved conditions as described in Tables 5.2, 5.3, 5.4 and 5.5. See also SOP# GM-2, Sample Handling and Storage.

2. Sample fractions, extracts, eluates, leachates, digestates, etc. shall be stored according to requirements of 5.4.5.1 above or according to guidance found in the approved preparation or analytical method used to prepare or analyze the subsample, as applicable. In cases of conflicting guidance, the storage/preservation requirements specified in 5.4.5.1 above shall supersede method guidance. No specific requirements apply to other cases not comprised by the above.

3. Samples and all subsamples, sample fractions, extracts, eluates, leachates and digestates shall be stored separately from all standards, reagents, cleaning supplies, fuels, food, etc.

4. VOC samples shall be stored separately from all other samples.

5. The manner in which samples and subsamples are stored shall be documented. This may be recorded in the sample receipt log or other linked documentation.

5.4.6 SAMPLE DISPOSAL

At a minimum, record the date of sample and/or subsample disposal and either the name (or initials) of the individual authorizing the disposal or the person who is responsible for the disposal.

5.4.7 INTRALABORATORY DISTRIBUTION OF SAMPLES FOR ANALYSIS

1. The laboratory shall utilize a proactive procedure to ensure that all samples and subsamples are analyzed within allowed maximum holding times (specified in 5.4.5.1 above).

2. All distribution of samples and subsamples for preparation and analysis shall be documented as to task assignment and analysis date deadline.

5.4.8 LABORATORY PREPARATION OF SAMPLES FOR ANALYSIS

Record all sample preparation procedures that may impact the analytical results.

5.4.8.1 Preparation Records

a. Sample preparation records shall include, but are not limited to:
   1. digestions
   2. filtrations
   3. distillations
   4. extractions
   5. leachings
   6. sample extract cleanup procedures

b. The specific sample processing protocol shall be identified. Where the procedure is routinely performed according to approved methodology or internal SOPs, preparation records may refer to the specific method or SOP (see 5.1.2.4.b)

5.4.8.2 Required information

a. All parameters associated with the preparation technique shall be recorded. These data shall include, but are not limited to:
   1. Sample or subsample ID number
   2. Duration times for processes (e.g., extraction cycles, digestions, distillations, sonications, etc.) if the method specifies a time limitation
   3. Volumes or weights of subsamples, reagents or dilution water
   4. Dilution factors
   5. Meter and other instrument readings
   6. Chromatography column elution profile retention times
   7. Adsorption column efficiency or breakthrough determinations
   8. pH checks

b. Where specific materials or supplies are explicitly required by the approved method, record description and the material composition of such equipment, labware or supplies. This information may be by reference to internal standard operating procedures (see 5.1.2.4.b).

c. Record all calculations associated with the preparation procedure.

d. Retain all elution profile chromatograms, pH meter recorder charts or other products of automatic instrument data recordings associated with the procedure.

e. Link all reagents that are used in the procedure to the applicable reagent preparation records.

5.4.8.3 pH Checks of Samples and Subsamples

a. The pH of all pH-preserved samples is verified before any sample preparation or sample analysis procedure. Additional pH checks and adjustments, where required by the approved method, shall be documented.

b. Record the results of pH checks on samples and subsamples.

c. The proper pH value as stipulated by approved preservation protocols or approved sample preparation methods shall follow the method prescribed procedures. If none are specified, the pH shall be determined as follows:

1. Use narrow-range pH paper.
2. Do not contaminate the sample or subsample by contact with pH paper or pH electrode.
3. Use non-contaminating transfer implements, if necessary, to obtain a sample portion for use in the pH check procedure.
4. Check pH of VOC samples after taking aliquot for analysis, or check pH on duplicate sample that can be destroyed for this purpose
5. Pour a portion of the sample on the pH paper, unless the sample is an analytical portion that cannot suffer significant quantitative loss. In this case, transfer a test specimen with disposable pipet or other implement to the pH paper (see 5.4.8.3.c.3 above)

5.4.9 TRACKING FOR INTERLABORATORY TRANSFER OF SAMPLES/SUBSAMPLES

If samples or sample extracts/digestates are sent to another laboratory, the information transmitted to the receiving laboratory must include, at a minimum:

a. Clear identification of subcontracted work by approved method designation
b. Subcontract Lab Information (Legal name, certification no., address, phone no. & contact name)
c. Originating Lab Information (Legal name, certification no., address, phone no. & contact name)
d. Date and time of sample collection
e. Method of preservation
f. Comments about sample or sample container (if applicable)
g. Date of sample preparation (if applicable)
h. Originating Laboratory ID number (if applicable)

5.4.10 SAMPLE ANALYSES DOCUMENTATION REQUIREMENTS

All sample analyses shall be completely documented by retaining all associated records. These records shall include, but are not limited to the following:

5.4.10.1 Information concerning all sample data:

a. All sample identifications
b. Dates and times of analyses
c. Instrumentation ID and instrumentation parameters affecting the analytical run
d. Approved method numbers for the analyses performed
e. All raw and reduced analytical data
f. All calculations
g. Analyst's initials or signature

5.4.10.2 GC/MS analyses:

a. Retain all electronically generated records (including the tune file and calibration date) on a write-protected diskette or tape in an orderly, logical manner; OR

b. Retain the hard copy records of all data in the analytical run (blanks, QC samples, standards, samples, etc.) which must include:

1. A copy of the total ion chromatogram, normalized to the highest non-solvent base peak;
2. Complete quantitation report;
3. Confirmation of all hits (mass spectra from the sample and library); and
4. Mass spectra from all unidentified compounds that exceed 5% of the highest base peak (excluding solvent fronts). This includes retention time, tabulation of mass abundances, and mass spectra of the 5 most probable library hits.

5.4.10.3 Assure that all analysis data is linked with records for ancillary data and procedures (e.g. sample preparation).

5.4.11 DOCUMENTATION REQUIREMENTS FOR OTHER LABORATORY OPERATIONS

The following activities, which are not specifically discussed in this Section, shall be documented according to the requirements found in the cited sections.

1. Preparation of Reagents and Analyte-Free Water - Section 6.2
2. Preparation of Analytical Calibration Standards - Section 7.2
3. Analytical Calibrations and Standardizations - Section 7.5 and 7.8
4. Preventative Maintenance - Section 8.0
5. Quality Control - Section 9.4
6. Corrective Actions - Section 11.6

5.5 ELECTRONIC DATA DOCUMENTATION

These requirements apply to all laboratory and field records which are generated or stored electronically.

5.5.1 RETENTION OF AUTOMATIC DATA RECORDING PRODUCTS

1. All products or outputs of automatic data recording devices, such as chart strip recorders, integrators and computers, shall be retained either in electronic, magnetic or paper form.

2. All such records shall be properly identified as to purpose, analysis date, and field and/or lab ID number. The information in Section 5.4.10.1 shall be recorded for all laboratory and all applicable field analyses.

5.5.2 ELECTRONIC DATA SECURITY

1. Controlled or secured access to levels of data-editing capability are recommended. Software should provide prompts to the user for double-checking entries before executing deletions or changes to data. User-interaction or data-alteration tracking software is recommended, if available.

2. Raw data that is electronically collected from instrumentation shall not be altered in any fashion. Software that allows an analyst to correct raw data (e.g. change baseline) is acceptable.

5.5.3 ELECTRONIC DATA STORAGE AND DOCUMENTATION

1. Electronically or magnetically stored data shall be easily retrievable for printing to paper.

2. All electronic/magnetic data files shall be coded, indexed, cross-referenced, etc., to allow linkage to sample data, analytical events and other laboratory procedural records. These file designations shall allow easy retrieval of the record.

3. All software algorithms employed to perform calculations required by the approved methodology or procedures shall be verified for accuracy and conformance with the methodology protocols, formulas, etc. This verification shall be documented.
   a. This requirement applies to all automatic calculations and automatic data collection affecting calibrations, analyses, QC determinations, spread sheets, etc.
   e. The vendor literature for software products may fulfill this requirement, if sufficiently detailed.

4. All software problems and their resolution shall be documented in detail, where these problems affect the correctness of laboratory data documented per this Custody SOP or where problems affect the cross-indexing of records. Record the calendar date, time, responsible personnel and relevant

technical details of all affected data and software files. Indicate which files have been affected. All software changes, updates, installations, etc. shall be similarly documented per the above concerns. File and link all associated service records supplied by vendors or other service personnel.

5.6 LEGAL OR EVIDENTIARY CUSTODY PROCEDURES

The use of Legal Chain-of-Custody (COC) protocols are not required by DEP. The following procedures are designed to document and track all time periods and the PHYSICAL POSSESSION AND/OR STORAGE of sample containers and samples from point of origin through the final analytical result and sample disposal.

This type of documentation is useful in establishing the evidentiary integrity of samples and/or sample containers. It can be used to demonstrate that the samples and/or sample containers were handled and transferred in such a manner to eliminate possible tampering. As such, these protocols are advantageous if data is to be used in legal cases such as law suits, criminal actions, enforcement actions, etc.

In addition to the records listed in Sections 5.1 through 5.5, the following protocols shall be incorporated IF legal COC is implemented by the organization:

5.6.1 GENERAL REQUIREMENTS

1. The Chain of Custody records shall establish an intact, contiguous record of the physical possession, storage and disposal of sample containers; collected samples; sample aliquots; and sample extracts or digestates. For ease of discussion, the above-mentioned items shall be referred to as "samples":
    a. The COC records shall account for all time periods associated with the samples.
    b. The COC records shall include signatures of all individuals who were actively involved with physically handling the samples.
        1. The signature of any individual on any record that is designated as part of the Chain of Custody is their assertion that they personally handled or processed the samples identified on the record.
        2. Each signature shall be accompanied by a short statement which describes the activity of the signatory (i.e. received by, relinquished by, etc.).
    c. In order to simplify record-keeping, the number of people who physically handle the sample should be minimized.
    d. The COC records are not limited to a single form or document. However, the lab will attempt to limit the number of documents that would be required to establish COC.
        1. Grouping activities on documents (e.g., a sample transmittal form to document field activities and laboratory receipt; a sample storage and disposal form to document storage; etc.).
        2. A COC Form shall document all sample transmittals from one party to another (see 5.6.3).
        3. The laboratory records such as initial sample log records, sample preparation logs, analyst's run logs, etc. shall also be considered as part of the chain of custody unless the organization has established other records or protocols to document these laboratory functions.

2. Legal chain of custody shall begin when the pre-cleaned sample containers are dispatched to the field.
    a. A COC form must be signed by the person relinquishing the prepared sample kits or containers and by the individual who receives the sample kits or containers.
    b. Thereafter, all parties handling the sample are responsible for sample custody (i.e. relinquishing and receiving) and documentation EXCEPT when the samples or sampling kits are relinquished to a common carrier.

3. The common carrier should not sign COC forms.
   a. The COC form shall indicate the name of a common carrier, when used. The shipping bill or other documents must be retained
   b. All other transferor and transferee signatures associated with common carrier transfers are required. This shall include laboratory, field and other personnel releasing or accepting materials from the common carrier.
   c. COC will be relinquished by the party who seals the shipping container and accepted by the party who opens it. The COC form shall indicate the date and time that the transport container was sealed for shipment.
   d. Transport containers shall be sealed with strapping tape and a tamper proof custody seal. The custody seal must have space for the signature of the person who affixed the seal along with the date and time.

4. The COC forms shall remain with the samples during transport or shipment. They must be put in a waterproof closure inside the sealed cooler or shipping chest.

5.6.2 REQUIRED CONTENTS FOR CUSTODY RECORDS

Tracking records shall include, by direct entry or linkage to other records:

1. Time of day and calendar date of each transfer or handling procedure
2. Signatures of transferors and transferees
3. Location of samples (if stored in the field or laboratory)
4. Handling procedures (e.g. sample preparation, sample analysis, etc.) performed on the samples
5. Storage conditions for the samples, including chemical and thermal preservation
6. Unique identification for all samples
7. History of access to samples by all personnel, with personnel names recorded
8. Final disposition of physical sample
9. Common carrier documents

5.6.3 REQUIRED INFORMATION TO BE INCLUDED ON COC FORMS USED FOR SAMPLE TRANSMITTAL

A Chain-of-Custody record or form shall accompany all evidentiary samples and sub-samples that are transmitted and received by any party. The COC record or form shall specifically contain the following information:

1. Client name, address and phone number
2. Sample identification (i.e. site name)
3. Sample location (i.e. specific address or field #)
4. Date and time of collection
5. Collector's name and phone number
6. Preservation type
7. Sample type (sample matrix)
8. Number of samples
9. Intended analyses, including method number
10. Signatures of all transferors and transferees
11. Time and date of all custody transfers
12. Common carrier usage, if applicable (see 5.6.1.3)
13. Any special remarks concerning the sample (i.e. exceptions)
14. Received date and time
15. Laboratory sample submission number
16. Field ID code supplied by sample submitter
17. Signature or initials of logger
18. Sampling kit code (if applicable)

5.6.4 CHAIN-OF-CUSTODY SEALS

At a minimum, tamper-indicating tape or seals shall be affixed to all shipping container closures when transferring or shipping sample container kits, or samples to another party.

1. The seal shall be placed so that the transport container cannot be opened without breaking the seal.
2. The time, calendar date and signatures of responsible personnel affixing and breaking all seals shall be recorded on the seals.
3. Seals shall be retained as a part of the COC documentation.
4. While not required, organizations may elect to apply seals to individual containers. This establishes the history of each individual sample. The requirements specified for transport container seals shall be followed.

5.6.5 CONTROLLED ACCESS TO SAMPLES

1. Access to all evidentiary samples and subsamples shall be controlled and documented. The number of individuals who physically handle the samples should be limited to those responsible for sample collection, initial laboratory receipt, sample preparation and sample analysis (see 5.6.1.1.c) and sample disposal.

2. Samples and subsamples shall be placed in locked storage (e.g., locked vehicle, locked storeroom etc.) at all times when not in the possession or view of authorized personnel.
    a. Some organizations maintain restricted access to their facilities and contend that storage under these conditions should constitute secure storage. This practice is acceptable as long as non-laboratory personnel (i.e. janitors, security guards, etc.) are not able to gain access to the samples after business hours.
    b. Field personnel shall not leave samples in unoccupied motel or hotel rooms.

5.6.6 TRANSFER OF SAMPLES TO ANOTHER PARTY

Transfer of samples, subsamples, digestates or extracts to another party are subject to all of the requirements of Section 5.6.

5.7 SAMPLE DISPOSAL

1. Disposal of the physical sample shall occur only with the concurrence of the affected legal authority, sample data user and/or submitter of the sample.
2. All conditions of disposal and all correspondence between all parties concerning the final disposition of the physical sample shall be recorded and retained.
3. Records shall indicate the date of disposal, the nature of disposal (i.e. sample depleted, sample flushed into sewer, sample returned to client, etc.), and the name of the individual who performed the task. Note: if samples are transferred to another party, custody transfer shall be documented in the same manner as other transfers (see 5.6.3 above).

Table 5.1

40 CFR Part 136 TABLE II: REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES (WATER/WASTEWATER SAMPLES)

PARAMETER #	PARAMETER NAME	CONTAINER[1]	PRESERVATION[2,3]	MAX HOLD TIME[4]
Table 1A - Bacterial Tests:				
1-5.	Coliform, total, fecal and *E. coli*	PA, G	Cool <10°C, 0.008% $Na_2S_2O_3$[5]	6 hours[22, 23]
6.	Fecal streptococci	PA, G	Cool <10°C, 0.008% $Na_2S_2O_3$[5]	6 hours[22]
7.	Enterococci	PA, G	Cool <10°C, 0.008% $Na_2S_2O_3$[5]	6 hours[22]
Table 1H – Protozoan Tests:				
8.	Cryptosporidium	LDPE; field filtration	0-8°C	96 hours[21]
9.	Giarida	LDPE; field filtration	0-8°C	96 hours[21]
Table 1B - Inorganic Tests:				
1.	Acidity	P, FP, G	Cool ≤6°C[18]	14 days
2.	Alkalinity	P, FP, G	Cool ≤6°C[18]	14 days
4.	Ammonia	P, FP, G	Cool ≤6°C[18], H_2SO_4 to pH<2	28 days
9.	Biochemical oxygen demand	P, FP, G	Cool ≤6°C[18]	48 hours
11.	Bromide	P, FP, G	None required	28 days
14.	Biochemical oxygen demand carbonaceous	P, FP, G	Cool ≤6°C[18]	48 hours
15.	Chemical oxygen demand	P, FP, G	Cool ≤6°C[18], H_2SO_4 to pH<2	28 days
16.	Chloride	P, FP, G	None required	28 days
17.	Chlorine, total residual	P, G	None required	Analyze within 15 mins.
21.	Color	P, FP, G	Cool ≤6°C[18]	48 hours
23-24.	Cyanide, total and amenable to chlorination	P, FP, G	Cool ≤6°C[18], NaOH to pH>12[6], reducing agent[5]	14 days
25.	Fluoride	P	None required	28 days
27.	Hardness	P, FP, G	HNO_3 or H_2SO_4 to pH<2	6 months
28.	Hydrogen ion (pH)	P, FP, G	None required	Analyze within 15 mins.
31, 43.	Kjeldahl and organic nitrogen	P, FP, G	Cool ≤6°C[18], H_2SO_4 to pH<2	28 days
38.	Nitrate	P, FP, G	Cool ≤6°C[18]	48 hours
39.	Nitrate-nitrite	P, FP, G	Cool ≤6°C[18], H_2SO_4 to pH<2	28 days
40.	Nitrite	P, FP, G	Cool ≤6°C[18]	48 hours
41.	Oil and grease	G	Cool ≤6°C[18], H_2SO_4 or HCl to pH<2	28 days
42.	Organic carbon	P, FP, G	Cool ≤6°C[18], HCl or H_2SO_4 to pH<2	28 days
44.	Orthophosphate	P, FP, G	Cool ≤6°C[18]	Filter within 15 mins; Analyze within 48 hours
46.	Oxygen, Dissolved Probe	G (Bottle & top)	None required	Analyze within 15 mins.
47.	Oxygen, Winkler	G (Bottle & top)	Fix on site and store in dark	8 hours
48.	Phenols	G	Cool ≤6°C[18], H_2SO_4 to pH<2	28 days
49.	Phosphorus (elemental)	G	Cool ≤6°C[18]	48 hours
50.	Phosphorus, total	P, FP, G	Cool ≤6°C[18], H_2SO_4 to pH<2	28 days
53.	Residue, total	P, FP, G	Cool ≤6°C[18]	7 days
54.	Residue, Filterable	P, FP, G	Cool ≤6°C[18]	7 days

Table 5.1, cont.

PARAMETER #	PARAMETER NAME	CONTAINER[1]	PRESERVATION[2,3]	MAX HOLD TIME[4]
55.	Residue, Nonfilterable (TSS)	P, FP, G	Cool ≤6°C[18]	7 days
56.	Residue, Settleable	P, FP, G	Cool ≤6°C[18]	48 hours
57.	Residue, volatile	P, FP, G	Cool ≤6°C[18]	7 days
61.	Silica	P or Quartz	Cool ≤6°C[18]	28 days
64.	Specific conductance	P, FP, G	Cool ≤6°C[18]	28 days
65.	Sulfate	P, FP, G	Cool ≤6°C[18]	28 days
66.	Sulfide	P, FP, G	Cool ≤6°C[18] add zinc acetate plus sodium hydroxide to pH>9	7 days
67.	Sulfite	P, FP, G	None required	Analyze within 15 mins.
68.	Surfactants (MBAS)	P, FP, G	Cool ≤6°C[18]	48 hours
69.	Temperature	P, FP, G	None required	Analyze immediately
73.	Turbidity	P, FP, G	Cool ≤6°C[18]	48 hours
Table 1B - Metals:				
18.	Chromium VI	P, FP, G	Cool ≤6°C[18], pH = 9.3-9.7[20]	28 days
35.	Mercury (CVAA)	P, FP, G	HNO_3 to pH<2	28 days
35.	Mercury (CVAFS)	FP, G; and FP-lined cap[17]	5 mL/L 12N HCl or 5 mL/L BrCl[17]	90 days[17]
3, 5-8, 12, 13, 19, 20, 22, 26, 29, 30, 32-34, 36, 37, 45, 47, 51, 52, 58-60, 62, 63, 70-72, 74, 75.	(All other Metals besides chromium VI and mercury)	P, FP, G	HNO_3 to pH<2, or at least 24 hours prior to analysis[19]	6 months
Table 1C – Organic Tests[8]				
13, 18-20, 22, 24-28, 34-37, 39-43, 45-47, 56, 76, 104, 105, 108-111, 113.	Purgeable Halocarbons	G, FP-lined septum	Cool ≤6°C[18], 0.008% $Na_2S_2O_3$[5]	14 days
6, 57, 106.	Purgeable Aromatic Hydrocarbons	G, FP-lined septum	Cool ≤6°C[18], 0.008% $Na_2S_2O_3$[5], HCl to pH 2[9]	14 days
3, 4.	Acrolein and Acrylonitrile	G, FP-lined septum	Cool ≤6°C[18], 0.008% $Na_2S_2O_3$[5], pH to 4-5[10]	14 days[10]
23, 30, 44, 49, 53, 77, 80, 81, 98, 100, 112.	Phenols[11]	G, FP-lined cap	Cool ≤6°C[18], 0.008% $Na_2S_2O_3$[5]	7 days until extraction, 40 days after extraction
7, 38.	Benzidines[11, 12]	G, FP-lined cap	Cool ≤6°C[18], 0.008% $Na_2S_2O_3$[5]	7 days until extraction[13]
14, 17, 48, 50-52.	Phthalate esters[11]	G, FP-lined cap	Cool ≤6°C[18]	7 days until extraction, 40 days after extraction
82-84.	Nitrosamines[11, 14]	G, FP-lined cap	Cool ≤6°C[18], store in dark, 0.008% $Na_2S_2O_3$[5]	7 days until extraction, 40 days after extraction
88-94.	PCBs[11]	G, FP-lined cap	Cool ≤6°C[18]	1 year until extraction, 1 year after extraction
54, 55, 75, 79.	Nitroaromatics and Isophorone[11]	G, FP-lined cap	Cool ≤6°C[18], store in dark, 0.008% $Na_2S_2O_3$[2]	7 days until extraction, 40 days after extraction

Table 5.1, cont.

PARAMETER #	PARAMETER NAME	CONTAINER[1]	PRESERVATION[2,3]	MAX HOLD TIME[4]
1, 2, 5, 8-12, 32, 33, 58, 59, 74, 78, 99, 101.	Polynuclear Aromatic Hydrocarbons [11]	G, FP-lined cap	Cool ≤6°C[18], store in dark, 0.008% $Na_2S_2O_3$[5]	7 days until extraction, 40 days after extraction
Table 1D-Pesticides Tests:				
1-70.	Pesticides [11]	G, FP-lined cap	Cool ≤6°C[18], pH 5-9[15]	7 days until extraction, 40 days after extraction
Table 1E-Radiological Tests:				
1-5.	Alpha, beta and radium	P, FP, G	HNO_3 TO pH<2	6 months
Table 1H – Protozoan Tests:				
8.	Cryptosporidium	LDPE; field filtration	0-8 °C	96 hours[21]
9.	Giardia	LDPE; field filtration	0-8 °C	96 hours[23]

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[1] "P" is polyethylene; "FP" is fluoropolymer (polytetrafluoroethylene (PTFE; Teflon®), or other fluoropolymer, unless stated otherwise in this table; "G" is glass; "PA" is any plastic that is made of sterilizable material (polypropylene or other autoclaveable plastic); "LDPE" is low density polyethylene.

[2] Add a reducing agent only if an oxidant (e.g. chlorine) is present. Reducing agents shown to be effective are sodium thiosulfate ($Na_2S_2O_3$), ascorbic acid, sodium arsenite ($NaAsO_2$), or sodium borohydride ($NaBH_4$). Be careful not to add excess reducing agent. For ascorbic acid, add approximately 0.1-0.6g of crystals, and then an additional 0.06g for each liter of sample volume.

[3] Except where noted in this table and the method for the parameter, preserve each grab sample within 15 minutes of collection. For a composite sample collected with an automated sampler, refrigerate the sample at ≤6°C during collection unless specified otherwise in this table or in the method(s). For a composite sample to be split into separate aliquots for preservation and/or analysis, maintain the sample at ≤6°C, unless specified otherwise in this table or in the method(s), until collection, splitting, and preservation has been completed. Add the preservative to the sample container prior to sample collection, as long as the integrity of the sample is maintained, otherwise add preservative to the sample within 15 minutes of collection. If a composite measurement is required but sample integrity would be compromised, individual grab samples may be collected at prescribed intervals and analyzed separately and the concentrations averaged. Alternatively, grab samples may be collected in the field and composited in the laboratory of the compositing procedure produces results equivalent to results produced by arithmetic averaging of the analysis results.

[4] When any sample is to be shipped by common carrier or sent via the U.S. Postal Service, it must comply with the Dept. of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transport is responsible for compliance. The Hazardous Materials Regulations do not apply to the following in this table: HCl in water solutions at concentrations of 0.04% by weight or less; HNO_3 in water solutions at concentrations of 0.15% by weight or less; H_2SO_4 in water solutions at concentrations of 0.35% by weight or less; and NaOH in water solutions at concentrations of 0.080% by weight or less.

[5] Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before the start of analysis and still be considered valid. For a grab samples, the holding time begins at the time of collection. For composite samples, the holding time begins at the end of collection of the composite sample.

[6] Sample collection and preservation: Collect a volume of sample appropriate to the analytical method in a bottle of the material specified. If the sample can be analyzed within 48 hours and sulfide is not present, adjust the pH to >12 with sodium hydroxide solution (5% of the weight per volume), refrigerate as specified, and analyze within 48 hours. Otherwise, to extend the holding time to 14 days and mitigate interferences, treat the sample immediately using any or all of the following techniques, as necessary, followed by adjustment of the sample pH to >12 and refrigeration as specified.

1. Sulfur: To remove elemental sulfur, filter the sample immediately. If the filtration time will exceed 15 minutes, use a larger filter or a method that requires a smaller sample volume. Adjust the pH of the filtrate to >12 with NaOH, refrigerate the filter and filtrate, and ship or transport to the laboratory. In the laboratory, extract the filter with 100mL of 5% NaOH for a minimum of 2 hours. Filter the extract and discard the solids. Combine the 5% NaOH-extracted filtrate with the initial filtrate, lower the pH to approximately 12 with concentrated HCl or H_2SO_4, and analyze the combined filtrate. Because the detection limit for cyanide will be increased by dilution by the filtrate from the solids, test the sample with and without the solids procedure if a low detection limit for cyanide is necessary. Do not use the solids procedure if a higher cyanide concentration is obtained without it. Alternatively, analyze the filtrates from the sample and the solids separately, add the amounts determined (in ug or mg) and divide by the original sample volume to obtain the cyanide concentration.

2. Sulfide: If the sample contains sulfide, as determined by lead acetate paper, or if sulfide is known or suspected to be present, immediately conduct one of the following volatilization treatments or the precipitation treatment as follows: Volatilization – Headspace expelling: In a fume hood or well-ventilated area, transfer 0.75 liter of sample to a 4.4 L collapsible container. Acidify with concentrated HCl to pH <2. Cap the container and shake vigorously for 30 seconds. Remove the cap and expel the headspace into the fume hood or open area by collapsing the container without expelling the sample. Refill the headspace by expanding the container. Repeat expelling a total of 5 headspace volumes. Adjust the pH to >12, refrigerate, and transport to the lab. Scaling to a smaller or larger sample volume must maintain the air to sample volume ratio. Dynamic stripping: In a fume hood or well, ventilated area, transfer 0.75 L of sample to a container of the material specified and acidify with concentrated HCl to pH <2. Using a calibrated air sampling pump or flowmeter, purge the acidified sample into the fume hood or open area through a fritted glass aerator at a flow rate of 2.25 L/min for 4 minutes. Adjust the pH to >12, refrigerate, and transport to the lab. Keep volume ratios the same if scaling. Precipitation: If the sample contains particulate matter that would be removed by filtration, filter the sample prior to treatment to assure that cyanide associated with the particulate matter is include in the measurement. Once in the lab, extract the filter with 100mL of 5% NaOH for a minimum of 2 hours. Filter the extract and discard the solids. Combine the 5% NaOH-extracted filtrate with the initial filtrate, lower the pH to approximately 12 with concentrated HCl or H2SO4, and analyze the combined filtrate. (See the last three sentences of footnote 6(1.) above.) For removal of sulfide by precipitation, raise the pH of the sample to >12 with NaOH, then add approximately 1 mg of powdered cadmium chloride for each mL of sample. Cap and shake the container to mix. Allow the precipitate to settle and test the sample with lead acetate paper. If necessary, add cadmium chloride, but avoid adding an excess. Finally, filter through a 0.45 micron filter. Cool the sample as specified and transport the filter and the filtrate to the lab. For lab procedure, reference footnote 6(1.). If a ligand-exchange method is used (e.g. ASTM D6888), it may be necessary to increase the ligand-exchange reagent to offset any excess of cadmium chloride.
3. Sulfite, thiosulfate, or thiocyanate: If these interferences are known or suspected to be present, use UV digestion with a glass coil (Method Kelada-01) or ligand exchange (Method OIA-1677) to preclude cyanide loss or positive interference.
4. Aldehyde: If formaldehyde, acetaldehyde, or another water-soluble aldehyde is known or suspected to be present, treat the sample with 20mL of 3.5% ethylenediamine solution per liter of sample.
5. Carbonate: Carbonate interference is evidenced by noticeable effervescence upon acidification in the distillation flask, a reduction in the pH of the absorber solution, and incomplete cyanide spike recovery. When significant carbonate is present, adjust the pH to ≥12 using calcium hydroxide instead of sodium hydroxide. Allow the precipitate to settle and decant or filter the sample prior to analysis (also see SM4500-CN.B.3.d).
6. Chlorine, hypochlorite, or other oxidant: Treat a sample known or suspected to contain these interferences as described in fotenote 5.

[7] For dissolved metals, filter grab samples within 15 minutes of collection and before adding preservatives. For a composite sample collected with an automated sampler, filter the sample within 15 minutes of completion of collection and before adding preservatives. If it is known or suspected that dissolved sample integrity will be compromised during collection of a composite sample collected automatically over time (e.g. by interchange of a metal between dissolved and suspended forms), collect and filter grab samples to be composited (footnote 2) in place of a composite sample collected automatically.

[8] Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

[9] If the sample is not adjusted to pH 2, then the sample must be analyzed within 7 days of sampling.

[10] The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within three days of sampling.

[11] When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to ≤ 6°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9. Samples preserved in this manner may be held for 7 days before extraction and for 40 days after extraction. Exception to this optional preservation and holding time procedure are noted in footnote 5 (regarding the requirement for thiosulfate reduction), and footnotes 12 and 13 (regarding the analysis of benzidine).

[12] If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0 ± 0.2 to prevent rearrangement to benzidine.

[13] Extracts may be stored up to 30 days at <0°C.

[14] For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.

[15] The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

[16] Sufficient ice should be placed with the samples in the shipping container to ensure that ice is still present when the samples arrive at the laboratory. However, even if ice is present when the samples arrive, it is necessary to immediately measure the temperature of the samples and confirm that the preservation temperature maximum has not been exceeded. In the isolated cases where it can be documented that this holding temperature cannot be met, the permitee can be given the option of on-site testing or can request a variance. The request for a variance should include supportive data which show that the toxicity of the effluent samples is not reduced because of the increased holding temperature.

[17] Samples collected for the determination of trace level mercury (<100 ng/L) using EPA method 1631 must be collected in tightly-capped fluoropolymer or glass bottles and preserved with BrCl or HCl solution within 48 hours of sample collection. The time to preservation may be extended to 28 days if a sample is oxidized in the sample bottle. A sample collected for dissolved trace level mercury should be filtered in the laboratory within 24 hours of the time of collection. However, if circumstances preclude overnight shipment, the sample should be filtered in a designated clean area in the field in accordance with procedures given in Method 1669. If sample integrity will not be maintained by shipment to and filtration in the laboratory, the sample must be filtered in a designated clean area in the field with the time period necessary to maintain sample integrity. A sample that has been collected for determination of total or dissolved trace level mercury must be analyzed within 90 days of sample collection.

[18] Aqueous samples must be preserved at ≤ 6°C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. Also, for purposes of NPDES monitoring, the specification of "≤ °C" is used in place of the "4 °C" and "< 4 °C" sample temperature requirements listed in some methods. It is not necessary to measure the sample temperature to three significant figures (1/100th of a degree); rather, three significant figures are specified so that rounding down to 6 °C may not be used to meet the ≤ 6°C requirement. The preservation temperature does not apply to samples that are analyzed immediately (within 15 minutes).

[19] An aqueous sample may be collected and shipped without acid preservation. However, acid must be added at least 24 hours before analysis to dissolve any metals that absorb to the container walls. If the sample must be analyzed within 24 hours of collection, add the acid immediately (see footnote 2). Soil and sediment samples do not need to be preserved with acid. The allowances in this fotenote supersede the preservation and holding time requirements in the approved metals methods.

[20] To achieve the 28-day holding time, use the ammonium sulfate buffer solution specified in EPA Method 218.6. The allowance in this footnote supersedes preservation and holding time requirements in the approved hexavalent chromium, unless measurement is compromised.

[21] Holding time is calculated from time of sample collection to elution for samples shipped to the laboratory in bulk and calculated from the time of sample filtration to elution for samples filtered in the field.

[22] Sample analysis should begin immediately, preferably within 2 hours of collection. The maximum transport time to the laboratory is 6 hours, and samples should be processed within 2 hours of receipt at the laboratory. (Table II of 40 CFR Part 136.3 was amended in May 2007. An additional 2 hours of laboratory preparation time has been added to the 6 hour transport holding time for water samples collected for bacterial analyses. Joint memorandum attached at the end of Section 5 of this Quality Manual.)

[23] For fecal coliform samples for sewage sludge (biosolids) only, the holding time is extended to 24 hours for the following sample types using either EPA Method 1680 (LTB-EC) or 1681 (A-1); Class A composted, Class B aerobically digested, and Class B anaerobically digested.

Table 5.2

APPROVED WATER AND WASTEWATER PROCEDURES, CONTAINERS, PRESERVATION AND HOLDING TIMES FOR PARAMETERS NOT FOUND IN 40 CFR 136 **

PARAMETER	METHOD	REFERENCE[1]	CONTAINER[2]	PRESERVATION[3]	MAXIMUM HOLDING TIME[4]
Bromine	DPD Colorimetric [5]	SM 4500-Cl-G	P, G	None required	Analyze immediately
Bromates	Ion Chromatography	EPA-300.0 B [6]	P, G	Cool, 4°C	30 days
Chlorophylls	Spectrophotometric	SM 10200H	P, G [7]	Unfiltered, dark 4°C Filtered, dark -20°C	48 hrs chilled until filtration [8], and analyze immediately or 28 days after filtration if frozen
Corrosivity	Calculated ($CaCO_3$ Stability, Langelier Index)	SM 2330 ASTM D513-82	P, G	Cool, 4°C [9]	7 days [9]
Odor	Human Panel	SM 2150	G only	Cool, 4°C	6 hours
Salinity	Electrometric [10] Hydrometric [10]	SM 2420 B SM 2520 C	G, wax seal	Analyze immediately or use wax seal	30 days [10]
Taste	Human Panel	SM 2160 B SM 2160 C SM 2160 D ASTM E679-91	G only	Cool, 4°C	24 hours
Total Dissolved Gases	Direct-Sensing Membrane-Diffusion Method	SM 2810	---	---	Analyze in-situ
Transparency	Irradiometric [11]	62-302.200(6), FAC	---	---	Analyze in-situ
Un-ionized Ammonia	Calculated [12]	DEP-SOP [13]	P, G	Cool, 4°C $Na_2S_2O_3$ [12]	8 hours unpreserved 28 days preserved [12]
Organic Pesticides [14]	GC and HPLC	EPA(600-series) [14]	[15]	[15]	[15]

**Reference: 62-160.700, F.A.C., Table 4 and DEP-SOP-001/01, FS 1000, Table FS 1000-5 March 31, 2008

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[1] SM XXXX = procedures from "Standard Methods for the Examination of Water and Wastewater", APHA-AWWA-WPCF, 20th Edition, 1998 and Standard Methods Online.
ASTM XXXX-YY= procedure from "Annual Book of ASTM Standards", Volumes 11.01 and 11.02 (Water I and II), 1999.

[2] P= plastic, G= glass.

[3] When specified, sample preservation should be performed immediately upon sample collection.

[4] The times listed are the maximum times that samples may be held before analysis and still be considered valid.

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[5] The approved procedure is for residual chlorine. However, in the absence of chlorine, the DPD colorimetric procedure can be adapted to measure bromine content of the sample. In such case, the validity of this assumption must be verified by using another procedure for chlorine which is not affected by the presence of bromine (i.e. negligible interference).

[6] "The Determination of Inorganic Anions in Water Ion Chromatography", EPA Method 300.0 B, Revision 2.1, August 1993, by John D. Pfaff, Carol A. Brockoff and James W. O'Dell, U.S. EPA, Cincinnati, Ohio 45268.

[7] Collect samples in opaque bottles and process under reduced light. Samples on filter taken from water having a $pH \geq 7$ may be placed in airtight plastic bags and stored frozen for up to three weeks. Samples from acidic water must be processed promptly to prevent chlorophyll degradation.

[8] Samples must be filtered within 48 hours of collection. Add magnesium carbonate to the filter while the last of the sample passes through the filter.

[9] Temperature and pH must be measured on site at the time of sample collection. 7 days is the maximum time for laboratory analysis of total alkalinity, calcium ion, and total solids.

[10] Samples collected for laboratory analysis, when properly sealed with a paraffin wax stopper, may be held indefinitely. The maximum holding time of 30 days is recommended as a practical regulatory limit.

[11] Transparency in surface waters is defined as a compensation point for photosynthetic activity, i.e., the depth at which one percent of the light intensity entering at the water surface remain unabsorbed. The DEP Chapter 62-302, FAC requires that the light intensities at the surface and subsurface be measured simultaneously by irradiance meters such as the Kahlsico Underwater Irradiometer, Model No. 268 WA 310, or an equivalent device having a comparable spectral response.

[12] The results of the measurement of pH, temperature, salinity (if applicable) and the ammonium ion concentration in the sample are used to calculate the concentration of ammonia in the unionized state. Temperature, pH, and salinity must be measured on-site at the time of collection. Laboratory analysis of the ammonium ion concentration should be conducted within 8 hours of sample collection. If prompt analysis of ammonia is impossible, preserve samples with H_2SO_4 to pH between 1.5 and 2. Acid preserved samples, stored at 4C, may be held up to 28 days for ammonia determination. Sodium thiosulfate should only be used if fresh samples contain residual chlorine.

[13] DEP Central Analytical Laboratory, Tallahassee, FL, Revision No. 1, October 3, 1983. The 1983 draft is available from the DEP Bureau of Laboratories.

[14] Other pesticides listed in approved EPA methods (608.1, 608.2, 614, 614.1, 615, 617, 618, 619, 622, 622.1, 627, 629, 631, 632, 632.1, 633, 642, 643, 644 and 645) that are not included in Table ID of 40 CFR Part 136 (March 2007).

[15] Container, preservation and holding time, as specified in each individual method, must be followed.

Table 5.3

RECOMMENDED SAMPLE CONTAINERS, SAMPLE VOLUMES, PRESERVATION TECHNIQUES AND HOLDING TIMES FOR RESIDUALS, SOIL AND SEDIMENT SAMPLES

PARAMETER	METHODS	REFERENCES	CONTAINER	PRESERVATION[1]	MAX HOLDING TIMES
Volatile Organics	Purge-and-Trap GC and GC-MS	8015, 8021, 8260, 5035	Glass (40 ml vial or 4 oz. wide-mouth) with Teflon® -lined lid	Cool 4°C	14 days
Semivolatile Organics	GC, HPLC, and GC-MS	8041, 8061, 8070, 8081, 8082, 8091, 8111, 8121, 8131, 8141, 8151, 8270, 8275, 8280, 8290, 8310, 8315, 8316, 8318, 8321, 8325, 8330, 8331, 8332, 8410, 8430, 8440, FL-PRO	Glass, 8 oz. widemouth with Teflon® -lined lid (50g sample)	Cool 4°C	14 days until extraction, 40 days after extraction
Dioxins		8290		Cool 4°C	30 days until extraction, 45 days after extraction
Total Metals-except mercury and chromium VI	Flame AA, Furnace AA, Hydride and ICP	All 7000-series methods (except 7195, 7196, 7197, 7198, 7470, and 7471) and 6010 (ICP)	Glass or plastic, 8 oz. widemouth (200g sample)	None	6 months
Chromium VI	Colorimetric, Chelation with Flame AA	7196 and 7197 (prep 3060)	Glass or plastic, 8 oz. widemouth (200g sample)	Cool 4°C ± 2°C	24 hours
Mercury	Manual Cold Vapor AA	7471	Glass or plastic, 8 oz. widemouth (200g sample)	Cool 4°C ± 2°C	28 Days

Reference: 62-160.700, F.A.C., Table 5 and DEP-SOP-001/01, FS 1000, Table FS 1000-6 March 31, 2008

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[1] Keep soils, sediments, and sludges cool at 4°C from collection time until analysis. No preservation is required for concentrated waste samples.

Table 5.4
PRESERVATION METHODS AND HOLDING TIMES FOR DRINKING WATER SAMPLES THAT DIFFER FROM 40 CFR PART 136, TABLE II

PARAMETER	PRESERVATION [1]	HOLDING TIME [2]	HOLDING TIME FOR EXTRACT [3]	CONTAINER [4]
Microbiologicals	Cool < 10°C, $Na_2S_2O_3$ [5]	30 hours [6]	---	P, G
Heterotropic Plate Count	Cool < 10°C, $Na_2S_2O_3$	8 hours	---	P, G
Radiologicals				
Group A	HCl or HNO_3 pH<2 [7,8,9]	6 months	---	P, G
Cesium-134	HCl pH <2 [8,9]	6 months	---	P, G
Iodine-131	None	8 days	---	P, G
Tritium	None	6 months	---	G
Asbestos	Cool 4°C	48 hours	---	P, G
Bromate	Ethylenediamine (50 mg/L)	28 days	---	P, G
Cyanide	Cool 4°C, Ascorbic acid (if chlorinated), NaOH pH >12	14 days	---	P, G
Nitrate				
Chlorinated	Cool 4°C	28 days	---	48 hours
Nonchlorinated	Cool 4°C	48 hours	---	48 hours
Odor	Cool 4°C	24 hours	---	G
502.2	$Na_2S_2O_3$ or Ascorbic acid, 4°C, HCl pH <2 if Ascorbic acid is used	14 days	---	Glass with PFTE -Lined Septum
504.1	$Na_2S_2O_3$, Cool 4°C	14 days	4°C, 24 hours	Glass with PFTE -Lined Septum
505	$Na_2S_2O_3$, Cool 4°C	14 days (7 days for Heptachlor)	4°C, 24 hours	Glass with PFTE -Lined Septum
506	$Na_2S_2O_3$, Cool 4°C, Dark	14 days	4°C, Dark, 14 days	Amber Glass with PFTE - Lined Cap
507	$Na_2S_2O_3$, Cool 4°C, Dark	14 days (see method for exceptions)	4°C, Dark, 14 days	Amber Glass with PFTE - Lined Cap
508	$Na_2S_2O_3$, Cool 4°C, Dark	7 days (see method for exceptions)	4°C, Dark, 14 days	Amber Glass with PFTE - Lined Cap
508A	Cool 4°C	14 days	30 days	Glass with PFTE -Lined Cap

Table 5.4, cont.

PARAMETER	PRESERVATION [1]	HOLDING TIME [2]	HOLDING TIME FOR EXTRACT [3]	CONTAINER [4]
508.1	Sodium Sulfite, HCl pH <2, Cool 4°C	14 days (see method for exceptions)	30 days	Glass with PFTE -Lined Cap
515.1	$Na_2S_2O_3$, Cool 4°C, Dark	14 days	4°C, Dark, 28 days	Amber Glass with PFTE - Lined Cap
515.2	$Na_2S_2O_3$, Cool 4°C, HCl pH <2, Dark	14 days	≤ 4°C, Dark, 14 days	Amber Glass with PFTE - Lined Cap
515.3	$Na_2S_2O_3$, Cool 4°C, HCl pH <2, Dark	14 days	≤ 4°C, Dark, 14 days	Amber Glass with PFTE - Lined Cap
515.4	Sodium Sulfite, HCl pH <2, Cool ≤ 10°C for 1st 48 hours ≤ 6°C thereafter, Dark	14 days	≤ 0°C, 21 days	Amber Glass with PFTE - Lined Cap
524.2	Ascorbic acid, HCl pH <2, Cool 4°C	14 days	---	Glass with PFTE -Lined Septum
525.2	Sodium Sulfite, Dark, HCl pH <2, Cool 4°C	14 days (see method for exceptions)	≤ 4°C, 30 days from collection	Glass with PFTE -Lined Cap
531.1, 6610	Sodium Sulfite, Monochloroacetic acid pH <3, Cool 4°C	28 days	---	Glass with PFTE -Lined Septum
531.2	Sodium Thiosulfate, Potassium Dihydrogen Citrate buffer to pH 4, Dark, ≤ 10°C for first 48 hrs, ≤ 6°C thereafter	28 days	---	Glass with PFTE -Lined Septum
547	Sodium Thiosulfate, Cool 4°C	14 days (18 months frozen)	---	Glass with PFTE -Lined Septum
548.1	Sodium Thiosulfate (HCl pH 1.5-2 if high biological activity), Cool 4°C, Dark	7 days	≤ 4°C, 14 days	Amber Glass with PFTE - Lined Septum
549.2	Sodium Thiosulfate (H_2SO_4 pH <2 if biologically active), Cool 4°C, Dark	7 days	21 days	High Density Amber Plastic or Silanized Amber Glass
550, 550.1	Sodium Thiosulfate, Cool 4°C, HCl pH <2	7 days	550, 30 days 550.1, 40 days Dark, 4°C	Amber Glass with PFTE - Lined Cap

Table 5.4, cont.

PARAMETER	PRESERVATION [1]	HOLDING TIME [2]	HOLDING TIME FOR EXTRACT [3]	CONTAINER [4]
551.1	Sodium Thiosulfate, Sodium Sulfite, Ammonium Chloride, pH 4.5-5.0 with phosphate buffer, Cool 4°C	14 days	---	Glass with PFTE -Lined Septum
552.1	Ammonium Chloride, Cool 4°C, Dark	14 days	≤ 4°C, dark 48 hours	Amber Glass with PFTE -Lined Cap
555	Sodium Sulfite, HCl, pH ≤ 2, Dark, Cool 4°C	14 days	---	Glass with PFTE -Lined Cap
1613B	Sodium Thiosulfate, Cool 0-4C, Dark		Recommended 40 days	Amber Glass with PFTE -Lined Cap

Reference: 62-160.700, F.A.C., Table 6 and DEP-SOP-001/01, FS 1000, Table FS 1000-8, March 31, 2008

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1 Preservation, when required, must be done immediately upon sample collection.

2 Stated values are the maximum regulatory holding times. Sample processing must begin by the stated time.

3 Stated time is the maximum time a prepared sample extract may be held before analysis.

4 (P) polyethylene or (G) glass. For microbiology, plastic sample containers must be made of sterilizable materials (poly-propylene or other autoclavable plastic).

5 Addition of sodium thiosulfate is only required if the sample has a detectable amount of residual chlorine, as indicated by a field test using EPA Method 330.4 or 330.2 or equivalent.

6 If samples are analyzed after 30 hours, but within 48 hours of collection, the laboratory is to indicate in the analytical report that the data may be invalid because of excessive delay in sample processing. No samples received after 48 hours are to be accepted or analyzed for compliance with the regulations of the Department of Environmental Protection or the Department of Health.

7 Group A parameters are: Gross Alpha, Gross Beta, Strontium-89, Strontium-90, Radium-226, Radium-228, Uranium, and Photon Emitters.

8 It is recommended that the preservative be added at the time of collection unless suspended solids activity is to be measured. It is also recommended that samples be filtered, if suspended or settable solids are present, prior to adding preservative, at the time of collection. However, if the sample has to be shipped to a laboratory or storage area, acidification of the sample (in its original container) may be delayed for a period not to exceed 5 days. A minimum of 16 hours must elapse between acidification and analysis.

9 If HCl is used to acidify samples, which are to be analyzed for gross alpha or gross beta activities, the acid salts must be converted to nitrate salts before transfer of the samples to planchets.

Table 5.5

List of Analytes , Acceptable Abbreviations & Sample Quantity Required in Water & Solid

Analyte	**Abbreviation**	**Sample Quantity in ml/g**
Alkalinity, Total	Alka., T-Alka	100
Bicarbonate Alkalinity	BiCarb Alk, B-Alka	calculation
Carbonate Alkalinity	Carb Alk., C-Alka	calculation
Aluminum	Al	150/100
Ammonia	NH_3	150/100
Antimony	Sb	150/100
Arsenic	As	150/100
Barium	Ba	150/100
Beryllium	Be	150/100
Biochemical Oxygen Demand	BOD, BOD5	400
Boron	B	150/100
Bromate	BrO3-	100
Bromide	Br	100
Cadmium	Cd	150/100
Calcium	Ca	150/100
Carbonaceous BOD	CBOD, CBOD5	400
Chemical Oxygen Demand	COD	50
Chlorate	ClO3-	100
Chloride	Cl	150
Chlorite	ClO2-	100
Chlorophyll	Chloro a; chloro a, b, c	500
Chlorine, Residual	Cl_2	50
Chromium	Cr	150/100
Chromium VI	CrVI; Cr6+	200/200
Cobalt	Co	150/100
Color	Color	100
Conductivity	Cond., Specific Conductance	50
Copper	Cu	150/100
Copper in Drinking Water	Cu	500
Dissolved Oxygen	DO	300
Dissolved Organic Carbon	DOC	15
E. coli	E-coli (MPN)	100
Enterococci	Enterococcus, Entero	100/100
Fecal Coliform	FC (MF), FC (MPN)	100/100
Fecal Streptococci	F Strep (MF), F Strep (MPN)	100
Fluoride	F	150
Gross Alpha	Gross Alpha; Gross α	900
Haloacetic Acids	HAA(5)'s	950

Hardness, Total Hardness (calc)	T-Hard, C-Hardness, Mg-Hard, Fe-Hard	100 calculation
Heterotrophic Plate Count	HPC, Standard Plate Count	100
Iron	Fe	150/100
Kjeldahl Nitrogen, Total	TKN	20/100
Lead	Pb	150/100
Lead in Drinking Water	Pb	500
Magnesium	Mg	150/100
Manganese	Mn	150/100
Mercury	Hg	100/100
Mixed Liquor Suspended Solids	MLSS	20
Mixed Liquor Volatile Suspended Solids	MLVSS	20
Molybdenum	Mo	150/100
Nickel	Ni	150/100
Nitrate as N	NO_3	100
Nitrate-Nitrite	NOX	10/100
Nitrite as N	NO_2	100
Nitrogen, Total	T-N	calculation
Odor	Odor	250
Oil & Grease	O & G	950
Organic Nitrogen	O-N	calculation
Ortho-phosphorous	O-P; ortho-Phos; σ-phos; ortho-phosphate	20
Oxidation Reduction Potential	ORP	Field Measure
pH	pH	50
Phosphorous, Total	T-P, Total Phos, Phos, Phosphate, Total Phosphate	10/100
Potassium	K	150/100
Radium 226	Rad 226	900
Radium 228	Rad 228	900
Salinity	Salinity	20
Selenium	Se	150/100
Silica	Silica	20
Silver	Ag	150/100
Sodium	Na	150/100
Specific Oxygen Uptake Rate	SOUR	1500
Sulfate	SO_4	200
Sulfide	Sulfide	300
Surfactants	MBAS	300
Temperature	Temp	25
Thallium	Tl	150/100

Tin	Sn	150/100
Titanium	Ti	150/100
Total Coliform	TC (MF), TC (MPN), TC (MMO-MUG),(READYCULT)	100/100
Total Dissolved Solids	TDS	50
Total Fixed Solids	TFS	calculation
Total Organic Carbon	TOC	15
Total Petroleum Hydrocarbons	TPH	950
Total Phenolics	Phenol	950
Total Solids	TS; %TS	10
Total Suspended Solids	TSS	500
Total Trihalomethanes	T-THM'S	120
Total Volatile Solids	TVS	20
Trihalomethanes	THM'S	120
Turbidity	ntu, Turbid.	100
Unionized Ammonia	Un-Ion Ammonia; Un-NH_3	calculation
UV-254	UV-254	20
Vanadium	V	150/100
Volatile Organic Compounds	VOC's	120
Volatile Suspended Solids	VSS	20
Zinc	Zn	150/100

Florida Department of Environmental Protection
Environmental Assessment Section

Florida Department of Health
Environmental Laboratory Certification Program

JOINT MEMORANDUM

TO: All Laboratories and Sample Collection Organizations

FROM: Steve Arms, Administrator, Florida Department of Health, Environmental Laboratory Certification Program (DoH ELCP)

Silky S. Labie, Quality Assurance Manager for Water, Waste and Resource Management Programs, Florida Department of Environmental Protection (DEP)

DATE: May 7, 2007

SUBJECT: Interim Strategy for Implementing the Environmental Protection Agency (EPA) approved test method updates published in the Federal Register on March 12, 2007 (pp. 11200 – 11249 of Vol. 72, No. 47) and March 26, 2007 (pp. 14220 – 14233 of Vol. 72, No. 57)

The Environmental Protection Agency (EPA) recently published changes to the Code of Federal Regulations (CFR) that affect Clean Water Act and Safe Drinking Water Act programs for drinking water, ambient water, waste water and sewage sludge. Affected EPA regulations are found at 40 CFR Parts 136, 141 143, 430, 455, 465 and 503.

The full text of the changes may be found at:

http://www.epa.gov/fedrgstr/EPA-WATER/2007/March/Day-12/w1073.pdf

and

http://www.epa.gov/fedrgstr/EPA-WATER/2007/March/Day-26/w1455.pdf.

Interim Implementation Strategy

The following is applicable to organizations that report data to DEP programs and include both field and laboratory activities that are used to provide data, directly or indirectly, to DEP programs.

Implementing Updates to Laboratory Analytical Method Reporting Requirements for DEP Regulations

Until new reporting and certification requirements are mandated in the revised DEP program rules, laboratories may report methods for regulatory compliance as listed in the rules and tables for the applicable regulatory programs found in the following references:

40 CFR, July 2006 edition (or anticipated July 2007 edition)
Federal Register, March 12, 2007 (pp. 11200 – 11249 of Vol. 72, No. 47)
Federal Register, March 26, 2007 (pp. 14220 – 14233 of Vol. 72, No. 57)

Laboratories will not be required by DEP to update their certifications in accordance with the March 2007 Federal Register changes cited above until the deadline to be established in the anticipated revisions to the DEP QA rule, 62-160, FAC becomes effective. Until the appropriate changes in DEP rules occur, the following interim policy concerning certification will be implemented:

> A laboratory must hold a current DoH ELCP certification in the applicable matrix for any analyte reported. For certification in the non-potable water matrix, the certification for the analyte may be the reported method or a method equivalent to the reported method. For certification in the potable (drinking) water matrix, the laboratory must be certified in the method reported to DEP. A certification held for a method that has been withdrawn by EPA and no longer appears in the references cited above will still be accepted by DEP for these interim requirements.

Some of the tables in the above references list equivalent methods by analytical technique, as in the following example:

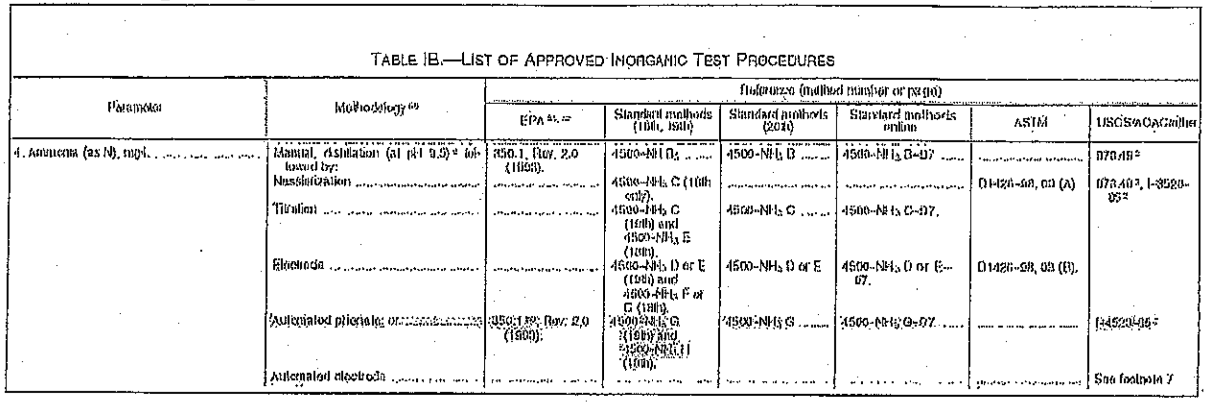

TABLE IB.—LIST OF APPROVED INORGANIC TEST PROCEDURES

Parameter	Methodology [58]	Reference (method number or page)					
		EPA [35, 52]	Standard methods (18th, 19th)	Standard methods (20th)	Standard methods online	ASTM	USGS/AOAC/other
4. Ammonia (as N), mg/L	Manual, distillation (at pH 9.5) [6] followed by:	350.1, Rev. 2.0 (1993).	4500-NH_3 B	4500-NH_3 B	4500-NH_3 B-97		973.49 [3]
	Nesslerization		4500-NH_3 C (18th only).			D1426-98, 03 (A)	973.49 [3], I-3520-85 [2]
	Titration		4500-NH_3 C (19th) and 4500-NH_3 E (18th).	4500-NH_3 C	4500-NH_3 C-97.		
	Electrode		4500-NH_3 D or E (19th) and 4500-NH_3 F or G (18th).	4500-NH_3 D or E	4500-NH_3 D or E-97.	D1426-98, 03 (B).	
	Automated phenate, or	350.1 [30], Rev. 2.0 (1993).	4500-NH_3 G (19th) and 4500-NH_3 H (18th).	4500-NH_3 G	4500-NH_3 G-97		I-4523-85 [2]
	Automated electrode						See footnote 7

Contact DEP for further clarification concerning equivalent method designations.

Implementing Updates to Required Sample Collection, Preservation and Holding Time Procedures and Impact on Laboratory Sample Receipt

Samplers should collect grab or composite samples for specific analytes or analyte groups as directed by DEP permitting authorities.

Until new sample preservation and holding time requirements are mandated in the revised DEP Quality Assurance (QA) rule, sample preservation and holding time procedures listed in any of the above cited references may be used.

Sample collectors may elect not to acidify water samples for metals analyses (as indicated in the March 2007 Federal Register changes to Table II at 40 CFR Part 136). However, if water samples for metals analyses are received unacidfied, laboratories must document the date and time of the acid addition, the lot number used, and the amount added. Additionally, labs must document verification that the sample pH was <2 for at least 24 hours after the addition of the acid and prior to the preparation of the sample for analysis. Samples collected for the analysis of boron, chromium VI (hexavalent chromium) or mercury require different preservation than the above and must be preserved and stored as indicated in Table II of 40 CFR Part 136.

Summary of Changes to EPA-Approved Test Methods for DEP Regulatory Programs

EPA has withdrawn many of the older EPA inorganic test methods. However, methods equivalent to the withdrawn procedures have been retained or added.

EPA has listed additional and revised methods that can be used for the applicable regulatory compliance reporting for drinking water, waste water and sewage sludge, as described in the federal register pages cited above.

EPA has re-titled Table IA at 40 CFR Part 136 to clarify that the listed biological test methods may be used for wastewater and sewage sludge.

EPA has moved methods for the microbiological testing of ambient waters from Table IA to a new table (IH) at 40 CFR Part 136.

EPA has listed methods for the testing of water samples associated with discharges from pesticide manufacturers in a new table (IG) at 40 CFR Part 136 in support of regulations at 40 CFR Part 455.

EPA has included a new section at 40 CFR Part 136.6 describing circumstances and specifying requirements allowing for the modification of test methods without prior EPA approval.

Summary of Changes to Sample Collection, Preservation and Holding Times

EPA has updated the list of analytes and analyte groups that must be collected as discrete grab samples for the applicable regulations at 40 CFR Part 122.

Table II of 40 CFR Part 136, Required Containers, Preservation Techniques, and Holding Times, has been amended for several parameters. Of note:

- An additional 2 hours of laboratory preparation time has been added to the 6-hour transport holding time for water samples collected for bacterial analyses.
- Immediate acid preservation of water samples for metals analyses (except boron, chromium VI, and mercury) is not required if nitric acid is added to bring the sample to a pH of < 2 at least 24 hours prior to sample preparation and analysis. Samples collected for the analysis of boron, chromium VI (hexavalent chromium) or mercury require different preservation than other water samples for metals analyses and must be preserved and stored as indicated in Table II.

Summary of Anticipated DEP Actions to Adopt the EPA Updates to Test Methods and Revised Sample Preservation Techniques and Holding Times

Laboratory certification requirements in the DEP Quality Assurance Rule, Chapter 62-160, F.A.C. will be revised as soon as possible and will include a provision for obtaining certification for test methods in the updated lists cited above by a specified date after adoption of the revised QA rule. Certification requirements for laboratories as specified in DEP rules are only applicable to laboratories and other entities reporting data to DEP. See the discussion above concerning the interim reporting of approved analytical methods and current laboratory certification status.

The DEP regulatory programs will update program rule citations to the above Federal Register notices or the July 2007 edition of the CFR as soon as possible.

The DEP QA Rule will be revised to incorporate by reference the updated tables for required sample containers, preservation techniques and holding times in FS 1000 of the DEP Standard Operating Procedures for Field Activities (DEP-SOP-001/01) in order to adopt the March 2007 Federal Register changes in Table II at 40 CFR Part 136.

Summary of DoH ELCP Actions to Accommodate Method Update Changes to Laboratory Certification

The DoH ELCP will process applications relevant to the Federal Register method updates in the following manner:

- Any laboratory that needs to add methods to its scope because approval was withdrawn for one or more methods for which it holds certification may do so by submitting an application (including the fee) to the DoH ELCP, including a cover letter that indicates that the purpose of the application is to comply with the EPA Methods Update Rule. If the requested method(s) on the application are of the same NELAC technology as the currently certified method, and the laboratory is otherwise in good standing with regards to its certification, the DoH ELCP will process the application administratively without the need for another on-site assessment, additional proficiency testing or documentation. The laboratory must make any necessary changes in its standard operating procedures, documentation, and quality control procedures prior to its next regular on-site assessment.
- If a laboratory applies for method(s) that include additional analytes and/or methods of a different technology than those for which it is already certified, then the usual processes for completing an application, including the requirements for additional PT and an on-site assessment, will be followed.
- An out-of-state laboratory that has been granted reciprocal certification must first obtain certification for the Fields of Accreditation needed from its primary NELAP-recognized accrediting authority and then apply to the DoH ELCP following the usual process.

Contact Information

Should you have questions concerning your certification, please contact Steve Arms at steve_arms@doh.state.fl.us. If your questions concern acceptability of a given method by a DEP regulatory program or concern the new sample preservation procedures, please contact Silky Labie at silky.labie@dep.state.fl.us.

cc: DEP Division Directors for Water and Waste Programs
DEP District Directors
DEP Bureau Chiefs for Water and Waste Programs
DEP Bureau Chief for Laboratories
DEP Office of General Counsel
DEP Water Program Administrators
DEP Waste Program Administrators
DEP Bureau of Laboratories Administrators
DEP Environmental Assessment Section Staff

6.0 ANALYTICAL PROCEDURES

6.1 LABORATORY GLASSWARE CLEANING PROCEDURES

In the analysis of samples the preparation of scrupulously clean glassware is mandatory. Lab glassware cleaning procedures must follow specific written method requirements. If procedures are not listed then the method of cleaning should be adapted to both the substances that are to be removed, and the determinations (tests) to be performed. Recommendations for such cleaning procedures are listed below.

If documentation through an active quality control program using spiked samples and reagent blanks can demonstrate that certain steps in the cleaning procedure are not required for routine samples, then those steps may be eliminated from the procedure.

Lab Glassware Cleaning Procedures

Analysis/Parameter	Cleaning Procedure (in order specified)
ORGANICS	
Semi-Volatile: (Pesticides, Herbicides, HPLC, Oil & Grease, TRPH & Total Recoverable Phenolics)	Solvents: 5, 1-4, 5 or 6, 13, 15 OR Muffle: 5, 1-4, 12, 13, 15 OR Oxidizer: 5, 1-3, 14, 3-5, 13, 15
Volatile or Purgeable: (and EDB, DBCP, THMS)	1-4, (6 optional), 10 OR 1-4 (5 & 7 optional), 10
TOC, POX, TOX:	14, 1-4, 12
INORGANICS	
Trace Metals:	1-4, 9, 8 (optional), 4
Nutrients, Minerals:	1-4, 8, 4
Analysis/Parameter	Cleaning Procedure (in order specified)
Solids:	1-4, 11 (Volatile Solids 16)
Non-Metals, Physical Properties: (Cyanide, BOD, COD)	1-4, (14 optional BOD)
MICROBIOLOGY	1-4, (Sterilize per approved method)
Analysis/Parameter	Cleaning Procedure

	(in order specified)
BIOASSAY	
Freshwater:	18, 2, 3, 9 or 8, 4, 5, 4, 20
Marine & Estuarine:	19, 2, 3, 9 or 8, 4, 5, 4, 20
RADIONUCLIDES	17, 3, 8, 4

Cleaning Procedures:

1. Remove all labels using sponge or acetone.
2. Wash with hot tap water and a brush to scrub inside of glassware, stopcocks, and other small pieces, if possible, using a suitable laboratory-grade detergent.
   Organics- Liquinox, Alconox or equivalents
   Inorganic anions- Liquinox or equivalent
   Inorganic cations- Liquinox, Acationox, Micro or equivalents
   Microbiology- must pass inhibitory residue test
3. Rinse thoroughly with hot tap water.
4. Rinse thoroughly with deionized water.
5. Rinse thoroughly with pesticide grade Acetone.
6. Rinse thoroughly with pesticide grade Methanol.
7. Rinse thoroughly with pesticide grade Hexane.
8. Rinse or soak with 1:1 HCl (Hydrochloric Acid).
9. Rinse or soak with >10% HNO3 (Nitric Acid).
10. Bake at 105 C for 1 hour.
11. Bake at 180 C (prior to use as per method).
12. Drain, then heat in muffle furnace for 30-60 minutes at 400 C.
13. Clean, dry glassware should be sealed and stored in dust-free environment.
14. Soak in oxidizing agent (Chromic acid or equivalent); preferably hot (40-50 C).
15. Last step (prior to use) should be a rinse with the solvent used in analysis.
16. Drain, then heat in muffle furnace for 1 hour at 550 C.
17. Heat 1 hour in EDTA solution at 90-100 C.
18. New glassware must be soaked overnight in 10% HNO3 or HCl.
19. New glassware must be soaked overnight in seawater.
20. Rinse thoroughly with dilution water.

CLASS A VOLUMETRIC GLASSWARE SHOULD NOT BE BAKED

6.2 LABORATORY REAGENT STORAGE

1. Laboratory reagents and chemicals must be stored according to method guidance and the manufacturer's instructions. All solvents used for VOC analyses shall be stored separately.

2. Reagents should be segregated according to compatibility groups (e.g. Solvents {flammable/non-flammable}, bases, acids, reactive chemicals, etc.). Storage should follow all OSHA requirements.

3. A permanent record of reagent storage and preparation shall be maintained for all chemicals. At a minimum, these records shall document:
   a. storage conditions and location for reagents (implemented internal laboratory SOPs and/or safety plans that outline storage conditions and location may be used in lieu of specific reagent container records)
   b. vendor name
   c. date received/date opened
   d. expiration dates
   e. lot numbers
   f. preparation dates
   g. amounts and concentration of all source reagents and compounds used
   h. signature or initials of preparer.
   I. pH of microbiological culturing medias before and after sterilization

4. Documentation shall be maintained on all sources of analyte-free water. This documentation shall include records on all maintenance, cartridge-changing and miscellaneous tasks performed to upkeep or repair the system and all routine QC analysis protocols specifically scheduled and performed to monitor the system. Records must be maintained which identify the source and the specific use of analyte-free water that is obtained from commercial vendors.

6.3 LABORATORY WASTE DISPOSAL

Handling, storage and disposal of laboratory-related hazardous wastes are subject to the regulations contained in the Resource Conservation and Recovery Act.

It is the responsibility of the laboratory to store, package, label, ship and dispose of hazardous wastes in a manner which ensures compliance with all Federal, State and local laws, regulations and ordinances.

A waste is considered hazardous if:

1. The waste material is listed as hazardous in 40 CFR Part 261.30-261.33.
2. The material exhibits any of the characteristics of hazardous waste: (ignitability, corrosivity, reactivity or TC toxicity).
3. The waste is listed in 1 or 2 above and is not excluded by any provisions under the Resource Conservation and Recovery Act.

A waste is considered an acute hazardous waste if it is identified in 40 CFR Part 261.31, 261.32 or 261.33 (e) as an acute hazardous waste.

Laboratories that generate hazardous waste are put into 3 categories based on the amount of hazardous waste generated monthly. These categories are: 1) conditionally exempt small quantity generator; 2) small quantity generator and; 3) full generator:

1. Conditionally Exempt Small Quantity Generator
A generator who generates no more than 100 kilograms of hazardous waste or 1 kilogram of acute hazardous waste in a calendar month and accumulates no greater than 1000 kilograms of hazardous wastes (40 CFR Part 261.5).

2. Small Quantity Generator
A generator who generates 100-1000 kilograms of hazardous waste per calendar month and accumulates no greater than 6000 kilograms of hazardous waste or more than 1 kilogram per month of acute hazardous waste (40 CFR Part 262.34).
3. Full Generator
A generator who generates hazardous wastes in excess of 1000 kilograms per calendar month or more than 1 kilogram per month of acute hazardous waste (40 CFR Part 262.34).

It is the responsibility of the laboratory to know which category their organization falls under. Since most laboratories will fall into the conditionally exempt small quantity generator category these disposal requirements are listed below.

Facilities falling into the small quantity generator and full generator categories must adhere to all regulations pertaining to waste, transport, storage and disposal in the Resource Conservation and Recovery Act.

Conditionally exempt small quantity generators must dispose of hazardous waste in an on-site facility or ensure delivery to a treatment, storage or disposal facility, which is:

1. Permitted under 40 CFR Part 270;
2. In interim status under 40 CFR Parts 270 & 265;
3. Authorized to manage hazardous waste by a state with a hazardous waste management program approved under Part 271; or
4. Permitted, licensed, or registered by a state to manage municipal or industrial solid waste*.
*(subject to local regulations).

6.3.1 GENERAL DISPOSAL/TREATMENT CONSIDERATIONS

1. Hazardous waste solvents, as identified in the 40 CFR Part 261 may not be evaporated off in a fume hood. Solvents evaporated off during the extraction/testing process are exempt.
2. Acidic & Basic wastes may be neutralized and disposed of via the sanitary sewer if they are not hazardous due to the presence of other constituents*. (*subject to local regulations).
3. Heavy metals may be precipitated out and the liquid portion disposed of via the sanitary sewer*. (*subject to local regulations).

6.3.2 STORAGE AND ACCUMULATION

Hazardous waste storage is limited to quantity and/or accumulation time and must comply with RCRA regulations as specified in the 40 CFR. These wastes should be packaged and separated according to compatible groups (e.g. solvents, acids, etc.)

6.3.3 SAMPLE DISPOSAL

Samples submitted to a laboratory for analysis are excluded from regulation as hazardous waste under 40 CFR Part 261.4(d) provided the samples are being transported to or from the laboratory, are being analyzed, are being held for analysis or are being maintained in custody for legal reasons. However, once a decision is made to dispose of laboratory samples, the exclusion provisions of 40 CFR Part 261.4(d) no longer apply. Samples that have been identified as hazardous may either be: 1) returned to the generator; or 2) disposed of according to applicable RCRA regulations summarized in this document. Samples which are determined to be non-hazardous may be subject to local environmental regulations. It will be the responsibility of the laboratory to be familiar with any such local regulations.

A sample collector shipping samples to a laboratory and a laboratory returning samples to a sample collector must comply with U.S. Department of Transportation (DOT), U.S. Postal Service (USPS), or any other applicable shipping requirements.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

7.1 INTRODUCTION

This SOP stipulates minimum calibration requirements necessary to ensure that the measuring system is capable of producing acceptable data. Acceptable calibration protocol must involve a demonstration that the instrument or measuring system is capable of acceptable performance at the beginning of the analysis sequence and that initial calibration is still valid after continued system operation.

7.2 GENERAL CONSIDERATIONS

7.2.1 Calibrations must be performed according to all analytical method directives OR as indicated in this Guidance Document if specifics are not addressed in the cited method.

7.2.2 Analytical method calibration acceptance criteria must be followed or if acceptance criteria are not specified in the method, general criteria presented in this SOP shall be used to verify an acceptable calibration.

7.2.3 The number of calibration standards used to achieve an acceptable calibration must adhere to the cited method. If this information is not in the method, then a minimum of a blank and 3 standards must be employed to develop calibration curves. See Section 7.5.3 for guidance on other types of analyses.

7.2.4 At least one of the calibration standards shall be at a concentration of 1 - 2 times the laboratory practical quantitation limit for the method. By using a calibration standard at that level, the laboratory can verify the PQL with each initial calibration.

7.3 STANDARD RECEIPT AND TRACEABILITY

7.3.1 Records to be retained for primary stock standards must include source, type of standard, date of receipt, lot number (if applicable), expiration date and purity statement.

7.3.2 Records to be maintained for preparation of intermediate standards must include identification of primary standards used, preparation date, methods of preparation (including specific dilution information), preparer identification, concentration prepared and expiration date.

7.3.3 Preparation records for working standards must include identification of primary and intermediate standards used in working standard preparation, date of preparation, method of preparation (including dilutions), concentrations prepared and preparer identification.

7.4 FREQUENCY OF STANDARD PREPARATION AND STANDARD STORAGE

7.4.1 STANDARD STORAGE

1. Standards must be stored according to analytical method guidance or supplier recommendations.

2. If no method or supplier guidance is available standards must be replaced upon decreased instrument response.

7.4.2 FREQUENCY OF STANDARD PREPARATION

1. If no method or supplier guidance is available standards must be renewed upon decreased instrument response.

2. It is recommended that all primary standards be held for no longer than one year.
3. Working standards are to be prepared on a daily basis unless specific method guidance stipulates differently.

7.4.3 Tables specifying standard storage protocol and standard preparation frequencies must be available for inspection at the laboratory.

7.5 LABORATORY INSTRUMENTS

7.5.1 INITIAL CALIBRATION

1. Instruments must be initially calibrated each time the instrument is set up or upon failure of any quality control calibration checks.

2. The number of standards to be used for initial calibration must conform to method protocol or general requirements in Section 7.5.3.

3. Correlation coefficients for photometric analyses must be calculated and documented and should be greater than or equal to 0.995.

4. A minimum of one quality control check standard at a mid-range concentration shall be analyzed prior to sample analyses to verify initial calibration. This quality control check standard shall be prepared independently of the calibration standards. Recoveries for this check standard should be between 90 and 110%, or as specified by the method.

7.5.2 CONTINUING CALIBRATION

1. One mid-range continuing calibration standard must be analyzed for each group of 20 samples analyzed. The check standard used for initial calibration verification will verify acceptable calibration for the first set of 20 samples.
Subsequent sample sets of 20 or portions thereof (if a complete set of 20 is not available), must have a continuing calibration check standard analyzed at the beginning of each sample set.

2. Recovery for the continuing calibration check standard shall be between 80 and 120%, the range specified by the analytical method or the documented acceptance range that is determined by internal historical data (see 9.2.3.4).

7.5.3 GENERAL CALIBRATION RECOMMENDATIONS BY SPECIFIC ANALYSIS OR ANALYSIS TYPE**

1. Titrimetric Analyses - Standardize all titrants just prior to use.

2. Residue or Solids Analyses
   a. Analyze Quality Control Check Samples on a quarterly basis.***
   b. See calibration requirements for analytical balances and ovens (Section 7.7.1 and 7.7.3).

3. Conductivity
   a. A minimum of 2 KCL standards must be analyzed bracketing the expected concentration of the samples to be analyzed.
   b. The readings for the calibration standards must be within 1% of the expected value.
   c. Continuing calibration checks must be within 1% of the true value.

4. Turbidity
   a. Calibration must be checked for each instrument testing range applicable to the levels of turbidity to be measured.
   b. If formazin standards are not used for the daily calibrations, then formazin standards must be prepared on a quarterly basis and compared with daily standards.
   c. Calibration must be checked every 20 samples with 1 standard in each applicable testing range.
   d. Acceptance criteria for all calibration and standard checks must be established per instrument accuracy specifications.

5. Dissolved Oxygen
   a. Probe - Calibrate against Winkler Titration on an annual basis. Results should agree within 0.2 mg/l.
   b. Winkler Titration - see titration section (7.6.3.1).

6. Color and Chlorine
   Final determination made by comparison against Nessler Tubes or sealed color standards.
   a. Confirm results against an approved alternate test procedure on a quarterly basis.
   b. Results should be within 10% of the original value.

7. Temperature
   a. Laboratory thermometers must be checked against an NIST certified thermometer on an annual basis. Results must be within the manufacturer's specifications.
   b. Other devices used to record temperature must be checked on a monthly basis against a thermometer that has been calibrated against an NIST certified thermometer.

8. BOD
   a. Analyze a glucose/glutamic acid check sample each day BODs are analyzed.
   b. Check standard recovery must satisfy method criteria.
   c. See Dissolved Oxygen calibration protocols (7.5.4).

9. Oil and Grease
   a. See calibration criteria for the analytical balance (7.7.3).
   b. Analyze a QC check sample on a quarterly basis (all applicable matrices).

10. Flash Point
   a. Analyze a solution of known flash point each day of operation.
   b. The flash point temperature should be within 5% of the literature flash point value.

11. Salinity
   a. Electrical Conductivity Method - follow protocols for conductivity calibration and standardize instrument for seawater analyses according to method protocol on a semiannual basis.
   b. Argentometric Method - standardize titrant daily and check method against a known seawater sample or alternate method quarterly.
   c. Hydrometric Method - check method against the argentometric method or with a QC check sample quarterly.
   d. Alternate method comparisons should agree within 10%.

12. Chlorophyll - analyze a QC check sample quarterly (if available).

13. Sulfate
   a. Gravimetric - analyze a QC check sample quarterly and follow calibration requirements for the analytical balance (Section 7.6.3).
   b. Turbidimetric - see requirements for calibration of turbidity (Section 7.5.3.4).
   c. If sulfuric acid is used for standard preparation, then it must be standardized with each preparation.

7.6 SUPPORT EQUIPMENT CALIBRATION

7.6.1 TEMPERATURE MONITORING

1. Ovens - temperature recorded daily. Temperatures must be within acceptable method range.
2. Incubators and water baths - monitor temperature twice daily for microbiological work and once for other applications. Temperatures must be within acceptable method ranges.

7.6.2 AUTOCLAVES

Must document that sterilization temperature and pressure has been achieved by the use of sterilization indicators with every autoclave run.

7.6.3 ANALYTICAL BALANCES

Monthly monitoring with Class S Weights. Results must fall within the suppliers acceptance criteria.

7.7 CALIBRATION DOCUMENTATION

Records must be maintained to document and verify acceptable instrument or measuring system calibration for each analysis.

7.7.1 Records must be maintained for all standard preparations and working standards must be easily traced to intermediate and primary standards used for preparation.

7.7.2 Acceptable calibration verification (% recoveries, correlation coefficients) must be recorded and easily identified with applicable daily calibrations.

7.7.3 If calibration acceptance criteria are based on manufacturer's instrument specifications or acceptable recoveries specified by QC check sample suppliers, then records of such activities must be maintained. Such records must be easily accessible and must establish verification of acceptance criteria.

7.7.4 Laboratories must have available for inspection a table specifying calibration acceptance criteria for all parameters.

7.8 DEFINITIONS

7.8.1 Mid-Range Standard - a standard in the middle of the linear range of the established calibration curve or a standard concentration in the middle of the expected sample concentration range depending on the type of determination to be performed.

7.8.2 Intermediate Standard - a standard prepared from the primary stock standard which is diluted to prepare the working calibration standards.

7.8.3 Working Standards - the standards that are actually analyzed to perform the instrument or measuring system calibration.

* Acceptance criteria presented in this guidance document are general advisory limits. Variances to the listed criteria must be supported with documentation. If the method stipulates different criteria, then the method criteria must be used to verify acceptable calibration.

** If analysis or analysis type is not mentioned in this SOP then method calibration protocol and general requirements as presented in this guidance document must be followed.

*** Recoveries for QC Check Samples should be between 90 and 110% or within acceptable ranges specified by the supplier.

8.0 PREVENTIVE MAINTENANCE

Preventive maintenance is the key ingredient to possessing analytical equipment that will produce reliable data over the life of the instrument.

Responsibility for preventive maintenance lies with the analyst and supervisory personnel in charge of the monitoring equipment. The analytical staff must be dedicated to the implementation of the preventive maintenance program and always watchful for signs that there is a need for maintenance activities. The analyst and supervisory personnel must be supported by vendor specialists or in-house experts that handle activities beyond simple repairs or maintenance.

The Preventive Maintenance Program must consist of:

1. A written PM schedule;
2. Documentation of all maintenance and repairs (records must be kept in an easily accessible manner);
3. Vendor operation and maintenance manuals available for all instrumentation; and
4. A written contingency plan specifying that backup equipment will be maintained for all instrumentation or stating that sampling events will be postponed and current sample load be invalidated until repairs are accomplished. If samples are sent to another laboratory the subject laboratory must have an approved CompQAP for the parameters of concern and the Project Manager must be notified if the analytical work is being performed under a Quality Assurance Project Plan.

Table 8.1 identifies preventive maintenance activities by instrument type with recommended frequencies. Please note that it may be necessary to perform activities more frequently depending on heavy workloads, sample types analyzed and/or instrument performance. If the instrument manufacturer recommends more frequent or additional maintenance activities these shall also be incorporated into the facility maintenance program.

Table 8.1

PREVENTIVE MAINTENANCE ACTIVITIES

INSTRUMENT/ACTIVITY	FREQUENCY
AA SPECTROPHOTOMETER (FLAME)	
Clean nebulizer	SA
Clean spectrophotometer quartz windows	W
Burner head cleaned; check tubing, pump and lamps	D(1)
O rings checked	M(1)
Fine Tune Wavelength; Check optics	A
Check electronics	A(3,4)
AA SPECTROPHOTOMETER (FURNACE)	
Check graphite tubes	D(1)
Flush autosampler tubing	D
Replace graphite electrodes and Shrouds	SA
Clean furnace housing and injector tip	D
Check electronics	A(3,4)
AA SPECTROPHOTOMETER (COLD VAPOR & HYDRIDE)	
Flush tubing (automated systems)	D(1)
Check absorption cell for vitrification	D(1)
Replace or clean quartz cell	3
Check electronics	A(3,4)
ICP	
Clean and realign torch	M
Clean nebulizer and spray chamber; Check peristaltic pump tubing and vacuum pump oil	W(1)
Check entire optical system (mirrors, windows, etc.)	A(3,4)
Check water lines, torch compartment and gases	D
Check electronics (voltages, waveforms, etc.)	SA
Check wavelength calibration and adjust as needed	SA
Run interference (interelement) standard	SA
GAS CHROMATOGRAPHS	
GENERAL	
Check septa, cylinder gas pressure, oxygen/moisture traps	D
Bake out injector body	2
Check electronics (voltages, waveforms, etc.)	Q(3,4)
Check GC temperature calibrations (injector, oven, detector)	Q
COLUMNS	
Change glass sleeve inserts, shorten ends of columns, change glass wool plugs, check for leaks or replace	3
ELECTRON CAPTURE DETECTOR	
Wipe Tests	SA
Hydrogen cleaning	3
Returned to factory for cleaning and refoil	3,4

Table 8.1, cont.

PREVENTIVE MAINTENANCE ACTIVITIES

INSTRUMENT/ACTIVITY	**FREQUENCY**
GAS CHROMATOGRAPHS, Cont.	
FLAME IONIZATION DETECTOR	
Clean	Q
Replace Flame Tip	A
PHOTO IONIZATION DETECTOR	
Clean lamp	M(1)
HALL ELECTROLYTIC CONDUCTIVITY DETECTOR	
Replace resin, change solvent and clean conductivity cell	3,4
Change Ni tube	Q
NITROGEN PHOSPHORUS DETECTOR	
Clean	Q
MASS SPECTROMETER	
Replace vacuum pump oil and change desiccant	A
Check ion source and analyzer (dismantle and clean, replace parts as needed)	Q
Check mechanicals (vacuum pumps, relays, gas pressures and flows)	Q
Check mass calibration w/ FC-43 (perfluorotributyl- amine)	D
PURGE AND TRAP	
Clean sparger	W
Change Trap	A
Bake Trap	2
Check purge flow	M
Check for leaks	M
HIGH PRESSURE LIQUID CHROMATOGRAPHY	
Gas lines checked for leaks	D
Clean mobile phase flow system with nitric acid	SA
Clean detector flow cells with nitric acid	SA (3)
Clean injection valve	A
Check solvent filters	W
Check pumps seals and check valve assemblies (clean and replace as pressures & flows of mobile phase indicate)	D
Lubricate oil felts, if present	M
Lubricate post column reagent pumps and check valve assembly oil felts	M
INFRARED SPECTROPHOTOMETER	
Clean instrument housing	M
Change desiccant and clean cells	Q
Clean windows	M

Table 8.1, cont.
PREVENTIVE MAINTENANCE ACTIVITIES

INSTRUMENT/ACTIVITY	FREQUENCY
AUTOANALYZERS	
Check for leaks, flush out system and clean up spills after use	D
Clean sample probe and check all tubing for wear and discoloration	M(1)
Clean optics	Q
Oil sample motor, lubricate gears, clean flow cell	SA
Clean pump rollers, platens and colorimeter filters	M
ION CHROMATOGRAPH	
Check for leaks	D
Check all lines for wear and discoloration	W(1)
Check pump pistons	A
TOC ANALYZER	
Change injection needle, clean injection port, and change catalyst	M
Inspect combustion tube	SA
RADIOCHEMISTRY	
LOW BACKGROUND GAS PROPORTIONAL COUNTERS	
Clean sample drawers and windows	W
LUCAS CELLS	
Clean Windows	M
REFRIGERATORS, INCUBATORS, OVENS	
Clean interior	M
Check thermometer temperature against certified thermometer or equivalent	A
ANALYTICAL BALANCES	
Clean pan and compartment	D
Check with class S weights	M
Manufacturer cleaning and calibration	A
AUTOCLAVES	
Gaskets checked	W(1)
Timing mechanism checked	SA
Clean interior	M
Sterilization indicator tape	D
MICROSCOPES	
Clean optics	M

Table 8.1, cont.

PREVENTIVE MAINTENANCE ACTIVITIES

INSTRUMENT/ACTIVITY	FREQUENCY
UV/VIS SPECTROPHOTOMETER/FLUOROMETER TD-700	
Lamp alignment checked	3,4
Windows cleaned	M
Check and adjust photomultiplier sensitivity and wavelength resolution	A
Replace lamp	4
Clean sample compartment before and after each use	D
Check electronics	A(3,4)
Adjust baseline for smoothness through entire wavelength range	SA
Clean cuvettes after each use	D
TOX ANALYZER (TOTAL ORGANIC HALOGENS)	
Clean titration cell; clean inlet and exit tube	W
Clean pyrolysis tube, recoat electrodes	5
pH AND ION SELECTIVE ELECTRODES	
PROBE	
Check probe for cracks and proper levels of filling solution; check reference junction; clean electrode	D(1)
Check response time	D
METER	
Check batteries and electronics for loose connections and cracked leads	D(1)
TURBIDIMETER	
Clean instrument housing	M
Clean cells	D
CONDUCTIVITY METER	
Check batteries and probe cables	D
Replatinize Probe	5
DISSOLVED OXYGEN METERS	
PROBE	
Check membrane for deterioration; check filling solution	D(1)
METER	
Battery level and electronics checked	D(1)
THERMOMETERS	
Check for cracks and gaps in the mercury	D(1)
TEMPERATURE PROBE	
Check connections, cables	D
Check against calibrated thermometer	D
AUTOSAMPLERS	
Check needles and tubing	D(1)
Clean	Q

Table 8.1, cont.

PREVENTIVE MAINTENANCE ACTIVITIES

INSTRUMENT/ACTIVITY	FREQUENCY
DATA SYSTEMS	
Clean computers, check battery backup and check ventilation fans	Q
AUTOMATIC SAMPLE COLLECTION SYSTEMS (ex. ISCO, Sigma, etc.)	
Check sampler operation (forward, reverse, automatic through three cycles of the purge-pump-purge cycle)	D(6)
Check purge-pump-purge cycle when sampler is installed	D(7)
Check the flow pacer that activates the sampler to assure proper operation	
Check desiccant	D(1,6)
Check batteries	D(1,6)
Check pumping rate against manufacturer's specifications	D(1,6)

KEY:

1	Replace as necessary
2	High background
3	Loss of sensitivity or failing resolution
4	Erratic response
5	QC failure
6	Prior to sampling event
7	In situ (under field conditions)

D	daily*
W	weekly
M	monthly
Q	quarterly
SA	semi-annually
A	annually

*Daily is defined as prior to use or a 12-hour period if equipment is run continuously

9.0 MINIMUM QUALITY CONTROL REQUIREMENTS AND ROUTINES TO CALCULATE AND ASSESS PRECISION, ACCURACY AND METHOD DETECTION LIMITS

9.1 QC CHECKS

9.1.1 LABORATORY QC CHECKS

The laboratory shall follow the minimum quality control requirements specified by each method. If no quality control requirements are listed in the method, or if the method quality control requirements are less stringent than those listed below, the laboratory shall follow the guidelines listed below:

9.1.1.1 Chemistry QC Checks

a. Method reagent blanks - shall be prepared and analyzed at a rate of one per sample set (see definitions in Appendix A).

b. Matrix Spikes - At least one sample in a sample set (or 5%, whichever is greater) with similar matrices shall be prepared and analyzed by the specified method. If a set contains samples of different matrices, matrix spikes should be prepared and analyzed for each matrix type. Matrix spikes must be included as routine protocol.

c. Reagent water or reagent matrix spikes - Reagent water or reagent matrix spikes may be used as additional QC checks to monitor the effectiveness of the method. If used, these must be analyzed at a frequency of 5%.

d. Quality control check samples - shall be analyzed in duplicate semiannually. Such samples shall be analyzed as blind samples (i.e., the component concentrations in these samples shall not be provided to the analyst until after analysis). If the data are not acceptable, the analytical results must be reported in a QA report (see Section 13).

e. Quality control check standards - shall be analyzed at a continuing frequency equivalent to 5% of the samples in the analytical set (i.e. one every 20 samples) or shall be analyzed at the beginning of each run to verify the standard curve.

f. Duplicate samples or matrix spike duplicates - at least one or 5% of all samples in a sample set with a similar matrix shall be selected and analyzed in duplicate. If a sample set contains samples from different matrices (e.g., effluent and drinking water), then duplicates or matrix spike duplicates should be analyzed for each matrix.

g. Continuing calibration standards shall be analyzed at a frequency equivalent to 5% of the samples in an analytical set. Alternatively, quality control check standards may be used (see e. above). At least one of these checks shall be a standard at a concentration of 1 - 2 times the laboratory stated PQL.

h. Additional quality control checks may be included and shall be used if specified by the approved method:

- a. Reagent purity checks
- b. Internal standards
- c. Surrogate spikes

9.1.1.2 Microbiology QC Checks

a. Blanks

1. Membrane Filter Analysis: For each set of samples, a control blank shall be run at the beginning (dilution water blank), every tenth sample (sample carry over blank), and at the end of the set.
2. MPN Analysis: A single tube of LTB broth media shall be inoculated with 10 milliters of sterile phosphate buffered dilution water (dilution blank control).

b. Duplicates - At least 10% of the known positive samples that have been processed shall be analyzed in duplicate or a minimum of one duplicate analysis per month for MF and MPN analyses.

c. Positive/Negative Controls - Microorganisms obtained from the American Type Culture Collection (ATCC) or equivalent sources shall be used to confirm the morphological and biochemical responses to test media. Positive and negative controls shall be run with each new lot of media, and monthly thereafter.

d. Water Quality Indicators:

1. Water source shall be tested monthly for chlorine residual, conductivity and standard plate count.
2. The concentration of metals in the water source shall be determined annually.
3. Water Suitability Test shall be conducted annually.

e. 5% of all positive environmental samples analyzed by membrane filter shall be verified per method requirements.

f. When using the MPN test, the MPN test shall be completed on 10% of all positive confirmed samples.

9.1.1.3 Laboratory QC Checks (Bioassays)

a. At least one set of controls (dilution water and hardness or salinity, if appropriate) shall be run with each test.

b. Analytical equipment shall follow the chemistry laboratory quality control checks listed above.

9.1.1.4 Laboratory QC Checks (Species Identification)

a. Should maintain or have access to a type specimen collection.

b. Must, at a specified frequency use outside experts to corroborate species identification.

9.2 ROUTINE METHODS USED TO ASSESS PRECISION AND ACCURACY

9.2.1 Precision and accuracy targets listed in the tables of Methods, Matrices and QA Targets must be generated from matrix spikes and matrix spike duplicates or duplicates of environmental samples. The laboratory must maintain a list of QC checks, as presented in Section 9.1.2, which identifies applicable analytical methods and the concentrations to be used to make the determination in terms of low, mid or high levels:

1. Low level is defined as concentrations from the minimum detection limit to a level 5 times the MDL.
2. Mid level is defined as the mean level between the minimum detection level and the upper end of the linear range.
3. High level is defined as concentrations at the upper and of the linear range.

9.2.3. The laboratories shall use the following formulas for calculating the precision and accuracy of test measurements and the associated acceptance ranges:

9.2.3.1 The precision of replicate pairs shall be calculated using one of the following formula:

a. The precision of duplicate pairs shall be calculated using

1. Percent Relative Standard Deviation (% RSD)

$$\% \text{ RSD} = \frac{s}{\bar{x}} \times 100$$

Where: $\bar{x}$ = Mean (average) of the data points
s = Standard deviation calculated as:

$$\sqrt{} \qquad \frac{\sum_{i=1}^{n} \qquad x-\bar{x}}{n-1}$$

In the case of pairs (duplicates) this formula becomes:

$$\% \text{ RSD} = \frac{A-B \text{ X } 2 \text{ X } 100}{A+B \text{ X } 2}$$

2. Relative Percent Difference (RPD)

$$\text{RPD} = \frac{A-B}{A+B} \text{ X } 200$$

Where: A = concentration in sample A
B = concentration in sample B

3. Industrial Statistic (I)

$$I = \frac{A-B}{A+B}$$

Where: A = concentration in sample A
B = concentration in sample B

9.2.3.3 The accuracy of a measurement shall be determined by the recovery of a known amount of analyte in a real sample as:

$$\% \text{ R} = \frac{Cs - Cu\ (100)}{s}$$

Where: Cs = concentration of spiked sample
Cu = concentration in unspiked sample
S = expected concentration of spike in sample
%R = percent recovery

9.2.3.4 Upper and Lower Warning and Control Limits to be used as acceptance criteria shall be calculated as follows:

$$\sqrt{} \qquad \frac{\sum_{i=1}^{n} \qquad x-\bar{x}}{n-1}$$

Where: s = Standard Deviation
n = Number of points or data pairs to be included in the calculation
x = Sample Percent Recovery or precision of replicates
$\bar{x}$ = Mean (average) of the data points

$CL = P_{av} \pm 3\ S$

Where: CL = Control limit (upper and/or lower)
P_{av} = Mean of P (average percent recovery or average % RSD)

$WL = P^{av} \pm 2\ S$

Where: WL = Warning limit (upper and/or lower)

9.2.3.5 Microbiological quality control acceptance criteria shall be calculated per formulae specified in Standard Methods for the Examination of Water and Wastewater, 17th Edition, Method Number 9020, Section 4.b (pp. 9-17 and 9-18).

9.2.4 Quality Control charts must be prepared or other easily followed system instituted to track results of QC checks.

9.2.5 Quality control charts or tabulation systems must be updated every 20 data points or annually at a minimum.

9.3 METHOD DETECTION LIMITS AND PRACTICAL QUANTITATION LIMITS

9.3.1 METHOD DETECTION LIMITS (MDLS)

MDLs shall be determined by:

1. EPA - "Definition and Procedure for the Determination of the Method Detection Limit - Revision 1.11", 40 CFR Part 136, Appendix B;

IN ALL CASES, THE METHOD DETECTION LIMIT IS DEFINED TO BE THREE TIMES THE STANDARD DEVIATION DERIVED FROM THE STUDY.

9.3.2 PRACTICAL QUANTITATION LIMIT (PQLS)

The PQL is defined as 12 times the standard deviation that is derived from the procedures used to determine MDL.

Note: EPA is currently considering changing the names BUT NOT THE DEFINITIONS of the above-mentioned terms:
MDL is proposed to be Method Detection Level (currently method detection limit); and
RDL is proposed to be Reliable Quantitation Level (currently practical quantitation limit).

9.3.3 VERIFICATION

MDLs or PQLs shall be verified on an continuous basis (see 9.1.2.1.g).

9.4 DOCUMENTATION

9.4.1 FIELD QC CHECKS

See the Custody Section for Field QC checks.

9.4.2 LABORATORY CHECKS

1. Records which document sample/standard preparation, source and concentration (this includes protocols for preparation and certification, if applicable) must be maintained. All required records specified in the Calibration SOP must be maintained.
2. Identification of analyses set that the applicable QC sample is associated with.
3. Calculations performed to determine QC results.
4. Control limits used to evaluate analysis results and how these were determined.

9.4.3 MDL STUDIES

1. Documentation for the MDL studies must be conducted according to all other SOPs regarding sample and standard handling procedures, calibrations, QC checks and analyses.
2. Documentation must include:
    a. Date of studies and calendar period for which the studies are applicable
    b. Analytical Method
    c. Identification of analyst responsible for analysis
    d. Compounds studied

10.0 DATA REDUCTION, VALIDATION AND REPORTING

10.1 DATA REDUCTION

Data reduction includes all activities that convert instrument/computer responses into reportable results. These activities may involve mathematical calculations, compound identification and summary statistics. The final results may be obtained in two ways:

1. Direct readings from the instrument; or
2. Calculations based on instrument output, readings or responses.

The initial data reduction is the responsibility of the analyst or field technician who operates the analytical instrument. In addition to the general duties specified below, additional responsibilities for manual and computer related data reduction have been specified.

1. Calculate spike recoveries and precision for duplicates;
2. Identify quality control data (blank, spikes, duplicates, etc.) for review by quality assurance officer;
3. Assure accurate transcription of sample identification numbers on all records;

10.1.1 MANUAL DATA REDUCTION

1. If applicable, assure that all readings or output are precisely measured and noted on strip charts;
2. Select appropriate formulae for calculating final results;
3. Enter the formulae and at least one complete sample calculation on the strip chart or in the notebook;
4. Assure that all data are accurately transcribed into notebooks, forms or spreadsheets;
5. Enter all manual calculations into notebook or data records;
6. Check raw data entries with final computer output to assure accurate initial data entry;
7. Record appropriate and accurate information concerning sample identification, operating conditions, etc.

If raw data is entered into a computer program or spreadsheet for data reduction, the organization must be aware of and have on file a record of the mathematical formulae that are being used by the computer. If such information is not available, the organization shall verify the formula by manual calculations and maintain a record of the verification process.

All raw data output (strip charts, tabular printouts, etc.) must be retained as a part of the records. These records at a minimum must be identified with the following information: Date of run; sample ID numbers; analyst or operator; type of analysis (nitrate, metals, etc.). In addition, the following information must be maintained: instrument operating conditions (if applicable); detector and column types; instrument configuration; etc. The latter information may be kept in cross referenced records or may be entered on the various output records.

10.1.2 COMPUTER/INTEGRATOR REDUCTION

1. Assure that all data to be used in final calculations are entered accurately: sample weights or volumes; final extract volumes; dry weight factors; dilution factors; surrogate standard concentrations, etc.;
2. Properly interpret the computer output in terms of properly identified components, positive or negative identifications, and appropriate confirmatory measures;
3. Record appropriate and accurate information concerning sample identification, operating conditions, etc.;
4. Calculate surrogate recoveries and internal standard responses (if applicable);
5. GC and GC/MS analyses should be checked to verify that target components are within acceptable retention time windows and that additional confirmation (if needed) is initiated.

Many analytical instruments are interfaced with computers or integrators that automatically evaluate, identify and calculate final values. The results are printed in combinations of graphic (ex.

chromatograms) and tabular forms. As with manual data reduction, the organization must be aware and should have a record on file of the mathematical formulae or algorithms that are being used by the computer. If the information is not available, the organization shall maintain records which demonstrate that the software is providing the expected results (e.g. check sample or check standard data is acceptable).

Typically computer data files are identified by a queue number or a data file number. In such cases, the organization must maintain a cross reference index or log to identify the computer data files with sample ID numbers. Additional information that should be entered into the data file records are: date of run, analysis type, and analyst initials. Cross referenced auxiliary records are required to identify instrument operating conditions (if applicable); detector and column types; instrument configuration; etc.

10.1.3 FORMULAE AND CALCULATIONS

The final results of each test shall be calculated by the formula specified in the analytical method that is being used.

The final result should be rounded off to an appropriate number of significant figures (typically 3 significant figures). If the digit 6,7,8 or 9 is dropped, increase the preceding digit by one unit; if the digit 0,1,2,3, or 4 is dropped, do not alter the preceding digit. If the digit to be dropped is 5, round off the preceding digit to the nearest even number: 2.225 becomes 2.22 and 2.335 becomes 2.34.

As a general rule the results should be converted to the reporting units presented on Table 10.1. Other reporting conventions (i.e. wet weight instead of dry weight) should be clearly identified on the final reports with appropriate justification.

Note: If components of interest are detected in any quality control blank (e.g. method blanks, digestion blanks, etc.), the blank concentration must be reported. The blank concentration shall not be subtracted from any associated sample data.

10.2 DATA VALIDATION

10.2.1 DATA INTEGRITY

The purpose for implementing a data integrity plan is to promote shared accountability among staff that are responsible for analysis, reporting, and record keeping. This plan is designed to recognize that there is no single accountable person, but multiple persons and departments that must share the responsibility of maintaining integrity in laboratory testing. Benchmark's data integrity procedures are defined in detail in SOP GM-19, found among the Management SOP's.

A mandatory data integrity training session will be given for all new hires. At this session the laboratory manager or QA officer will define data integrity and review the data integrity plan:

- Employees will be given examples of unethical behavior as related to data manipulation.
- Employees will be informed that all reports and data are subject to in-depth review and that any infractions found will be investigated.
- Any violations witnessed by an employee should be reported to a senior staff member or the QA Supervisor. This information will be kept confidential.
- A written ethical agreement will be signed stating employees will not engage in any unethical practices concerning data integrity.

The QA officer shall randomly select 5 data reports each calendar quarter, or submit blind samples to the laboratory as a means of verifying that data integrity requirements are being met. If any violations are found, an immediate investigation will be conducted. Any disciplinary actions taken as a result of the investigation will be documented in locked file cabinets and protected by passwords electronically, to ensure confidentiality. Data integrity procedures will be reviewed by management on an annual basis.

Table 10.1
DATA REPORTING UNITS

TEST NAME OR COMPONENTS	REPORTING UNITS			
	WATER	SED	FISH	WASTE
Metals except:	ug/L	mg/kg	mg/kg	mg/kg
Reports for potable(drinking water),				
Calcium, magnesium, sodium, potassium	mg/L	mg/kg	mg/kg	mg/kg
Microbiological parameters except:	cfu/100mL	#/gram		
Heterotropic Plate Count (HPC)	cfu/mL			
Purgeable organic components (VOCs and VOAs)	ug/L	ug/kg	mg/kg	mg/kg
Extractable organic components Including pesticides and herbicides except:	ug/L	ug/kg	mg/kg	mg/kg
Dioxin/Furan Scan and Dibenzo dioxins and dibenzofurans	ng/L	ng/kg	ng/kg	ng/kg
Odor (60 Degree C)	TON			
Odor (Room Temp)	TON			
pH (Laboratory)	units			
Carbon Dioxide	mg/L	mg/kg	mg/kg	mg/kg
Color (True-PTCO)	CU			
Color (Apparent-PTCO)	CU			
Conductivity	uMHOS/cm			
Corrosivity	SI units			
Flash Point				DEG F
Hardness (as CaCO3)	mg/L			
Settleable Solids	ml/L/h			
Total Solids	mg/L	mg/kg		mg/kg
Volatile Total Solids	mg/L	mg/kg		mg/kg
Total Suspended Solids	mg/L	mg/kg	mg/kg	
Volatile Total Suspended Solids	mg/L	mg/kg		mg/kg
Total Dissolved Solids (180 Degree C)	mg/L			
Volatile Total Dissolved Solids	mg/L	mg/kg	mg/kg	
Toxicity (EP and TCLP)	mg/L			
Turbidity	NTU			
Radium-226, Total	pCi/L	pCi/g		
Radium-228, Total	pCi/L	pCi/g		
Radium-226, Diss	pCi/L	pCi/g		
Radium-228, Diss	pCi/L	pCi/g		
Gross Alpha, Total	pCi/L	pCi/g		
Gross Beta, Total	pCi/L	pCi/g		
Acidity	mg/L	mg/kg	mg/kg	mg/kg
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L			
Alkalinity, Carbonate (as $CaCO_3$)	mg/L			
Alkalinity, Total (as $CaC0_3$)	mg/L	mg/kg	mg/kg	mg/kg
Bicarbonate (as HCO3 ION)	mg/L	mg/kg		
Carbonate (as CO_3 ION)	mg/L	mg/kg		
Ammonia (an N)	mg/L	mg/kg	mg/kg	mg/kg

Table 10.1
DATA REPORTING UNITS, cont.

TEST NAME OR COMPONENTS	REPORTING UNITS			
	WATER	SED	FISH	WASTE
Ammonia, Dissolved (as N)	mg/L			
Ammonia, Unionized (as NH_3)	mg/L			
Bromide	mg/L	mg/kg		mg/kg
Chlorate	mg/L	mg/kg		mg/kg
Chloride	mg/L	mg/kg		mg/kg
Chlorite	mg/L	mg/kg		mg/kg
Chlorine Residual	mg/L	mg/kg	mg/kg	mg/kg
Cyanide	mg/L	mg/kg	mg/kg	mg/kg
Cyanide Amenable to Chlorination	mg/L	mg/kg	mg/kg	mg/kg
Cyanide, Free	mg/L	ug/kg	mg/kg	mg/kg
Dissolved Oxygen (Winkler)	mg/L			
Dissolved Oxygen (Electrode)	mg/L			
Fluoride	mg/L	mg/kg	mg/kg	mg/kg
Nitrate-Nitrogen	mg/L	mg/kg	mg/kg	mg/kg
Nitrite-Nitrogen	mg/L	mg/kg		
Nitrate+Nitrite Nitrogen	mg/L	mg/kg	mg/kg	mg/kg
Nitrate+Nitrite Nitrogen, Dissolved	mg/L			
Ortho-Phosphate Phosphorus	mg/L	mg/kg	mg/kg	mg/kg
Silicon (Si)	mg/L	mg/kg	mg/kg	mg/kg
Silica (SiO_2)	mg/L	mg/kg	mg/kg	mg/kg
Sulfate	mg/L	mg/kg		mg/kg
Reactive Sulfides (as H_2S)	mg/L	mg/kg		mg/kg
Sulfides	mg/L	mg/kg		mg/kg
Sulfite	mg/L	mg/kg		mg/kg
Temperature	Deg C			
Total Dissolved Phosphorus	mg/L	mg/kg		mg/kg
Total Kjeldahl Nitrogen	mg/L	mg/kg	mg/kg	mg/kg
Total Kjeldahl Nitrogen, Dissolved	mg/L			
Total Petroleum Hydrocarbons (TPH)	mg/L	mg/kg	mg/kg	mg/kg
Total Phosphorus	mg/L	mg/kg	mg/kg	mg/kg
Bio-Chemical Oxygen Demand, 5 Day	mg/L	mg/kg	mg/kg	
Bio-Chemical Oxygen Demand, 5 Day, Dissolved	mg/L	mg/kg	mg/kg	
Bio-Chemical Oxygen Demand, 20 Day	mg/L	mg/kg	mg/kg	
Bio-Chemical Oxygen Demand, 60 Day	mg/L	mg/kg	mg/kg	
BOD, Carbonaceous, 5 Day	mg/L			
Chemical Oxygen Demand	mg/L	mg/kg	mg/kg	mg/kg
Chemical Oxygen Demand, Dissolved	mg/L			
Linear Alkyl Sulfonate (MBAS)	mg/L	mg/kg	mg/kg	mg/kg
Oil and Grease	mg/L	mg/kg	mg/kg	mg/kg
Phenols (4AAP)	ug/L	mg/kg	mg/kg	mg/kg
Total Organic Carbon	mg/L	mg/kg	mg/kg	mg/kg
Total Organic Carbon, Dissolved	mg/L			
Purgeable Organic Carbon	mg/L			
Total Organic Halogen	ug/L	ug/kg	mg/kg	

10.2.2 DATA VALIDATION

Data validation is accomplished through a series of checks and reviews that are intended to assure that the reported results are of a verifiable and acceptable quality.

A majority of these tasks should be performed by the Quality Assurance Officer, but some may be delegated to another individual (ex. supervisor) who was not actively involved with generating the data.

1. Verify that all quality control blanks meet criteria;
2. Review all other quality control data (spikes, duplicates, quality control check standards, quality control check samples, etc.) for acceptability;
3. Review all surrogate and standard additions spike recoveries and internal standard responses for acceptability;
4. Identify any sample set or data that are unacceptable and initiate appropriate corrective action measures;
5. Assign data qualifiers (if needed) to reported values;
6. Verify mass spectral interpretation (if applicable) and/or component identification;
7. Assign data qualifiers to all applicable data (see Table 10.2). Note: the reported value always precedes the data qualifier code.

10.3 DATA REPORTING AND OVERALL PROJECT VALIDATION

10.3.1 LABORATORY DATA REPORTS

The final reports from the laboratory may be generated in several different ways:

1. Hand written report forms;
2. Manually typed reports and narrative;
3. Computer generated reports;
4. Any combination of the above methods.

All parties who are involved with the data review and validation process are responsible for providing data entry operators or clerical personnel with accurate records for transcription. If data are automatically reported through a LIMS system, the final reviewer must assure that the appropriate commands have been input to release the data for final reports.

10.3.2 ENGINEERING PROJECT REPORTS

The final reports from an engineering firm or the organization responsible for a project involves assimilating and presenting data from both the laboratory and field. These reports may also include narratives on site history, an analysis of current findings; and conclusions and/or recommendations on further project work.

10.3.3 PROJECT VALIDATION

Project validation is the process by which all project data is reviewed prior to reporting the data to the client. This task is normally assigned to the project manager but may be performed by an individual who is responsible for overall management operations.

Table 10.2
DATA QUALIFIER CODES

SYMBOL	MEANING
	(Per 62-160.700 Table 1)
A	Value reported is the arithmetic mean (average) of two or more determinations. This code shall be used if the reported value is the average of results for two or more discrete and separate samples. These samples shall have been processed and analyzed independently. Do not use this code if the data are the result of replicate analysis on the same sample aliquot, extract, or digestate.
B	Results based upon colony counts outside the acceptable range. This code applies to microbiological tests and specifically to membrane filter colony counts. The code is to be used if the colony count is generated from a plate in which the total number of coliform colonies is outside the method indicated ideal range. This code is not to be used if a 100 mL sample has been filtered and the colony count is less than the lower value of the ideal range.
F	When reporting species: F indicates the female sex.
H	Value based on field kit determination; results may not be accurate. Value based on field kit determination; results may not be accurate. This code shall be used if a field screening test (i.e., field gas chromatograph data, immunoassay, vendor-supplied field kit, etc.) was used to generate the value and the field kit or method has not been recognized by the Department as equivalent to laboratory methods.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
J	Estimated value. A "J" value shall be accompanied by a narrative justification for its use. Where possible, the organization shall report whether the actual value is less than or greater than the reported value. A "J" value shall not be used as a substitute for K, L, M, T, V, or Y; however, if additional reasons exist for identifying the value as estimate (e.g., matrix spike failed to meet acceptance criteria), the "J" code may be added to a K, L, M, T, V, or Y. The following instances shall be noted along with the "J" qualifier for justification: 1. Surrogate recovery limits have been exceeded. 2. No known quality control criteria exists for the component. 3. The reported value failed to meet the established quality control criteria for either precision or accuracy. 4. The sample matrix interfered with the ability to make any accurate determination. 5. The data are questionable because of improper laboratory or field protocols (e.g. composite sample was collected instead of a grab sample).
K	Off scale low. Actual value is known to be less than the value given. This code shall be used if: 1. The value is less than the lowest calibration standard and the calibration curve is known to be non-linear 2. The value is known to be less than the reported value based on sample size, dilution or some other variable NOTE: This code shall not be used to report values that are less than the laboratory practical quantitation limit or laboratory method detection limit.

Table 10.2
DATA QUALIFIER CODES, cont.

SYMBOL	MEANING
	(Per 62-160.700 Table 1)
L	Off scale high. Actual value is known to be greater than the value given. To be used when the concentration of the analyte is above the acceptable level for quantitation (exceeds the linear range or highest calibration standard) and the calibration curve is known to exhibit a negative deflection.
M	When reporting chemical analyses: presence of material is verified but not quantified; the actual value is less than the value given. The reported value shall be the laboratory practical quantitation limit. This code shall be used if the level is too low to permit accurate quantification, but the estimated concentration is greater than the method detection limit. If the value is less than the detection limit use "T" below.
N	Presumptive evidence of presence of material. This qualifier shall be used if: 1. The component has been tentatively identified based on mass spectral library search; or 2. There is an indication that the analyte is present, but quality control requirements for confirmation were not met (i.e. presence of analyte was not confirmed by alternative procedures).
O	Sampled, but analysis lost or not performed.
Q	Sample held beyond accepted holding time. This code shall be used if the value is derived from a sample that was prepared or analyzed after the approved holding time restrictions for sample preparation or analysis.
T	Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only and shall not be used in statistical analysis.
U	Indicates that the compound was analyzed for but not detected. This symbol shall be used to indicate that the specified component was not detected. The value associated with the qualifier shall be the laboratory method detection limit. Unless requested by the client, less than the method detection limit values shall not be reported.
V	Indicates that the analyte was detected in both the sample and the associated method blank. Note: The value in the blank shall not be subtracted from associated samples.
Y	The laboratory analysis was from an improperly preserved sample. The data may not be accurate.
Z	Too many colonies were present (TNTC); the numeric value represents the filtration volume.
?	Data are rejected and should not be used. Some or all the quality control data for the analyte were outside criteria, and the presence or absence of the analyte cannot be determined from the data.
*	Not reported due to interference.

Table 10.2
DATA QUALIFIER CODES, cont.

SYMBOL	MEANING
	(Per 62-160.700 Table 1)
	The following codes deal with certain aspects of field activities. The codes shall be used if the laboratory has knowledge of the specific sampling event. The codes shall be added by the organization collecting samples if they apply:
D	Measurement was made in the field (i.e. in situ). This applies to any value (except pH, specific conductance, dissolved oxygen, temperature, total residual chlorine, transparency, or salinity) that was obtained under field conditions using approved analytical methods. If the parameter code specifies a field measurement (e.g. "Field pH"), this code is not required.
E	Indicates that extra samples were taken at composite stations.
R	Significant rain in the past 48 hours. (Significant rain typically involves rain in excess of ½ inch within the past 48 hours.) This code shall be used when the rainfall might contribute to a lower than normal value.
I	Data deviate from historically established concentration ranges.

NOTE: **1) The following codes found in Table 10.2 may or may not be acceptable for use with results submitted for compliance with 62-550 and 92-555, depending on the parameter(s) and/or the circumstances. Results with these codes will be evaluated on a case by case basis:**

J, Q, R, and Y

2) The following codes found in Table 10.2 are not acceptable for results submitted in compliance with 62-550 and 62-555 (i.e. Drinking Water):

A, F, H, N, O, T, Z, ? and *

10.3.3.1 Laboratory

a. Review all identified quality control checks. Assure that any deviations or questionable data have been reported with qualifiers or with appropriate explanations;

b. Check for overall project consistency and any obvious anomalous values;

c. Check for clerical errors, transposed numbers and accurate data transfer.

10.3.3.2 Field/Engineering

a. Review all quality control data (field and laboratory) for project acceptability. Attach appropriate justification or explanation for any questionable data;

b. Check for overall project consistency, including comparison with historical or expected results;

c. Check for clerical errors, transposed numbers and accurate data reporting.

All final reports should be verified and signed by the project manager(s), laboratory director or other individual who is responsible for the overall operations of the organization.

10.4 DATA STORAGE

All records of the laboratory that are pertinent to NELAC standards or a specified project must be retained for a period of at least 5 years after the completion of the project. These records include:

1. All field notebooks, data sheets and documentation on the sampling event;
2. All field and laboratory analytical records including supporting calibration, raw data, data reduction calculations, quality control information and all data output records (chromatograms, strip charts and other instrument response readout records);
3. All field and laboratory custody records including shipping receipts, sample transmittal forms, internal routing and assignment records and sample disposal;
4. All notebooks, data forms, and logs pertaining to laboratory operations including sample receipt and log in;
5. All records concerning receipt, preparation and use of calibration standards;
6. All statistical calculations used in data reduction and in determination of quality control limits;
7. Preventative maintenance records for all analytical and support equipment and instrumentation;
8. Copies of final reports;
9. Standard operating procedures.

Records such as SOPs, manuals and reference documents must clearly indicate the time period during which the procedure or document was in force.

Records that are stored by computers or PCs must have hard copy or write-protected backup copies.

The records must be protected from environmental degradation; stored under secure conditions to discourage tampering or vandalism; and must be cross indexed by project number, laboratory ID number or some other common identifier for easy retrieval.

Access to archived information shall be documented with an access log.

11.0 CORRECTIVE ACTIONS

Quality controls are used to monitor and assess the effectiveness and validity of a sampling or analysis activity. If a specified quality control measure is determined to be out of a predetermined acceptance range, and the source or reason for the deviation is not identified and corrected, the sample data associated with the quality control measure may not be useful or valid information.

Some quality control criteria (ex. calibration) have a direct effect on the test results. Others (ex. blanks and duplicates) are indicators of improper protocols or contamination.

11.1 QUALITY CONTROL MEASURES AND ACCEPTANCE CRITERIA

Table 11.1 identifies each of the quality control checks that are required by test methods acceptance criteria. The acceptance range criteria or the source of the acceptance range has been identified.

11.2 IDENTIFYING AND ASSESSING QC MEASURES

Generally, quality control information is reviewed by several individuals. The responsibility for the initial assessment of a quality control measure lies with the individual who (1) identifies the sample or procedure as a QC measure; and (2) has access to the test results:

11.2.1. The individual responsible for operating the analytical instrument or equipment must be responsible for assessing the following applicable QC Measures:

1. Method, reagent and calibration blanks
2. Calibration integrity: initial and continuing calibration, interference standards, and QC check standards
3. System performance checks
4. Tuning criteria
5. Surrogate and internal samples
6. Titrating solutions

11.2.2. The following checks are normally assessed by a secondary reviewer (supervisor or QA Officer), but may be evaluated by the primary analyst:

1. Standard Reference Material
2. QC Check Samples
3. Spiked samples (matrix and blank)
4. Duplicates

11.2.3. The following must be assessed by the organization or individual(s) responsible for sample collection, but may be reviewed by laboratory personnel if the sample has been identified as:

1. Precleaned and field cleaned equipment blanks
2. Trip blanks
3. Field collected duplicates
4. Split samples

11.3 DETERMINING THE SOURCE OF QC PROBLEMS

Once a problem has been identified, the process (whether analytical or review) should be halted until the reason for the problem has been identified. Finding the source of a QC problem involves identifying probable sources of error, and checking each source to determine if the protocols were properly followed. Common sources of error and expected follow-up protocols are outlined on Table 11-2. Usually, the individual who is responsible for identifying the problem is responsible for determining the cause. However, other personnel and organizations may need to cooperate.

11.4 INITIATING CORRECTIVE ACTION

When the source of a QC error has been identified, appropriate steps must be taken to eliminate or minimize recurrences.

11.4.1. If a QC measure listed in 11.2.1 above is not acceptable, testing cannot continue until the QC check meets specifications. Corrective actions may be initiated:

1. By the individual who is operating the instrument; or
2. By an individual in oversight authority (i.e. supervisor or QA Officer) if a solution is not immediately apparent.

11.4.2. Corrective actions for QC measures in 11.2.2 and 11.2.3 must be initiated by the individual who identifies the problem.

11.5 SPECIFIC CORRECTIVE ACTIONS

A list of expected corrective actions for each QC measure is included on Table 11-2. Since many QC problems have unique solutions, the corrective action protocols are not limited to those listed. Further assessment, based on an individual's experience and knowledge may be warranted.

11.6 DOCUMENTATION AND NOTIFICATION OF AFFECTED PARTIES

If a quality control measures fails to meet acceptance criteria, the QC measure, and the procedures were used to correct the problem must be documented.

Documentation does not imply a formal memo or corrective action form:

1. Corrective actions that are initiated during an on-going analytical run may be documented on the chromatogram, integrator or strip chart recorder records as well as in the instrument, analytical and/or field logs.
2. Corrective actions that require input or intervention of more than one individual must at a minimum be documented in the related logs and records. Corrective action forms for larger organizations are recommended.
3. If more than one organization is involved with identifying a QC problem and the associated corrective actions, formal memos are recommended, although dated and signed phone logs are acceptable. In all cases, a copy of all documentation should be maintained in the project files.

If an identified quality control problem affects more than one set of data or multiple projects, the documentation associated with identifying and resolving the problem must be cross referenced to all associated projects.

11.7 CORRECTIVE ACTIONS FROM EXTERNAL SOURCES

The need to initiate corrective action may be the result of activities or audits from external sources. Sources include systems audits; performance audits; split samples; blind QC samples; and findings from project or data validation review.

IN ALL CASES, CORRECTIVE ACTIONS MUST BE INITIATED.

Table 11.1
ACCEPTANCE CRITERIA AND CORRECTIVE ACTIONS FOR QUALITY CONTROL CHECKS

QC CHECK		ACCEPTANCE CRITERIA
BLANKS		
Method blank		<MDL or less than 1/10 of concentration of any batch sample
Reagent blank		
Calibration blank		
Precleaned Equipment Blanks		
Field Cleaned Equipment Blanks		
Trip Blanks		
CALIBRATION		
Calibration Standard (CALSTD)		a. Reference any method specific acceptance criteria, if none exists, use following criteria. b. A minimum correlation coefficient of 0.995 must be achieved.
Quality Control Sample (QCS)	**Nutrients:**	a. Reference any method specific acceptance criteria, if none exists, use following criteria. b. A standard deviation of +/- 10% of the standard's true value must be achieved.
Laboratory Check Standard (LCS)	**Nutrients:**	a. Reference any method specific acceptance criteria, if none exists, use following criteria. b. Must be within laboratory generated control limits. If outside control limits see following criteria. c. Data acceptable with a standard deviation of +/- 15% however, it must be footnoted on final report.
Interference standard		Method acceptance criteria
Tuning criteria		Method acceptance criteria
SYSTEM PERFORMANCE CHECKS		
Pesticide		Method acceptance criteria
Standard Reference Materials		Within certified limits
QC Check Samples		Within specified limits
SPIKES		
Matrix Spike (MS)	**Nutrients:**	a. Must be within laboratory generated control limits. If outside control limits see following criteria. b. Data acceptable with a standard deviation of +/- 20% however, it must be footnoted on final report.
Laboratory Fortified Blank (LFB)		Within method specified criteria

Table 11.1, cont.

ACCEPTANCE CRITERIA AND CORRECTIVE ACTIONS FOR QUALITY CONTROL CHECKS

QC CHECK	ACCEPTANCE CRITERIA
DUPLICATES	
Laboratory Duplicates	Nutrients: Within range specified in laboratory generated control limits
Matrix Spike Duplicates	Within range specified in laboratory generated control limits
Field Duplicates	Within range specified in laboratory generated control limits
OTHERS	
Surrogate Standards	Method acceptance criteria
Internal Standards	Method acceptance criteria
Split Samples	Meets precision criteria in laboratory generated control limits
Titrating Solutions	a. +/- 10% of expected (lab determined) value b. Replicate sample aliquot results are within method specified limits
MICROBIOLOGY	
Monthly parameters Chlorine Residual Conductivity Heterotrophic Count	Per Page 305 of EPA-600/8-78-017
Annual metals concentration	Per Page 305 of EPA-600/8-78-017
Distilled water suitability test	Per Table IV-A-3 of EPA-600/8-78-017
Incubators	35 +/-0.5 C or 44.5 +/-0.2 C
Duplicates	Within calculated precision criteria (See Standard Methods 17th Ed., pp. 9-17 and 9-18)
Morphological and Biochemical Confirmation	Per Table IV-A-5 of EPA-600/8-78-017
Positive and negative media controls	Per Table IV-A-4 of EPA-600/8-78-017
MF Blanks	<1 CFU
MPN dilution blanks	<1
Inhibitory Residue Test	The RPD between Groups A, B and C should be less than 15% if there are no toxic or inhibitory substances.
Inhibitory Residue Blank	<1 CFU

Table 11.1, cont.
ACCEPTANCE CRITERIA AND CORRECTIVE ACTIONS FOR QUALITY CONTROL CHECKS

QC CHECK	ACCEPTANCE CRITERIA
MICROBIOLOGY, cont.	
Membrane Filter Analysis	Verified colonies must be coliforms
MPN Analysis	Verified colonies must be coliforms

Table 11.2
PROBABLE SOURCES AND EXPECTED CORRECTIVE ACTIONS

1. **BLANKS**
   a. Sources and expected review procedures:
      1. Contaminated reagents - verify reagent sources
      2. Environmental Contamination (all sample collection, sample and analysis conditions) - review sampling handling protocols
      3. Improper or incomplete laboratory and/or field decontamination/cleaning procedures - review cleaning protocols
      4. Contaminated sample containers - verify source and storage conditions
      5. Contaminated source water - verify water source
   b. Expected Corrective Actions:
      1. Review data with respect to reported contamination levels. If sample concentrations are near the reported blanks levels, reprocess (reextract or digest) associated samples or resample. If sample concentrations or the reporting levels are significantly higher than blanks, or contaminants are not detected in the samples, report the sample data and concentrations in blank.
      2. Take measures to eliminate future problems: discard reagents, revise protocols, perform preventative maintenance on system, adjust use of interfering chemicals (solvents, fuels, etc.).

2. **CALIBRATION**
   a. Sources and expected review procedures:
      1. Improperly prepared or outdated standards - review preparation logs for calculation/dilution errors and use of expired sources.
      2. Improperly prepared or outdated check standard - verify check standard
      3. Poor instrument response - determine if preventative maintenance is required
      4. Incorrect calculations - review and verify all calculations
      5. Contamination problems (see blanks above)
   b. Expected Corrective actions:
      1. Recalculate calibration curve
      2. Prepare fresh standards
      3. Recalibrate instrument
      4. Perform preventative maintenance
      5. Perform mass calibration and retune
      6. Reanalyze all samples bracketing those from previous ACCEPTABLE QC check through next acceptable QC check.
      7. Take measures to eliminate sources of contamination

3. **SYSTEM PERFORMANCE CHECKS**
   a. Sources and expected review procedures:
      1. Pesticides:
         Poor column performance - replace/repack column
      2. Standard Reference Materials and QC Check Samples:
         a. Improper sample preparation or analysis - review all protocols associated with sample preparation and analysis
         b. Incorrect dilutions or calculations - recheck all calculations
         c. Contamination (see blanks above)
   b. Expected Corrective Actions:
      1. Reanalyze all samples bracketing those from previous ACCEPTABLE QC check through next acceptable QC check
      2. Reprocess all samples associated with QC check sample or standard reference material (unless the problem is unique to processing of the check sample)
      3. Take measures to eliminate sources of contamination

Table 11.2, cont.

PROBABLE SOURCES AND EXPECTED CORRECTIVE ACTIONS

4. **SPIKES**
    a. Sources and expected review procedures:
        1. Error in calculation - review/recheck all calculations
        2. Error in preparing or using spike solutions - review all preparation and/or analytical logs (including sample preparation) for proper dilutions, solvents, buffers, etc.
        3. Outdated standards - review expiration dates and standard preparation logs
        4. Contamination problems (see blanks above)
        5. Poor instrument response - determine if preventative maintenance is required
    b. Expected Corrective Actions:
        1. Take measures to eliminate contamination problems, reprocess if necessary
        2. Perform required maintenance and revise pm schedules
        3. Review preparation, calculation and record keeping to determine if additional training or more stringent protocols are needed
        4. If the laboratory has no historical data to show that the sample matrix produces consistently unacceptable (out of control) recoveries, and none of the sources discussed above are responsible for the problem, the sample must be reprocessed and reanalyzed. If reanalysis produces the same result, associated samples should be reported with qualified results. If results are different, all associated samples must be reprocessed for analysis.

5. **DUPLICATES**
    a. Sources and expected review procedures:
        1. Non representative sample - review sample collection and/or sample processing protocols
        2. Error in calculations - recheck calculations
        3. Contamination problems (see blanks above)
        4. See matrix spikes above
    b. Expected Corrective Actions:
        1. Report data with qualifiers and explanation
        2. Revise sample collection/sample processing protocols to assure a representative sample
        3. Takes measures to eliminate contamination problems.
        4. Reprocess and reanalyze sample set (if laboratory generated replicate).

6. **SURROGATE SPIKES**
    a. Sources and expected review procedures:
        1. See 4.a above
    b. Expected Corrective Actions:
        1. See 4.b above

7. **INTERNAL STANDARDS**
    a. Sources and expected review procedures:
        1. See 4.a above
    b. Expected Corrective Actions:
        1. See 4.b above
        2. Reanalyze samples from last acceptable QC check to next acceptable QC check

9. **SPLIT SAMPLES**
    a. Sources and expected review procedures:
        1. See 5.a above
    b. Expected Corrective Actions:
        1. See 5.b above

Table 11.2, cont.

PROBABLE SOURCES AND EXPECTED CORRECTIVE ACTIONS

10. TITRATING SOLUTIONS

a. Sources and expected review procedures:
   1. Error in calculation - review/recheck all calculations
   2. Error in preparing or using titrant and standard solutions - review all preparation and/or analytical logs (including sample preparation) for proper dilutions, solvents, buffers, etc.
   3. Outdated standards and/or - review expiration dates and standard preparation logs
   4. Contamination problems (see blanks above)
   5. Non representative sample - review sample collection and/or sample processing protocols
   6. Indistinct or inconsistent endpoint readings

b. Expected Corrective Actions:
   1. Take measures to eliminate contamination problems, reprocess if necessary
   2. Review preparation, calculation and record keeping to determine if additional training or more stringent protocols are needed
   3. If replicate analyses are not acceptable, titrate additional aliquots
   4. Reanalyze samples from last acceptable QC check to next acceptable QC check
   5. Train analysts to titrate to consistent endpoint

11. MICROBIOLOGY - MONTHLY PARAMETERS, METALS, WATER SUITABILITY

a. Sources and expected review procedures:
   1. Deionizer/Water not functioning properly

b. Expected Corrective Actions:
   1. Clean, replace cartridges and/or perform other preventative maintenance tasks
   2. Reanalyze water
   3. Reprocess samples (if still within holding times) or resample

12. MICROBIOLOGY - AUTOCLAVE

a. Sources and expected review procedures:
   1. Autoclave not functioning properly

b. Expected Corrective Actions:
   1. Perform preventative maintenance and resterilize

13. MICROBIOLOGY - INCUBATORS

a. Sources and expected review procedures:
   1. Incubator not functioning properly
   2. Thermometers or recording devices not functioning properly

b. Expected Corrective Actions:
   1. Perform preventative maintenance on devices, recalibrate if necessary
   2. Reprocess samples (if still within holding times) or resample

14. MICROBIOLOGY - DUPLICATES

a. Sources and expected review procedures:
   1. Counting errors or difficulties in identifying coliform organisms (membrane filter).
   2. Nonrepresentative sample.
   3. Contamination problems.

b. Expected Corrective Actions:
   1. Recount or re-examination colonies to determine counting error or misidentifications.
   2. Examine blanks and samples analyzed to determine possible sources of contamination.

Table 11.2, cont.
PROBABLE SOURCES AND EXPECTED CORRECTIVE ACTIONS

MICROBIOLOGY – DUPLICATES, Expected Corrective Actions, cont.

3. If 14.a.2 above is found to be the problem, or the problem has not been identified, data must be invalidated and resampling and retesting must occur.

15. MICROBIOLOGY - ATCC AND BIOCHEMICAL CONFIRMATION

a. Sources and expected review procedures:
   1. Media prepared improperly (incorrect pH, sterilized too long, etc.).
   2. Incorrect incubator temperatures.
   3. Media shelf life has expired and no longer functions properly.

b. Expected Corrective Actions:
   1. Isolate problem with media preparation.
   2. Confirm proper incubator temperatures.
   3. Prepare new batch of media from the same lot to determine media acceptability or discard media if the shelf life has expired.
   4. Prepare new media from a different lot number.
   5. Invalidate all affected data linked to the media that was not functioning acceptability.

16. MICROBIOLOGY - POSITIVE AND NEGATIVE MEDIA CONTROLS

a. Sources and expected review procedures:
   1. See 15.a.1-3 under ATCC or biochemical confirmation.
   2. Samples used were not positive or negative.
   3. Improper analytical protocol.
   4. Contamination problems (negative control).
   5. Colony misidentification.
   6. Stressed organisms that did not respond in a typical fashion.

b. Expected Corrective Actions:
   1. See 15.b.1-4 under corrective actions for ATCC or biochemical confirmation.
   2. Re-examine response for misidentifications.
   3. Use alternate positive and negative control samples to confirm media response and check on original samples.
   4. Invalidate data and retest if problem was with the media or testing system.

17. MICROBIOLOGY - MF BLANKS

a. Sources and expected review procedures:
   1. Equipment or rinse water/dilution water improperly sterilized.
   2. Rinsing technique not adequate.
   3. Contamination problems.

b. Expected Corrective Actions:
   1. Review sterility checks on the autoclave for rinse/dilution water and other associated equipment.
   2. Evaluate rinsing protocols between samples.
   3. Review testing procedures and test location for other sources of contamination.
   4. Reject data and resample

18. MICROBIOLOGY - MPN DILUTION BLANKS

a. Sources and expected review procedures:
   1. Equipment or dilution water not properly sterilized.
   2. Contamination problems during test procedure.

b. Expected Corrective Actions:
   1. Review sterility checks on the autoclave for dilution water and other sterilized equipment.
   2. Review testing procedures and location for possible sources of contamination.

Table 11.2, cont.

PROBABLE SOURCES AND EXPECTED CORRECTIVE ACTIONS

19. MICROBIOLOGY - INHIBITORY RESIDUE TESTS

a. Sources and expected review procedures:
   1. Detergent residues inhibit bacterial growth.
   2. Alternate rinsing practice alleviates the problem.

b. Expected Corrective Actions:
   1. Implement rinsing protocols that produce an acceptable inhibitory residue test.
   2. Change detergents to one that produces an acceptable test result under normal rinsing operations.

20. MICROBIOLOGY - MEMBRANE FILTER VERIFICATION

a. Sources and expected review procedures:
   1. Compare original counts against verified colony counts.

b. Expected Corrective Actions:
   1. Adjust initial colony count based upon positive verification percentage and report as verified coliform count.

21. MICROBIOLOGY - MPN COMPLETED TESTS

a. Sources and expected review procedures:
   1. Compare original results against completed test results.

b. Expected Corrective Actions:
   1. Adjust original MPN result calculated from the completed test results.

22. BIOASSAY - DILUTION WATER CONTROLS

a. Sources and expected review procedures:
   1. See 1.a.1-5 above

b. Expected Corrective Actions:
   1. Invalidate data and retest

12.0 PERFORMANCE AND SYSTEMS AUDITS

12.1 REQUIREMENTS FOR AUDITS OF LABORATORY OPERATIONS

12.1.2 INTERNAL AUDITS

12.1.2.1 Internal Systems Audit

Internal systems audits should be conducted as the complement to implementation and use of internal SOPs and Quality Plans, in order to assure good Quality Assurance management practices.

In general, procedures for conducting internal audits should be developed according to the following guidelines:

a. Schedule systems audits to occur with routine frequency. Annual auditing of all lab operations is a minimum recommendation. Audits of selected systems may be staggered throughout the year to accomplish this goal.

b. Develop a standardized protocol and list of minimum requirements which will constitute the style and scope of the audit and which will provide the criteria list by which operational deficiencies can be detected. These protocols and criteria should reflect the intent of all internal SOPs and Quality Plans, and should at a minimum conform to all regulatory requirements for procedures and documentation. The use of standardized audit forms and checklists is recommended.

c. Designate appropriate personnel as Quality Assurance staff and charge these officials with auditing responsibility and authority, preferably independently of and lateral to the chain of authority responsible for laboratory operations.

d. Encourage all staff members to adopt good Quality Assurance practices, at all levels of the organization and to perceive audits as an educational opportunity.

The scope of internal systems audits of lab operations should include, but is not limited to the proper execution of:

a. Electronic and paper documentation and filing associated with sample and data handling and all ancillary or support procedures, to include procedures employed to track all records pertinent to any sample results.
b. All sample log-in, trafficking, log-out and disposal.
c. Sample preparations.
d. Calibrations.
e. Sample analyses.
f. Data reduction, validation and reporting.
g. Standard and reagent preparation and storage.
h. Waste disposal and segregation.
I. Non-contaminating practices and the design/maintenance of non-contaminating laboratory environments.
j. Container and labware decontamination and storage.
k. Preventative maintenance and repair procedures.
l. QC management practices and assessment of analytical precision, accuracy and sensitivity.
m. proper promulgation and execution of established written procedures.]]

12.1.2.2 Requirements For Internal Performance Audits

Conduct blind, internal performance audits on all analytical systems. These audits shall be conducted at least semiannually.

General requirements for internal performance audits are:

a. Obtain QC samples of certified assay from external sources or vendors, or prepare QC check samples internally.
b. Samples may be composed in artificial matrices such as analyte-free laboratory water or in other matrices whose characteristics are well delineated and can be consistently controlled from sample to sample.
c. Analysts whose systems are to be audited shall not be made aware of the concentration values or the compound names of constituents of the audit sample. They may be informed of the nature of the samples or the audit samples may be inserted into the routine laboratory sample analysis train without the knowledge of the affected analysts.
d. Replicated analysis of the audit samples is discretionary. However, all routine QC procedures and sample handling procedures must be followed when analyzing performance samples. This is required in order that the performance audit may best represent the actual routine operations for the system.
e. Any corrective action taken must be completed within thirty days of an internal audit.

12.1.2.3 Documenting and Reporting Internal Audits

Document all aspects of the audit. Retain all standard forms used in the audit, as well as all notes and final reports. Distribute audit reports or deficiency lists and corrective action orders to appropriate management staff affected, and verify execution of satisfactory corrective actions with follow-up documentation (see Section 11). Provide copies of all of the above to all staff at all levels involved in the audit or whose system area was affected. The following may also be included in all documentation and reports:

a. Audit dates.
b. Auditor names.
c. Systems audited.
d. Parameters analyzed in performance audits.
e. Analysts involved in performance audits.
f. Personnel interviewed for systems audits.
g. All supporting documentation solicited or submitted in support of any systems, performance or data-package audit.
h. Narrative description or report of findings, including summary charts and tables.
I. Report condensations for executive summaries.
j. Statistical evaluation report for performance audit analytical results.
k. Recommended or required corrective actions.
l. List of personnel for report distribution and follow-up responsibilities associated with corrective actions.

13.0 GENERAL MANAGEMENT RESPONSIBILITIES

13.1 Client Complaints

The laboratory shall operate from a standard operation procedure for responding to client complaints. The procedures include provisions for conducting an internal audit of laboratory operations that are called into question by the client. If audit findings cast doubt on the correctness or validity of the laboratory's calibrations or test results, the laboratory shall take immediate corrective action and shall immediately notify in writing, any client whose work may have been affected. The laboratory will maintain a record of complaints and subsequent actions to resolve the complaint. Laboratory management shall review feedback from clients and corrective actions in response to client complaints.

The laboratory shall address client complaints through the following steps:

1) Obtain precise definitions of the complaint.

2) Complaints regarding issues other than reported data will be reviewed on a case-by-case basis by management.

3) Complaints regarding reported results or procedures will initiate internal audit:
    (a) Review all quality control checks.
    (b) Check for consistency and any obvious anomalous values.
    (c) Check for clerical errors, transposed numbers and accurate data transfer.
    (d) Verify that the sample ID numbers are correct and consistent with the chain of custody.

4) If the internal audit is not satisfactory or, if the client requests, then a reanalysis will be conducted:
    (a) Reanalyze the same sample if within hold time requirements.
    (b) Collect a new sample and reanalyze.

5) Client complaints will be documented as case narratives.

13.2 Confidentiality and Proprietary Rights

The laboratory does not currently conduct work requiring high security (i.e. National security). The laboratory will maintain this standard operating procedure to insure that clients confidential information and proprietary rights are not compromised. Client confidentiality will be retained through the following procedures:

a) Employees will be cautioned to avoid discussing laboratory business in social circles.

b) Employees will be cautioned to avoid discussing laboratory business in front of other visiting clients in the laboratory.

c) Reporting operations will carefully check mailings to ensure results are mailed to the correct clients.

d) Discarded reports will be submitted to a paper shredder.

e) Client results will not be discussed with other clients or compliance agencies without written permission of the client.

f) Data will not be transferred electronically without request from the client.

g) Electronically transmitted data that is sent via facsimile or other electronic means must include a blanket statement that is used to protect the confidentiality of client information sent in error.

h) Client ID's will be removed from copies of worksheets when a client requests a copy of raw data.

13.3 Personnel Training Processes/Procedures

13.3.1 Undue Pressure on Employees

All personnel are required to notify the laboratory of any outside burdens or conflicts that may adversely effect the quality of their work (i.e. secondary employment, self-employment, internship, etc.) by completing a Secondary Employment Form.

13.3.2 Technical staff members shall have the education and experience to demonstrate specific knowledge of their duties, laboratory operations, test methods, QA/QC procedures and records management.

The training process will operate from a documented standard operating procedure with the following components:

a) Technical degree.

b) College level technical courses completed.

c) Initial demonstration of capability.

d) Verification of familiarity with latest version of laboratory's quality manual relating to his/her responsibilities.

e) Verification that the most recent version of the test method or SOP has been read.

f) Demonstration of continued proficiency.

g) Verification of advisement of ethical and legal responsibilities.

h) Attendance of training courses or workshops on specific equipment, analytical techniques or laboratory procedures.

13.3.3 Demonstration of Capability

As a part of data validation, lab analysts are required to demonstrate that they can properly follow test method protocol. Therefore, an Initial Demonstration of Capability (IDC) must be completed by each analyst prior to first use of a given test method and at any time there is a change in test method or instrumentation related to the test method. In addition to the IDC, a Continuing Demonstration of Capability (CDC) must also be completed by the analyst on an annual basis following the IDC.

Method requirements for demonstrations of capability, if given, will be followed unless an analyte cannot be spiked (i.e. coliforms, pH, etc). If an analyte cannot be spiked, then correct analysis of four duplicate quality control samples within the laboratory's acceptance criteria will be acceptable. Please reference Table 13.1 for all other demonstration of capability requirements and acceptance criteria.

Table 13.1
Demonstration of Capability Requirements

METHOD	METHOD NAME	STANDARD	LDR	MDL (MDL > 0.1X VALUE)
SM2120B	COLOR	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		
SM2340C	HARDNESS	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		7 reps@2-3x est. IDL (annually)<20%RSD(50-150 %Rec)
SM2340B	HARDNESS (CALC)	CALCULATION CHECKED BY QC OFFICER		
140.1	ODOR	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		
SM4500H^+B	PH	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		
9045	PH	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		
SM2540C	TOTAL DISSOLVED SOLIDS	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		7 reps@2-3x est. IDL (annually)<20%RSD(50-150 %Rec)
SM2540D	TOTAL SUSPENDED SOLIDS	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		7 reps@2-3x est. IDL (annually)<20%RSD(50-150 %Rec)
1664	OIL AND GREASE & TPH	initial precision and recovery test O&G 4 samples<11%rsd 83-101%rec TPH 4 samples<28%rsd 83-116%rec		MDL<1.4 or<1/3 of MCL
170.1	TEMPERATURE	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		
180.1	TURBIDITY	QCS +/- 10 % quarterly	initially and verified every 6 months (with min. blk+ 3 stds)	
200.7	All 200.7 metals	QCS +/- 5 %	initially and verified every 6 months (with min. blk+ 3 stds)	7 reps at 2 to 3 x est MDL every 6 months
200 series	200 series AA metals	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
245.1	MERCURY	5 stds + QCS +/-10%		7 reps@2-3x est. IDL (annually)<20%RSD(50-150 %Rec)
300.0	All 300.0 Method Anions	QCS +/- 10 % quarterly	initially and verified every 6 months (with min. blk+ 3 stds)	7 reps at 2 to 3 x est IDL every 6 months
SM4500ClG	CHLORINE RESIDUAL	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		7 reps@2-3x est. IDL (annually)<20%RSD(50-150 %Rec)
SM4500NH_3C(18th Ed)	AMMONIA NITROGEN (AQ)	QCS +/- 10 % quarterly	initially and verified every 6 months (with min. blk+ 3 stds)	7 reps at 2 to 3 x est IDL every 6 months
SM4500NH_3C(18th Ed)	AMMONIA NITROGEN (SOLIDS)	QCS +/- 10 % quarterly		7 reps at 2 to 3 x est IDL annually
350.1	AMMONIA NITROGEN (AQ)	QCS +/- 10 % quarterly	initially and verified every 6 months (with min. blk+ 3 stds)	7 reps at 2 to 3 x est IDL every 6 months
350.1	AMMONIA NITROGEN (SOLIDS)	QCS +/- 10 % quarterly		7 reps LFB annually
DEP SOP 10/03/83	UNIONIZED AMMONIA (CALC)	CALCULATION CHECKED BY QC OFFICER		
351.2	TOTAL KJELDAHL NITROGEN (AQ)	QCS +/- 10 % quarterly	initially and verified every 6 months (with min. blk+ 3 stds)	7 reps at 2 to 3 x est IDL every 6 months
351.2	TOTAL KJELDAHL NITROGEN (SOLIDS)	QCS +/- 10 % quarterly		7 reps LFB annually
351-350	ORGANIC NITROGEN (CALC)	CALCULATION CHECKED BY QC OFFICER		
353.2	NITRATE + NITRITE (AQ)	QCS +/- 10 % quarterly	initially and verified every 6 months (with min. blk+ 3 stds)	7 reps at 2 to 3 x est IDL every 6 months
353.2	NITRATE + NITRITE (SOLIDS)	QCS +/- 10 % quarterly		7 reps LFB annually
353.2	NITRATE NITROGEN (CALC)	CALCULATION CHECKED BY QC OFFICER		
353/300+351	TOTAL NITROGEN (CALC)	CALCULATION CHECKED BY QC OFFICER		
365.3	ORTHO PHOSPHORUS	QCS +/- 10 % quarterly	initially and verified every 6 months (with min. blk+ 3 stds)	7 reps at 2 to 3 x est IDL every 6 months
365.3	TOTAL PHOSPHORUS (AQ)	QCS +/- 10 % quarterly	initially and verified every 6 months (with min. blk+ 3 stds)	7 reps at 2 to 3 x est IDL every 6 months
365.3	TOTAL PHOSPHORUS (SOLIDS)	QCS +/- 10 % quarterly		7 reps LFB annually
SM4500SiO_2C / 200.7	DISSOLVED SILICA	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		7 reps@2-3x est. IDL (annually)<20%RSD(50-150 %Rec)
410.4	CHEMICAL OXYGEN DEMAND	QCS +/- 10 % quarterly	initially and verified every 6 months (with min. blk+ 3 stds)	7 reps at 2 to 3 x est IDL every 6 months
420.1	TOTAL PHENOL	QCS +/- 10 % quarterly	initially and verified every 6 months (with min. blk+ 3 stds)	7 reps at 2 to 3 x est IDL every 6 months
445.0	CHLOROPHYLL A	QCS +/- 10% sets of 10 or more samples should be analyzed and the % RSD of chl a <15% for samples that are 10x IDL	Min 5 calibration stds. from 0.2 to 200 ug/L perform linear regression of response vs conc. upper limit LDR = (response-intercept)/slope	MDL: dilute 90%acetone until it yields a response which is 3x the ave. response of the blank filters. IDL: dilute 90%acetone until it is no longer detected by the fluorometer
6010	All 6010 Metals	document the background correction points, IDL study and IEC table.	initially and verified every 6 months (with min. blk+ 3 stds)	7 reps at 3 to 5 x est MDL
7471	MERCURY	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		7 reps@2-3x est. IDL (annually)<20%RSD(50-150 %Rec)
1311/1312	TCLP / SPLP	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		7 reps@2-3x est. IDL (annually)<20%RSD(50-150 %Rec)
SM3500FeB	FERROUS IRON	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		7 reps@2-3x est. IDL (annually)<20%RSD(50-150 %Rec)
200.7-3500FeB	FERRIC IRON (CALC)	CALCULATION CHECKED BY QC OFFICER		
SM10200H	CHLOROPHYL A,B,C	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM2320B	ALKALINITY	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%

METHOD	METHOD NAME	STANDARD	LDR	MDL (MDL > 0.1X VALUE)
300.1	All 300.1 method anions	QCS +/- 15% quarterly	initially and verified every 6 months (with min. blk+3 stds)	7 reps at 3 to 5 x est IDL every 6 months
9056A	All 9056 method anions	4LFB(80-120%REC) <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM4500ClO$_2$D	CHLORINE DIOXIDE	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM4500CO$_2$D	CARBON DIOXIDE (CALC)	CALCULATION CHECKED BY QC OFFICER		
SM2330B	CORROSIVITY (CALC)	CALCULATION CHECKED BY QC OFFICER		
SM2510B	SPECIFIC CONDUCTANCE	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM2520B	SALINITY	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM2540G	TOTAL FIXED SOLIDS	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM2540G	TOTAL SOLIDS	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM2540G	TOTAL SUSPENDED SOLIDS	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM2540G	TOTAL VOLATILE SOLIDS	4LFB(80-120%REC) at 10xMDL <20%RSD (anaually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM2540E / 160.4	VOLATILE SUSPENDED SOLIDS	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM2710B	S.O.U.R.	4 SAMPLES <20%RSD (80-120 %REC)		
SM3113B	As, Pb, Se, Sb and Tl	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)	initially and verified annually	7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
USAC EDB-09-3	Ellutriate Metals	4 SAMPLES or LFBs <20%RSD (80-120%REC)		
SM4500NO$_2$B	NITRITE NITROGEN	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM4500SO$_3$B	SULFITE	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM4500S^{2}D	SULFIDE	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM4500S^{2}H	HYDROGEN SULFIDE (CALC)	CALCULATION CHECKED BY QC OFFICER		
SM5210B	BOD	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM5310B	TOTAL ORGANIC CARBON	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM5540C	SURFACTANTS	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3x est. IDL over 3-5 days (annually) rsd<20%
SM5910B	UV-254	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		
FL-PRO	TPH (FL-PRO)	4 SAMPLES OR STANDARDS <20%RSD (80-120 %REC)		7 reps(50-150%rec) 2-3x est. IDL (annually) rsd<20%
335.4	TOTAL CYANIDE	QCS +/- 10 % quarterly	initially and verified every 6 months (with min. blk+ 3 stds)	7 reps at 2 to 3 x est IDL every 6 months
SM4500CNG	AMENABLE CYANIDE	4LFB(80-120%REC) at 10xMDL <20%RSD (annually)		7 reps(50-150%rec) 2-3X est. IDL over 3-5 days (annually) rsd<20%
9012B	TOTAL & AMENABLE CYANIDE	4LFB(80-120%REC) <20%RSD (annually)		7 reps(50-150%rec) 2-3X est. IDL over 3-5 days (annually) rsd<20%
SM9215B	HETEROTROPIC PLATE COUNT	4 SAMPLES/STDS %RSD WITHIN CURRENT CONTROL LIMITS		
READYCULT & SM9223B	TOTAL COLIFORM	4 SAMPLES/STDS %RSD WITHIN CURRENT CONTROL LIMITS		
SM9221B & QuantiTray	TOTAL COLIFORM (MPN)	4 SAMPLES/STDS %RSD WITHIN CURRENT CONTROL LIMITS		
SM9221E	FECAL COLIFORM (MPN)	4 SAMPLES/STDS %RSD WITHIN CURRENT CONTROL LIMITS		
READYCULT & SM9223B	E-COLI	4 SAMPLES/STDS %RSD WITHIN CURRENT CONTROL LIMITS		
QuantiTray	E-COLI (MPN)	4 SAMPLES/STDS %RSD WITHIN CURRENT CONTROL LIMITS		
SM9222B	TOTAL COLIFORM (MF)	4 SAMPLES/STDS %RSD WITHIN CURRENT CONTROL LIMITS		
SM9222D	FECAL COLIFORM (MF)	4 SAMPLES/STDS %RSD WITHIN CURRENT CONTROL LIMITS		
SM9230BC	FECAL STREP (MF)	4 SAMPLES/STDS %RSD WITHIN CURRENT CONTROL LIMITS		
ENTEROLERT	ENTEROCOCCI (MPN)	4 SAMPLES/STDS %RSD WITHIN CURRENT CONTROL LIMITS		
1600	ENTEROCOCCI (MF)	4 SAMPLES/STDS %RSD WITHIN CURRENT CONTROL LIMITS		
624	VOLATILE ORGANICS	4 STANDARDS (Ref. Table 5 Calibration and QC Acceptance Criteria EPA 624)		
8260		4 STANDARDS (Ref. Table 5 Calibration and QC Acceptance Criteria EPA 624)		
524.2		MINIMUM 4 STANDARDS (2-5 ug/L) <20%RSD (80-120 %REC)		7 reps over several days <20%RSD (80-120 %REC)
504.1	Ethylene dibromide / 1,2-Dibromo-3-chloropropane	MINIMUM 4 STANDARDS (2-5 ug/L) <20%RSD (80-120 %REC)		7 reps over several days <20%RSD (80-120 %REC)
552.2	Haloacetic Acids	MINIMUM 4 STANDARDS (2-5 ug/L) <20%RSD (80-120 %REC)		7 reps over several days <20%RSD (80-120 %REC)

▓ IDC METHOD REQUIRED
░ IDC BENCHMARK CRITERIA

13.4 Mechanisms for Reviewing New Work Relative to Facilities and Resources

The laboratory has the following procedure for reviewing all new work to ensure that it has the appropriate facilities and resources before commencing such work.

Evaluate whether:

a) The laboratory has the correct method certifications to meet compliance requirements of the client's permit.

b) Evaluate the time-line expectations of the client relative to the ability of the laboratory to meet the client's expectations.

c) Evaluate the laboratory's current operating effectiveness,
    - Data integrity
    - Corrective actions
    - Customer complaints
    - Proficiency testing results

d) Evaluate whether the space and type of space is appropriate for the new work.

e) Evaluate whether sufficiently trained personnel are currently available for assignment to new work.

f) Evaluate whether currently available equipment has the capacity and correct performance for new work.

13.5 Legal and Ethical Responsibilities of Employees

The Code of Conduct shall apply to all directors, officers and personnel in the laboratory and its purpose is to articulate Company standards of conduct and to provide guidance to employees in discharging their obligations under this Code.

a) The Company will not tolerate unlawful, improper or unethical conduct, or the appearance of impropriety by an employee. Employees are expected to use good judgement in a legal and ethical manner consistent with the standards established by the Code, in all their dealings on behalf of the Company. Each employee must use common sense and his/her own judgement in applying these standards to specific situations that may arise.

b) Company employees have their first business responsibility to the Company and are expected to avoid any activity that may affect their ability to impartially perform contract work.

c) Employees should not become involved in any activity that results in or may result in obtaining or acquiescing in the unauthorized receipt of competitor's confidential bid/proposal information.

d) Employees are strictly prohibited from engaging in any fraudulent conduct (including deceit, deception, concealment, breach of trust and any other act of dishonesty). All employees are expected to obey the law in this area and to deal fairly and openly in all business relations.

e) Company employees should not promise future employment or business opportunities to a procurement official or give anything of value to a procurement official. Both state and federal criminal statues strictly prohibit bribery, dispensing of gratuities and sub contractor kickbacks at the workplace.

f) The Company reserves the right not to employ close relatives of officers, or other high level employees of customers including competitors, or others with whom the company deals with, to avoid the appearance of conflict of interest, or to protect confidential information.

g) Any employee who knows of or suspects an unethical or prohibited practice has a duty to immediately report the incident to his/her supervisor. The Company will not tolerate violation of the Code of Conduct by any director, officer or employee and disciplinary action, up to and including dismissal, may result from any violation of this Code.

13.6 Departures from Documental Policies and Procedures

The laboratory performs work, (under special request from clients) that is not for compliance reporting. In some cases, work will be performed under procedures supplied by the client or under modified procedures that do not meet compliance requirements. This work will be conducted in the following way:

1) Samples will be provided unique log-in ID's in the same manner as compliance samples.

2) Those parameters using non-compliance procedures, will be marked as "non-compliance" on the chain of custody.

3) Containers will be marked as "non-compliance".

4) Routine, repeat out-of-compliance work will be collected in separate notebooks or files.

5) If the procedure for a non-compliance sample departs from documented procedures and is recorded in a compliance workbook, then that data will be noted in the margin as "non-compliance".

6) The final report will not contain reference to Benchmark's certification numbers.

APPENDIX A
Definitions

The following definitions are used by Benchmark EA, Inc. Employees are encouraged to use these terms as defined.

μmho – Unit of measurement used when analyzing samples for specific conductivity. One μmho is equal to one μS.

Acceptance Criteria – The numerical limits prescribed for accepting or rejecting generated data.

Accuracy – The degree of agreement of a measurement with an accepted reference or true value

Aliquot – Portion of a sample or standard prepared in accordance with prescribed criteria.

Ambient Temperature – For the purposes of this laboratory, the surrounding room temperature of the laboratory (~20-25°C).

Analytical Bias - The consistent appreciable noise observed in a method which is greater than zero.

Analytical Set - The basic unit for analytical quality control. Also known as sample set or analytical batch. The analytical set is defined as samples which are analyzed (or sampled together) with the same method sequence, the same lots of reagents and with the same treatment common to all samples. The samples must have been analyzed (or collected) within the same specified time period or in continuous sequential time periods. Samples in each set should be of similar composition.

Apparent Color - The color of water resulting from the presence of dissolved substances, which absorb light. Only applies to samples that have not been filters.

Aqueous – Laboratory testing matrix defined as an aliquot of sample consisting mostly of water. Any fresh water laboratory samples, <20% solid, are aqueous, i.e. ground; drinking and some surface water (<5ppt salinity) samples.

Audits - A systematic check to determine the quality of the operation of some function or activity.
Performance Audits - Quantitative data are independently obtained for comparison with routinely obtained data in a measurement system. Examples of these audits are EPA performance evaluation programs, commercial performance evaluation programs, split sampling program involving at least two laboratories, blind spike samples.
Systems Audits - These are qualitative in nature and consist of an on-site review and evaluation of a laboratory or field operations quality assurance system and physical facilities for sampling, calibration and measurements.
Project Audits - These consist of an independent review of all sampling and analytical activity records that are associated with a specific project or event to determine if the resulting data are valid and acceptable. Enough documentation must be available so that a reviewer is able to reconstruct the history of the samples from time of sample collection (or sample container acquisition) through final results and sample disposal.

Brilliant Green Lactose Bile Broth (BGB) – The culture medium used during the total coliform confirmed phase of the MPN and MF techniques.

Calibration - Process by which the correlation between instrument response and actual value of a measured parameter is determined. Calibration Curve: A curve which plots the concentration of known analyte standards against the instrument response to the analyte. Also known as a Standard Curve.
Calibration Standard (CALSTD) - A solution prepared from the primary dilution standard solution or stock standard solutions and the internal standards and surrogate analytes. The **CALSTD** solutions are used to calibrate the instrument response with respect to analyte concentration.

Quality Control Sample (QCS) – A solution of method analytes of known concentrations that is used to fortify an aliquot of **CALBLK** or when appropriate the **METHBLK**. The **QCS** is obtained from a source external to the laboratory and different from the source of calibration standards. It is used to check laboratory performance with externally prepared test materials, ie. "Second Source" and is typically half the concentration of the highest standard in the curve.

Laboratory Check Standard (LCS)- A solution of analytes prepared in the laboratory by adding appropriate volumes of the Stock Standard Solutions to reagent grade water. Typically there are three **LCS** per analytical run: low, medium, and high in concentration that span the range of the calibration curve.

Calibration Blank (CALBLK) – A volume of reagent grade water fortified with the same matrix as the calibration standards, but without the analytes, internal standards, or surrogates.

Chemical Waste - Includes sludge and residual from domestic or industrial wastewater processing, and liquid or solid chemicals that are no longer used for its intended purpose.

Chlorophyll a (*chl a*) – A photosynthetic pigment present in all green plants, including planktonic algae. It is known to 1 to 2% of the dry weight of the algae. It can be quantitatively measured to estimate the biomass of phytoplankton.

Chromogenic Substrate – Used in microbiological testing to detect the presence of an enzyme, ß-D-galactosidase. When ß-D-galactosidase is present the enzyme substrate reaction causes chromogen to be relased resulting in a color change. The color change indicates the presence of total coliform bacteria.

Colilert® – One brand of reagent used for the Enzyme Substrate Test. See MMO-MUG.

Colloidal Matter – Finely divided organic or inorganic matter; examples include clay, silt, plankton, microscopic organisms, etc.

Colorimetric – A laboratory method used to analyze certain chemical properties by measuring color spectrophotometrically.

Community Water System – A public water system that serves at least 15 connections used by year round residents or regularly serves at least 25 year round residents.

Confidence Level - The statistical probability associated with an interval of precision (or accuracy) values in a QC chart. The values of confidence intervals are generally expressed as percent probability. It is a commonly accepted convention that the result being tested is significant if the calculated probability is greater than 90 percent, and is highly significant if the probability is greater than 99 percent.

Confluent Growth (CFG) – A continuous bacterial growth covering the entire filtration area of a membrane filter or a portion thereof, in which bacterial colonies are not discrete.

Contaminant – Any physical, chemical, biological or radiological substance, or matter in water.

Correction Factor – A substitution factor used to compensate measurements of instruments not in agreement with traceable standards.

Correlation coefficient (r^2) – value obtained through linear regression of calibration standards.

Data Quality - The totality of features and characteristics of data that bears on its ability to satisfy a given purpose. The characteristics of major importance are accuracy, precision, completeness, representativeness, and comparability. These characteristics are defined as follows:

Representativeness - Expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Comparability - Expresses the confidence with which one data set can be compared to another.

Data Quality Objectives - A set of specifications that the environmental data must meet in order to be acceptable for its intended use in a program area. DQOs are commonly established for limits of detection and quality of data (precision, accuracy, representativeness and comparability).

Deionized Water (DI) – Water used by the laboratory that has ions and particulates (turbidity and microorganisms) removed by means of a purification system.

Detection Limits - The smallest concentration/amount of an analyte of interest that can be measured with a stated probability of significance. Detection limits must be further defined as:

Instrument Detection Limit - The smallest amount of an analyte of interest that generates an instrument response (signal) under prescribed conditions such that the magnitude of the signal is larger than the absolute uncertainty (error) associated with it.

Drinking Water (DW) - Water intended for human consumption, dermal contact, culinary purposes or dishwashing as approved by the Florida Department of Health.

EC Broth (ECB) – The culture medium used during the fecal coliform confirmed phase of the MPN and MF techniques.

EDTA – Aka ethylenediamine tetraacetate.

Environmental Sample - Means any sample from a natural source or source that may reasonably be expected to contribute pollution to or receive pollution from ground waters or surface waters of the state. This includes, but is not limited to: receiving waters; waters used to define natural background conditions; soils; sediments; industrial, domestic or municipal discharge effluents; chemical storage or handling facilities; waste disposal facilities or areas; industrial or agricultural chemical handling or application areas; surface water run-off; and facilities for handling or applying of chemicals for weed or insect control [definition per Rule 10D-41.101(7), F.A.C.].

Parent Sample - Refers to a sample from which aliquots are taken for testing purposes.

Subsample - Refers to any derivative obtained from a sample. These include, but are not limited to: aliquots; filtrates; digestates; eluates; fractions; extracts; reaction products; supernatants; etc.

Enzyme Substate Coliform Test – See chromogenic and fluorogenic substrate definitions for an example.

Equilibrium - A state of balance between opposing forces or actions that is either static (as in a body acted on by forces whose resultant is zero) or dynamic (as in a reversible chemical reaction when the rates of reaction in both directions are equal).

Field Duplicates – Two separate samples collected at the same time and placed under identical circumstances and treated exactly the same throughout field and laboratory procedures. Analyses of field duplicate indicate the precision associated with sample collection, preservation, and storage, as well as with laboratory procedures.

First draw sample – A one-liter sample of tap water that has been standing in plumbing pipes uninterrupted, for at least 6 hours and is collected without flushing the tap.

Fluorogenic Substrate – Used in microbiological testing to detect the presence of an enzyme, ß-glucuronidase. When ß-glucuronidase is present the enzyme substrate reaction produces a substance to be relased resulting in fluorescence at 366nm of UV light. The fluorescence indicates the presence of *Eschericia coli (E. coli)* bacteria.

Gravimetric – A laboratory method used to analyze certain chemical properties by measuring mass.

Ground water under the direct influence of surface water (GWUDI) – Any water beneath the surface of the ground with significant occurrence of insects, macroorganisms, algae, large diameter pathogens (i.e.*Giardia lamblia* or *Cryptosporidium)*, significant and rapid shifts in water characteristics (i.e.turbidity, temperature, conductivity or pH) which closely correlate to climatological conditions.

Ground Water (GW) - Any water that comes from beneath the surface of the ground. Includes all waters found below ground in confined or unconfined aquifers.

Haloacetic acids (five) (HAA5) – The sum of the concentrations in milligrams per liter of the haloacetic acid compounds, there are five: monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid and dibromoaceticacid, rounded to two significant figures after addition.

Halogen – One of the chemical elements: chlorine, bromine or iodine.

Heterotrophic Plate Count (HPC) – Formerly known as the standard plate count (SPC). A microbiological procedure for estimating the number of heterotrophic bacteria in water and measuring changes during water treatment and distribution. Unless stated otherwise, HPC refers to method (9215 A&B), the pour plate method, as set forth in Standard Methods for Examination of Water and Wastewater, American Public Health Association, 20th Edition, 1998, pp. 9-34 to 9-38.

Humic Material – Derived from humus, which is a dark material resulting from partially decomposed plant or animal matter.

Interferents – Substances present in a sample that may interfere with the final outcome of a laboratory procedure.

Ion-selective electrode (ISE) - an electrode that is used to measure the concentration of a specific ion in a solution by use of an ion-selective membrane.

Kjeldahl Nitrogen, Total – Sum of organic nitrogen; ammonia (NH3) and ammonium (NH4+) in the chemical analysis of soil, water, or wastewater. To calculate Total Nitrogen (TN), the concentrations of nitrate-N and nitrite-N are determined and added to TKN. TKN is determined in the same manner as organic nitrogen, except that the ammonia is not driven off before the digestion step.

Laboratory Fortified Blank (LFB) – An aliquot of reagent grade water or other blank matrices to which known quantities of the method analytes are added in the laboratory. The LFB is analyzed exactly like a sample, and is to determine whether the methodology is in control, and whether the laboratory is capable of making accurate and precise measurements.

Lauryl Tryptose Broth (LTB) – The culture medium used during the presumptive phase of the MPN and MF techniques.

Limited Use System – All water systems that have less than 15 service connections or which regularly serve less than 25 individuals daily at least 60 days out of the year or at least 25 individuals daily less than 60 days out of the year.

Limited Use Community Public Water System – Serves 2 or more rental residences or 5 or more non-rental homes. I.e. a triplex with 2 rental units, two rental mobile homes, at least 5 homes connected to the same system or a small group care facility.

Limited Use Commercial Public Water System – Serves any non-residential building. I.e. Stores that have the employees at the site or stores that have public access.

Linear Dynamic Range (LDR) - The concentration range over which the analytical curve remains linear.

Materials Safety Data Sheet (MSDS) – Written information provided by vendors concerning a chemical's toxicology, health hazards, physical properties, fire, and reactivity data including storage, spill, and handling precautions.

Matrix – specified sample type such as Aqueous, Saline, or Solid and Chemical Materials. The characteristic of an environmental or laboratory sample, associated with its physical and chemical properties, which defines how such a sample is handled when subjected to the intended analytical process.

Matrix Duplicate (MD) – Two aliquots of the same sample that are treated exactly the same throughout laboratory procedures

Matrix Spike (MS) – An aliquot of an environmental sample to which known quantities of method analytes are added in the laboratory. The **MS** is analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results. The background concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the **MS** corrected for background concentrations.

Matrix Spike Duplicate (MSD) - A second aliquot of a solid matrix sample to which known quantities of method analytes are added in the laboratory. The **MSD** is analyzed exactly like the matrix spike, and its purpose is to determine the precision between the two spikes.

Maximum Contamination Level (MCL) – The maximum permissable level of a contaminant in water, which is delivered to any user of a public-water system.

Membrane filter technique (MF) – A microbiological procedure for estimating the number of bacteria present in a sample. This laboratory conducts the MF procedure for the following bacteria: total coliform, fecal coliform, Fecal streptococcus and Enterococcus. Unless otherwise stated MF refers to method (9222 A, B&D and 9230C), as set forth in Standard Methods for the Examination of Water and Waste Water, American Public Health Association, 20th edition, 1998, pg.9-56 to 9-65 and 9-74 to 9-78.

Method Detection Limit (MDL) - The smallest amount of an analyte of interest that can be measured and reported with 99% confidence that the concentration is greater than zero.

m-Endo – The growth medium used to cultivate total coliform bacteria for the membrane filtration method. Available in agar or broth.

Method Blank (METHBLK) – An aliquot of reagent grade water or other blank matrices that are treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents, internal standards, and surrogates that are used with other samples. The **METHBLK** is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus.

m-FC – The growth medium used to cultivate fecal coliform bacteria for the membrane filtration method. Available in agar or broth.

MMO-MUG - Also known as the Enzyme Substrate Test. A microbiological procedure used for the simultaneous detection of total coliform and E. coli. Unless stated otherwise, MMO-MUG refers to method (9223 A&B), as set forth in Standard Methods for Examination of Water and Wastewater, American Public Health Association, 20th Edition, 1998, pp. 9-68 to 9-70.

Most Probable Number (MPN) – The reporting unit per 100mL that is the estimation of bacterial density used for the Multiple Tube Fermentation technique. For the purposes of this laboratory the terms MPN and Multiple Tube Fermentation are analogous.

Multiple Tube Fermentation – A microbiological procedure for estimating the number of Enterobacteria present in a sample. This laboratory conducts the Multiple Tube procedure for the following bacteria: total coliform and fecal coliform. Unless otherwise stated Multiple Tube Fermentation refers to method (92221A, C&E), as set forth in Standard Methods for the Examination of Water and Waste Water, American Public Health Association, 20th edition, 1998, pg.9-47 to 9-55.

Nesslerization – The addition of Nessler's reagent to a sample aliquot that yields a gold color when nitrogen is present.

Non-Community Water System – A public water system that is not a community water system i.e. a church. A non-community water system is either a "transient non-community water system " or a "non-transient non-community water system".

Non-Transient Non-Community Water System (NTNCWS) – A public water system that is not a community water system and that regularly serves at least 25 of the same persons over 6 months per year.

Organizational Terms:
Internal - Refers to operations, personnel, documents and protocols within the specified organization.
External - Refers to operations, personnel, documents and protocols from a party that is separate from or outside the specified organization.

Package Plant - In order to use less space, treat difficult waste, deal with intermittent flow or achieve higher environmental standards, a number of designs of hybrid treatment plants have been produced. Such plants often combine all or at least two stages of the three main treatment stages into one combined stage.

Parameter Group - Is defined as a group of samples that have been preserved in the same manner, prepared by similar protocols and analyzed using instruments of similar technology (also known as analyte group). Examples of parameter groups are:
Volatiles - (EPA methods 601, 602, and 624)
Pesticides - (EPA methods 608, 614, 622)
Trace Metals - (All metals except mercury)
Nutrients - (Total Kjeldahl Nitrogen, Nitrate $^+$ Nitrite, Total Phosphorous)

Performance Evaluation Samples - A sample submitted for analysis whose composition and concentration are known to the submittor but unknown to the analyst. Also known as a Blind Sample.

Pheophytin a (*phe a*) – A magnesium-free degradation product or derivative of *chlorophyll a*.

Point-of-entry treatment device (POE) – Treatment device applied to the drinking water entering a house or building for the purpose of reducing contaminants in the drinking water distributed throughout the house or building.

Point-of-use treatment device (POU) – Treatment device applied to a single tap used for the purpose of reducing contaminants in drinking water at that one tap.

Potentiometric - The apparent equivalence point of a titration at which a relatively large potential change is observed.

Potentiometric Surface - An imaginary surface formed by measuring the level to which water will rise in wells of a particular aquifer. For an unconfined aquifer the potentiometric surface is the water table; for a confined aquifer it is the static level of water in the wells. (Also known as the piezometric surface.)

Practical Quantitation Level (PQL) - The smallest concentration of an analyte of interest that can be reported with a specific degree of confidence. Per Benchmark EA's Quality Manual, this value is twelve times the standard deviation of the replicate analyses.

Precision - A measure of mutual agreement among individual measurements of the same property.

Primary Dilution Standard Solution (PDS) – A solution of several analytes prepared in the laboratory from stock standard solutions and diluted as needed to prepare calibration solutions and other needed analyte solutions.

Public Water System – A system that provides water to the public for human consumption through pipes or other conveyances, if such a system has at least 15 service connections or regularly serves an average of 25 individuals daily at least 60 days out of the year. A public water system is either a "community water system" or a "non-community water system".

Qualifiers - These codes shall be used by laboratories when reporting data values that either meet the specified description outlined below or do not meet the quality control criteria of the laboratory. Reference Table 10.2 of this Quality Manual for complete list.

Quality Assurance - A system of activities whose purpose is to provide the producer or user of environmental data the assurance that it meets defined standards of quality with a stated level of confidence.

Quality Plans (QP) - An orderly assembly of detailed and specific procedures which delineates how data of a known and accepted quality is produced.

Quality Control - The overall system of activities whose purpose is to document and control the quality of environmental data so that it meets the needs of the users.

Quality Control Measures:
1) Blanks - An artificial sample of an analytical matrix designed to monitor the introduction of artifacts into the system.
a) Field Quality Control Blanks
1) Field Blanks - Blanks of analyte free water that are prepared on-site by filling appropriate sample containers with the water, adding appropriate preservatives, sealing the containers, and completing the appropriate documentation. These blanks should be prepared during the middle to end of a sampling event by filling sample containers with water from the equipment decontamination water transport containers. They are to be treated, stored, transported, and analyzed in the same manner as the sample group for which it was intended. These blanks may be submitted for all water parameter groups.
2) Equipment Blank - Blanks of analyte-free water that are prepared on-site by pouring the equipment decontamination water through decontaminated field equipment. Appropriate sample containers, for each analyte group must be used, preservatives added, if required, and appropriate documentation must be completed. These blanks are to be stored, transported and analyzed with the intended parameter groups. At least one equipment blank is required for each water and solid matrix analytical group, and must be collected **at the beginning** of the sampling episode. If field decontamination is performed on-site, additional equipment blanks must be submitted for all water and solid matrix analytical groups.
3) Trip Blank - These blanks are required for only VOC samples. Blanks of volatile organic free water that are prepared by the organization that is providing the sample containers. These are transported to the site with the empty VOC sample containers, and shipped to the analyzing laboratory in the same containers as the VOC samples. They remain unopened for the entire trip. Proper labeling and documentation must be completed. A trip blank must be submitted for each cooler that transports VOC samples.
b) Laboratory:
1) Replicate Sample - Samples that have been collected at the same time from the same source (field replicates) or aliquots of the same sample that are prepared and analyzed at the same time (laboratory replicates). Duplicate samples are one type of replicate sample. The analytical results from

replicates are used to determine the precision of a system. If the concentration of analytes in the sample are below detectable limits, Duplicate Spike Samples may be used to determine precision. Blind Replicates (Duplicates) are replicates that have been collected (field replicate) or prepared (laboratory replicate) and are submitted and analyzed as separate samples (analyst does not know they are replicates).

2) Quality Control Checks - Standards or samples from an independent source that are analyzed at a specified frequency.

3) Split Samples - Replicates of the same sample that are given to two independent laboratories for analysis.

4) Acceptance Criteria - The numerical limits, prescribed by the approved analytical method or internal data, by which an analytical system is verified. These numerical limits may be generated from internal, historical data using the formula specified in Section 9.2.3.4. Acceptance criteria shall be generated and used for all Quality Control Measures described above. Also known as Control Limits.

ReadyCult® - One brand of reagent used for the Enzyme Substrate Test. See MMO-MUG.

Reagent Water – A sample of water which conforms to ASTM grades II, III or IV. For the purposes of this laboratory, deionized water used in a chemical reaction, especially one used to detect, measure, or prepare reagents

Recreational Water (RW) – Samples from a body of water where people swim recreationally i.e. public pool, public beach, public springs, etc.

Relative Percent Difference (RPD) - The difference between two sample results divided by their mean and expressed as a percentage.

Registered Water System – A commercial entity that does not use it's piped water for consumption, are required to provide bottled water as an alternative. Main uses include hand washing and toilet flushing.

Saline (SA) - Laboratory testing matrix defined as an aqueous aliquot of sample containing high levels of salts. Any laboratory samples >5ppt salinity are considered saline; examples of this are marina, estuary and seawater samples.

Sample Custody - All records and documentation required to trace a sample from point of origin through disposal after analysis. These records must include, but are not limited to:

1) Field notebooks;
2) Field sample ID tags;
3) Laboratory transmittal forms (if applicable);
4) Laboratory sample receipt logs;
5) Sample extraction/preparation logs or worksheets;
6) Analytical (instrument) logs or worksheets;
7) Calibration and quality control data associated with a sample set;
8) Instrument maintenance logs;
9) Sample disposition logs; and
10) Final reports.

Legal Chain of Custody is a special type of sample custody in which all events (i.e. possession, transport, storage, and disposal) and time intervals that are associated with a specific sample must be documented in writing. In addition to the records described above, chain of custody records must include the following:

1) Sample transmittal forms or tags that have adequate spaces for the dated, original signatures of all individuals who handle the sample (or cleaned sample containers if obtained from a contracted laboratory) from time of collection (or container receipt) through laboratory delivery.

2) Laboratory sample storage logs that identify date, time, and individuals who remove samples from storage.

3) Secure, limited access storage areas.

Sampling Kit - A set of sampling accessories that has been assembled for a specified use or project. A Sampling Kit may include, but is not limited to: sample containers; sampling equipment (e.g., bailers); sample preservatives, trip blanks; reagent transfer tool (e.g., disposable pipets); calibration standards; indicator papers (e.g., pH paper); or reagents. Sampling Kits shall be subject to the documentation outlined in Section 5.0.

Sediment (SDMNT) – Surface or subsurface soils and sediments of fresh or salt water origin (i.e. lake, stream, marina, etc.).

Sensitivity - The slope of the analytical curve.

Sludge (SLDG) - A muddy or slushy mass, deposit, or sediment as precipitated solid matter produced by water and sewage treatment processes

Solid - Laboratory testing matrix defined as an aliquot of sample consisting mostly of solid, but may have some liquid present. Any laboratory samples >20% solid material are considered solid; examples of this are sludge, digester and soil samples.

Source Water – Water as it enters a system.

Standard Bacteria Sample or "Bacti" - The standard aliquot, not less than one hundred milliliters (100 ml), of raw or finished drinking water that is examined for the presence of coliform bacteria.

Standard Methods Agar (SMA) - The growth medium used to cultivate heterotrophic bacteria for the Heterotrophic Plate Count.

Stock Standard Solution (SSS) – A concentrated solution containing a certified standard that is a method analyte. Stock Standards are used to prepare secondary or working standards.

Stoichiometric - Calculation of the quantities of chemical elements or compounds involved in a chemical reaction.

Subpart H System – A public water system using surface water or ground water under the direct influence of surface water as a source that are subject to the requirements of 40 CFR, Part 141 (National Primary Drinking Water Standards), Subpart H.

Supplier of Water – Any individual; corporation; company; association; partnership; municipality; State agency, Federal agency or tribal agency that owns or operates a public water system.

Surface Water (SW) – All water which is open to the atmosphere and subject to surface runoff.

Threshold Odor – Method used for measuring the intensity of odor.

Titrimetric - A common laboratory method of quantitative/chemical analysis that can be used to determine the unknown concentration of a known reactant.

Too Numerous To Count (TNTC) - When the total number of bacterial colonies exceed 200 on a 47-millimeter diameter membrane filter. Reported as >200cfu/100mL.

Total Trihalomethanes (TTHM) - The sum of the concentration in milligrams per liter of the trihalomethane compounds: trichloromethane (chloroform), dibromochloromethane, bromodichloromethane, tribromomethane (bromoform), rounded to two significant figures.

Transient Non-Community Water System (TWS) – A non-community water system that does not regularly serve at least 25 of the same persons over six months per year i.e. campground.

True Color – The color of water once turbidity has been removed.

Volumetric – A laboratory method used to analyze certain chemical properties by measuring volume.

Wastewater - Includes any influent or effluent associated with domestic or industrial waste treatment facilities.

Water System – The mechanical and electrical assembly of one or more pumps, pipes, storage structures, treatment equipment and distribution network meant to provide water to the plumbing of a building or premise.

Well - Any excavation that is constructed when the intended use of such excavation is to conduct ground water from a source bed to the surface (by pumping or natural flow) when ground water from such excavation is used for a public water supply system.

APPENDIX B
Selected References

Quality Control/Quality Assurance

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ISCO 6712 FULL SIZE PORTABLE SAMPLER

Isco 6712 Full-size Portable Sampler

Isco's 6700 Series Portable Samplers have set the industry standard, providing the most comprehensive and durable performance available. With the introduction of our new 6712, Isco takes another step toward the ultimate by including SDI-12 interface capabilities.

This full-size portable lets you take full advantage of the advanced 6712 Controller, with its powerful pump, versatile programming, and optional plug-in modules for integrated flow measurement. Setup is fast and simple, with online help just a key stroke away.

The environmentally-sealed 6712 controller delivers maximum accuracy and easily handles all of your sampling applications, including:

- Flow-paced sampling with or without wastewater effluent
- stormwater monitoring
- CSO monitoring
- permit compliance
- pretreatment compliance

In the Standard Programming Mode, the controller walks you through the sampling sequence step-by-step, allowing you to choose all parameters specific to your application. Selecting the Extended Programming Mode lets you enter more complex programs.

Optional land-line and GSM and CDMA cellular telephone modems allow programming changes and data collection to be performed remotely, from a touch-tone phone. They also provide dial-out alarm.

Bottle options are available for practically any sequential or composite application.

Versatile and Convenient

With eleven bottle choices, Isco's 6712 Sampler lets you quickly adapt for simple or intricate sampling routines. Up to 30 pounds (13.5 kg) of ice fits in the insulated base, preserving samples for extended periods, even in extreme conditions. The 6712 with the “Jumbo Base” option holds bottles up to 5.5 gallon (21 liter).

Tough and Reliable

The 6712 Portable Sampler features a vacuum-formed ABS plastic shell to withstand exposure and abuse. Its tapered design and trim 20-inch (50.8 cm) diameter result in easy manhole installation and removal. Large, comfortable handles make transporting safe and convenient—even when wearing gloves.

Isco's 6712 Portable Sampler carries a NEMA 4X, 6 (IP67) enclosure rating.

Superior capability, rugged construction, and unmatched reliability make the 6712 the ideal choice for portable sampling in just about any application.

Specifications

Isco 6712 Full-size Portable Sampler

Size (Height x Diameter):	27 x 20 inches (50.7 x 68.6 cm)
Weight:	Dry, less battery - 32 lbs (15 kg)
Bottle configurations:	24 - 1 Liter PP or 350 ml Glass 24 - 1 Liter ProPak Disposable Sample Bags 12 - 1 Liter PE or 950 ml Glass 8 - 2 Liter PE or 1.8 Liter Glass 4 - 3,8 Liter PE or Glass 1 - 9,5 Liter PE or Glass 1 - 5.5 gallon (21 Liter)PE or 5 gallon (19 Liter) Glass, (with optional Jumbo Base)
Power Requirements:	12 V DC (Supplied by battery or AC power converter.)

Pump

Intake suction tubing:	
Length	3 to 99 feet (1 to 30 m)
Material	Vinyl or Teflon
Inside dimension	3/8 inch (1 cm)
Pump tubing life:	Typically 1,000,000 pump counts
Maximum lift:	28 feet (8.5 m)
Typical Repeatability	±5 ml or ±5% of the average volume in a set
Typical line velocity at Head height: of	
3 ft. (0.9 m)	3.0 ft./s (0.91 m/s)
10 ft. (3.1 m)	2.9 ft./s (0.87 m/s)
15 ft. (4.6 m)	2.7 ft./s (0.83 m/s)
Liquid presence detector:	Non-wetted, non-conductive sensor detects when liquid sample reaches the pump to automatically compensate for changes in head heights.

Controller

Weight:	13 lbs. (5.9 kg)
Size (HxWxD)	10.3 x 12.5 x 10 inches (26 x 31.7 x 25.4 cm)
Operational temperature:	32° to 120°F (0° to 49°C)
Enclosure rating:	NEMA 4X, 6 (IP67)
Program memory:	Non-volatile ROM
Flow meter signal input:	5 to 15 volt DC pulse or 25 millisecond isolated contact closure.
Number of composite samples:	Programmable from 1 to 999 samples.
Clock Accuracy:	1 minute per month, typical, for real time clock

Software

Sample frequency:	1 minute to 99 hours 59 minutes, in 1 minute increments. Non-uniform times in minutes or clock times 1 to 9,999 flow pulses
Sampling modes:	Uniform time, non-uniform time, flow, event. (Flow mode is controlled by external flow meter pulses.)
Programmable sample volumes:	10 to 9,990 ml in 1 ml increments
Sample retries:	If no sample is detected, up to 3 attempts; user selectable
Rinse cycles:	Automatic rinsing of suction line up to 3 rinses for each sample collection
Program storage:	5 sampling programs
Sampling Stop/Resume:	Up to 24 real time/date sample stop/resume commands
Controller diagnostics:	Tests for RAM, ROM, pump, display, and distributor

Ordering Information

***Note**: Power source, bottle configuration, suction line, and strainer must be ordered separately. Many options and accessories are available for 6712 Samplers; see separate literature for 700 Series Modules and other components to expand your monitoring capabilities. Contact Isco, or your Isco representative for pricing and additional information.*

Description	Part Number
6712 Portable Sampler, Full-size Includes controller with 512kB RAM, top cover, center section, base, distributor arm, instruction manual, pocket guide.	68-6710-070
6712 Portable Sampler, with Jumbo Base As described above	68-6710-082

The 6712 Controller is also an SDI-12 data logger, and has many optional capabilities. Please contact Isco or your Isco distributor for more information.

Teledyne Isco, Inc.
4700 Superior Street
Lincoln NE 68504 USA
Phone: (402) 464-0231
USA and Canada: (800) 228-4373
Fax: (402) 465-3022
E-Mail: iscoinfo@teledyne.com
Internet: www.isco.com

OPEN CHANNEL FLOW MONITOR

MODEL OCF 5.0

MANUAL SERIES A.1.1

Open Channel Flow Monitor

Non-Contacting – Accurately Measures Flow Through Flumes and Weirs

New!

Open Channel Flow Monitor

Model OCF 5.0

Displays, Transmits
Totalizes and Data Logs

Simple 5-key Calibration
Password Protected
2 million point Data Logger
On-screen Flow Reports
USB Output to Flash Drives
4-20mA/0-5V Output

Easy to Install and Calibrate
Simple, Accurate and Reliable

Non-Contacting Sensor

The OCF 5.0 uses a non-contacting ultrasonic sensor mounted over a flume or weir to measure flow. It is accurate, reliable and verifiable. The separate, watertight electronics/display enclosure can be mounted within 500 ft (150 m) of the sensor. The OCF 5.0 continuously displays, totalizes, transmits and data logs open channel flow.

Keypad Operating System

Use the built-in keypad for fast, easy calibration with menu selection of flume or weir and measurement units (e.g. gallons, liters etc.) Calibration values and data logs are password-protected and retained during power interruptions. The OCF 5.0 will display on-screen flow reports with daily total, minimum, maximum and average flow and will transfer data logs to a USB flash drive. PC software is included.

GREYLINE
instruments inc.

RELIABLE MEASUREMENT AND CONTROL

Built-in Data Logger Creates Flow Reports

Save time and labour — flow information is stored automatically

2-Million Point Data Logger

The OCF 5.0 stores time and date-stamped flow values at programmable intervals of 10 seconds to 60 minutes. Daily flow reports are automatically created and can be viewed right on the instrument's LCD display including total, minimum, maximum and average flow rates.

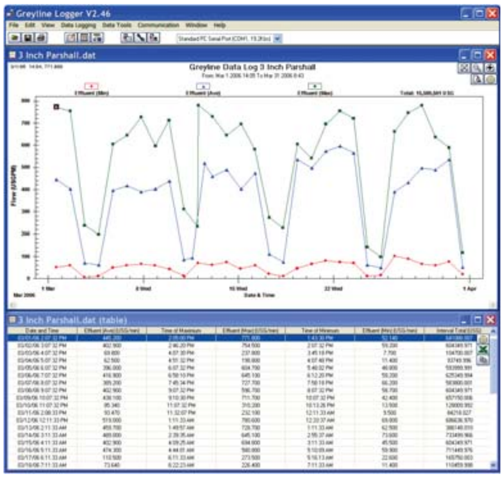
Easy Data Logger Downloads

You don't need a laptop to retrieve log files! Plug any USB Flash Drive into the OCF 5.0 USB output to download data log files automatically. Downloaded files are sequentially named by the flowmeter so log files from the same or multiple instruments can be stored on one flash drive.

Greyline Logger software for Windows

Greyline Logger is included with each OCF 5.0. This powerful software displays data in both graph and table formats. You can view flow data on-screen, generate flow reports and save files to disk. Graphs can be exported as images and data tables can be exported as delimited text files, or directly to Microsoft Excel.

- *Display, analyze and export log files in graph and table formats*
- *Generate flow reports including totalizer, minimum, maximum and average flow rates*
- *Convert measurement units*
- *One-click export to Microsoft Excel*



PZ15 Ultrasonic Sensor

Non-Contacting Ultrasonic Sensor

Each OCF 5.0 includes a non-contacting PZ15 sensor designed for the special requirements of open channel flow measurement. The sensor can be installed 8" (203 mm) or more above the highest water level. The ultrasonic sensor beam is narrow enough to work on very small flumes and powerful enough for really large applications. The OCF 5.0 automatically tunes to extended cable lengths up to 500 ft (150 m) lengths.

OCF 5.0 Outputs Included

Connect the OCF 5.0's isolated 4-20mA output to external displays, chart recorders or controllers and use the built-in relays for flow/level alarms and flow proportionate pulse to samplers, chlorinators or external totalizers.

Retains Memory during Power Interruptions

Date, time, calibration data and user settings are stored and retained in back-up battery protected memory. Data log files are in stored Secure Digital (SD) non-volatile memory.

Security

Access to the OCF 5.0 calibration menu and settings are password-protected when enabled.

OCF 5.0 Specifications

General Specifications

Greyline OCF 5.0 Open Channel Flow Monitor

Electronics Enclosure:	Watertight and dust tight NEMA4X (IP 66) polycarbonate with clear, shatterproof cover
Accuracy:	±0.25% of Range or 2 mm (0.08") whichever is greater, Repeatability and Linearity: ±0.1%
Display:	White, backlit matrix - displays flow rate, totalizer, relay status, operating mode and calibration menu
Programming:	built-in 5-key calibrator with English, French or Spanish language selection
Power Input:	100-240VAC 50-60Hz (see Options), 4.0 Watts maximum (with standard features)
Output:	Isolated 4-20mA/0-5V, 1000 ohm load maximum, programmable offset
Control Relays:	2 Relays, form 'C' dry contacts rated 5 amp SPDT; programmable level alarm, pump control, pump alternation, failsafe/echo-loss, air temperature alarm
Electrical Surge Protection:	Sensor, 4-20mA and AC power input
Operating Temp. (electronics):	-5° to 140°F (-20° to 60°C)
Approximate Shipping Weight:	10 lbs. (4.5 kg)

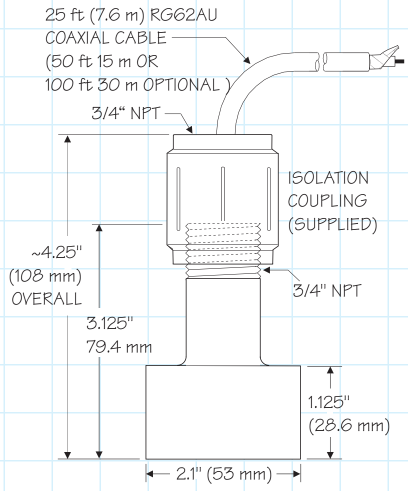
Sensor Specifications

Maximum Range:	15 ft (4.57 m) with standard PZ15 sensor
Deadband (Blanking):	Programmable, Minimum 8 in (203.2 mm)
Beam Angle:	8°
Operating Frequency:	92 KHz
Exposed Materials:	PVC
Operating Temperature:	-40° to 150°F (-40° to 65°C) with automatic temperature compensation
Submersion Rating:	Protected for accidental submersion to 10 ft (3 m) maximum
Sensor Cable:	RG62AU coaxial, 25 ft (7.6 m) standard length (See Options)

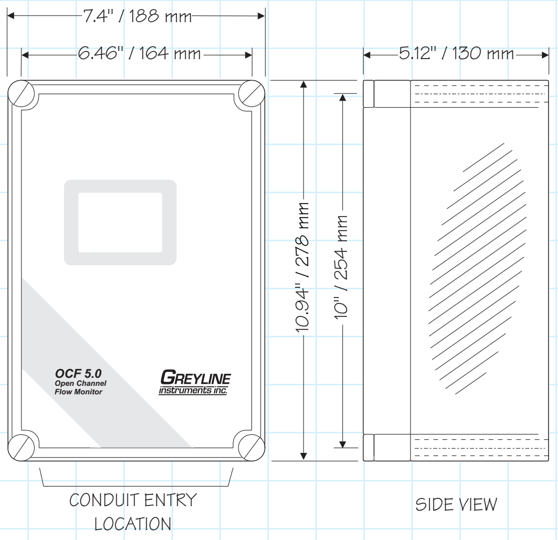
Popular Options

Sensor Cable:	50 ft. (15 m) continuous or 100 ft. (30 m) continuous RG62AU coaxial from Sensor, or splice up to 500 ft (150 m) with Junction Box
Intrinsic Safety Barriers:	For Sensor mounting in Class I,II,III, Div. I,II, Groups C,D,E,F,G hazardous locations
Power Input:	9-32 VDC
Control Relays:	4 additional (6 total), rated 5 amp SPDT
Enclosure Heater:	Thermostatically controlled - recommended for temperatures below 32°F (0°C)
Sunscreens:	Sensor sunscreen and enclosure sunscreen for outdoor installations
Sensor Mounting Stand:	Adjustable, includes galvanized steel pipe, flanges, fittings and hardware

Dimensions



PZ15 SENSOR



ENCLOSURE

Non-Contacting Ultrasonic
OCF 5.0 Open Channel Flow Monitor

- **Works with any Flume or Weir**
- **Built-in Totalizer**
- **Password protected**

Programmable for any Flume or Weir

The OCF 5.0 includes a built-in 5-button keypad for fast, easy calibration. Select your choice of engineering units (gallons, liters, cubic meters, etc.) and choose your flume or weir type from the menu. The flowmeter also supports entry of flow formulae for non-standard flumes and weirs. 'Find K&n' software (included) can be used to calculate non-standard calibration constants for entry into the OCF 5.0 calibration menu.

Built-in control relays can be programmed for flow alarms or a flow proportionate pulse for remote totalizers, samplers or chlorinators. The isolated 4-20mA (or 0-5V) output can be connected to chart recorders, remote displays and controllers.

Non-Contacting Sensor

Designed specifically for open channel flow applications, the new Greyline PZ15 ultrasonic sensor can be mounted just 8" (20.3 cm) above the maximum water level. It is ideal for confined space and small flumes. The PZ15 sensor is rated for measurement distances up to 15 ft (4.576 m).

The PZ15 sensor mounts above the flowing liquid so there is no fouling. No maintenance is required. The sensor will not be damaged by accidental submersion and it self-tunes to extended cable lengths up to 500 ft (152 m).

Smart Operating System

The OCF 5.0 tracks flow continuously through a flume or weir. False echoes from turbulence, splashing rain or snowfall are automatically rejected. Temperature compensation is automatic for high accuracy. Flow rate and totalizer are shown on the large backlit LCD display.

How to Order

Contact a Greyline sales representative in your area or phone one of our sales engineers. Describe your requirements and receive our prompt quotation.

Applications Support

Take advantage of Greyline's applications experience. Phone toll free 1-888-473-9546 for advice or information on applications, installation or service for Greyline products.

No Risk Appraisal

The Greyline OCF 5.0 Level & Flow Monitor must meet your requirements. Discuss your application with a Greyline representative to arrange a 30-day trial.

The Greyline Guarantee

Quality of Materials and Workmanship - Each instrument manufactured by Greyline is warranted against defects in materials and workmanship for a period of one year from date of purchase. Refer to our limited warranty included with each product.

GREYLINE
instruments inc.

Canada: 16456 Sixsmith Dr., Long Sault, Ont. K0C 1P0
Tel: 613-938-8956 / 888-473-9546   Fax: 613-938-4857
USA: 105 Water Street, Massena NY 13662
Tel: 315-788-9500 / 888-473-9546   Fax: 315-764-0419
Internet: www.greyline.com   E-mail: info@greyline.com

RELIABLE MEASUREMENT AND CONTROL

USER'S GUIDE

Installation & Operation
Instructions

Open Channel Flow Monitor
Model OCF 5.0
Manual Series A.1.1

Note: This page has been left blank intentionally.

INDEX

IMPORTANT NOTE: This instrument is manufactured and calibrated to meet product specifications. Please read this manual carefully before installation and operation. Any unauthorized repairs or modifications may result in a suspension of the warranty.

Available in Adobe Acrobat pdf format

CONNECTIONS:

POWER INPUT: The standard model requires AC power input between 100 to 240 VAC 50/60Hz. No adjustments are necessary for voltages within this range.

Optional DC: 9-32 VDC. Connect to + and - terminals.

Optional Thermostat and Heater modules are available rated for 115 VAC or 230 VAC.

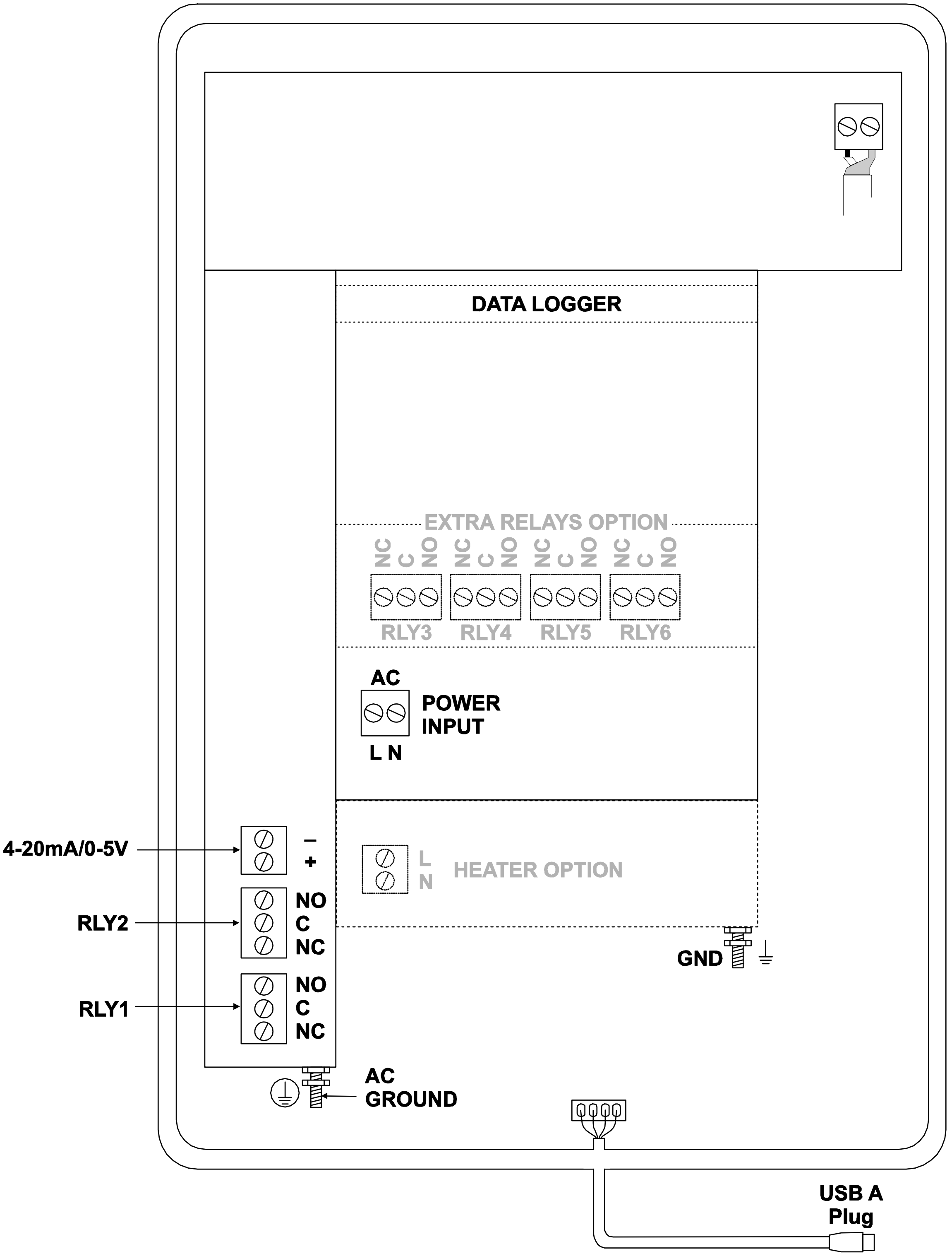
IMPORTANT NOTE: To comply with CSA/UL electrical safety standards, AC power input and relay connection wires must have conduit entry to the instrument enclosure. Installation requires a switch, overcurrent fuse or circuit breaker in the building (in close proximity to the equipment) that is marked as the disconnect switch.

⚠ Risk of electric shock. Loosen cover screw to access connections. Only qualified personnel should access connections.

Note: Use of instrumentation over 40°C ambient requires special field wiring.

Note: User replaceable fuse is 2 Amp 250V (T2AL250V).

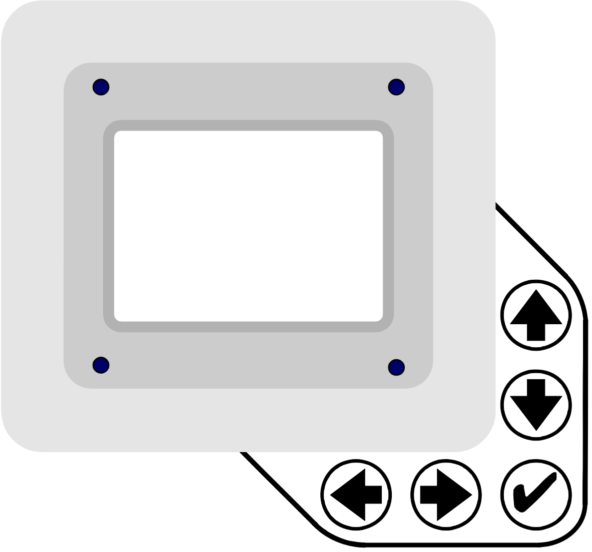
CONNECTIONS



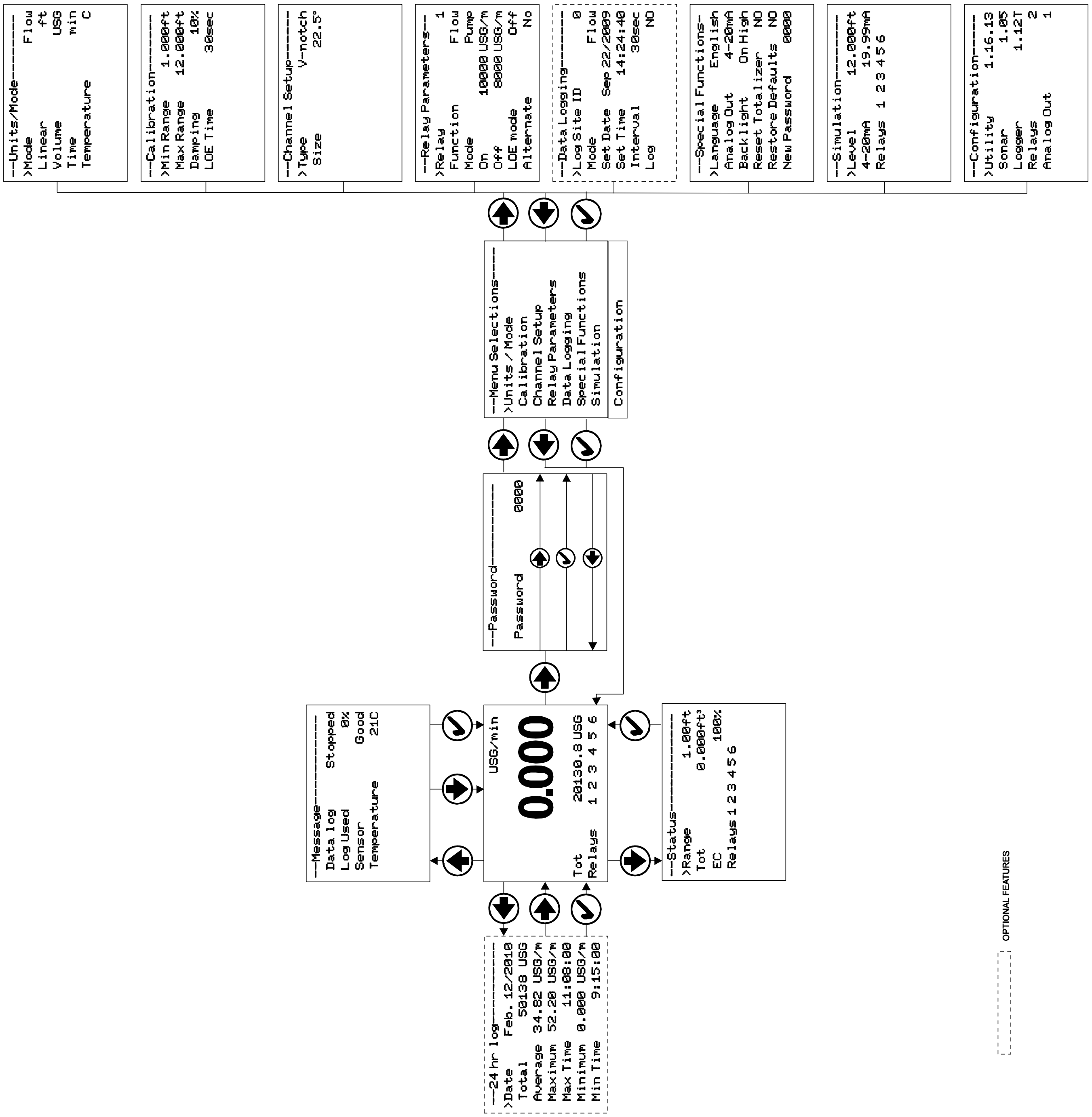
KEYPAD SYSTEM

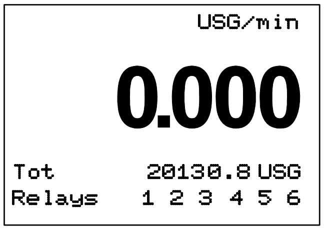
The OCF 5.0 uses a menu system. Arrows show the four directions to leave a menu box. Press a key to move to the next item in the direction shown. Move the cursor (underline) under numerals and increase or decrease numerals with the ⬆ and ⬇ keys.

To store calibration values permanently (even through power interruptions), press ✓.



CALIBRATION MENU





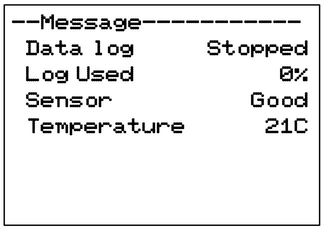
```
          USG/min

           0.000

Tot       20130.8 USG
Relays   1 2 3 4 5 6
```

RUN

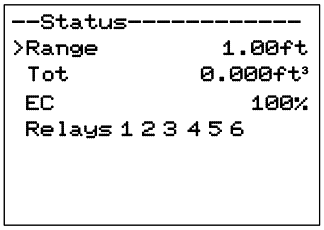
The main display shows the units selected from the Units/Mode menu, Level, Range, Flow, HRT, and Volume rate being measured, TOTALIZER and RELAY states. The OCF 5.0 will start-up with this display and will return to this screen after a timeout if keys are not pressed in other menus.



```
--Message------------
 Data log     Stopped
 Log Used          0%
 Sensor          Good
 Temperature      21C
```

MESSAGE

Press ⬆ from the RUN display to view status of the data logger and error/warning messages provided by the instrument. The word `Message` will appear on the RUN display if error messages are being generated by the instrument. Refer to the manual section Error/Warning Messages for a description. Press ✓ to return to the main display.

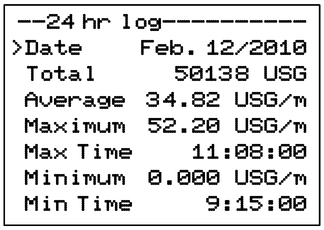


```
--Status-------------
>Range         1.00ft
 Tot         0.000ft³
 EC              100%
 Relays 1 2 3 4 5 6
```

STATUS

Press ⬇ from the RUN display to view instrument status. Range will be displayed in linear units.

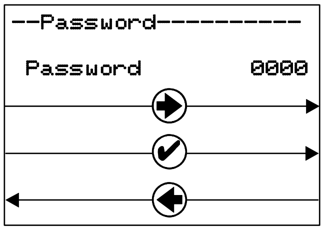
`Tot`	Displays the current totalizer reading.
`EC`	Displays echo confidence.
`Relays`	Energized relays will display as a white character on a black background.



```
--24 hr log-----------
>Date     Feb. 12/2010
 Total      50138 USG
 Average  34.82 USG/m
 Maximum  52.20 USG/m
 Max Time     11:08:00
 Minimum  0.000 USG/m
 Min Time      9:15:00
```

24 HR LOG

Press ⬅ from the RUN display to view a formatted flow report from instruments with a built-in data logger. Press ⬇ to scroll down one day or repeatedly to scroll to a specific date. Up to 365 days can be stored. Newest date will overwrite the oldest. Press ✓ to return to the main display.



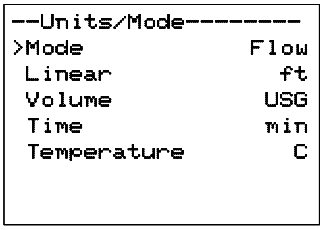
PASSWORD

The Password (a number from 0000 to 9999) prevents unauthorized access to the Calibration menu.

From the Run display press ➡ to get to Password. Factory default password is 0000 and if it has not been changed press the ✓ to proceed to the Menu Selections screen.

If a password is required, press ➡ to place the cursor under the first digit and ⬇ or ⬆ to set the number, then ➡ to the second digit, etc. Press ➡ or ✓ to proceed to the Menu Selections screen.

A new password can be stored by going to Special Functions/New Password.

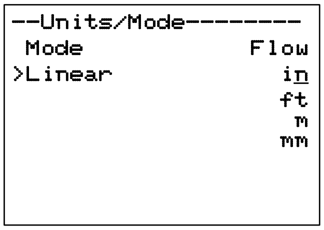


```
--Units/Mode---------
>Mode            Flow
 Linear            ft
 Volume           USG
 Time             min
 Temperature        C
```

UNITS/MODE

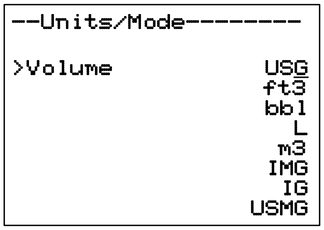
From >Mode press the ➡ and then the ⬆ or ⬇ to select Level, Range, Flow, HRT or Volume.

Range	displays distance from the sensor to the target or liquid surface like a tape measure. Range mode is useful to measure the exact distance from the sensor to the zero level during calibration.
Level	used to measure tank level in linear units, or "Head" in an open channel for comparison with flow tables.
Volume	displays tank inventory in engineering units.
HRT	select Horizontal Round Tank mode to calculate and display volume units in a horizontal round tank.
Flow	calculates open channel flow through a flume or weir.



```
--Units/Mode---------
 Mode            Flow
>Linear            in
                   ft
                    m
                   mm
```

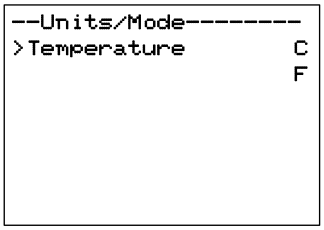
Volume, HRT or Flow gives the additional choice of volumetric units:



```
--Units/Mode---------

>Volume           USG
                  ft3
                  bbl
                    L
                   m3
                  IMG
                   IG
                 USMG
```

ft3	-	cubic feet
USG	-	US gallons
USMG	-	US million gallons (FLOW only)
IG	-	Imperial gallons
IMG	-	Imperial million gallons (FLOW only)
m3	-	cubic meters
L	-	liters
bbl	-	U.S. oil barrel

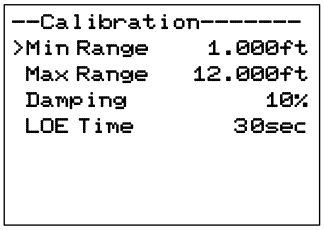


```
--Units/Mode---------
>Temperature        C
                    F
```

Press ✓ to store the selection, then ⬇ to the next menu item and ➡ to enter.

Linear	press ➡ and then ⬆ or ⬇ to select units of measurement. Press ✓ to store the selection.
Temperature	press ➡ then ⬆⬇ to select C or F (Centigrade or Fahrenheit).

Press ⬅ or ✓ to return to the Menu Selections screen.



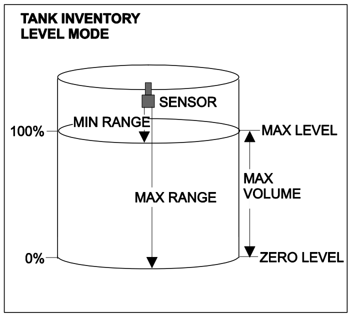
```
--Calibration-------
>Min Range    1.000ft
 Max Range   12.000ft
 Damping          10%
 LOE Time       30sec
```

CALIBRATION

Press ⬇ to `Calibration` and ➡ to enter. Use ⬇ or ⬆ to position `>` before each menu item and ➡ to enter. When settings are completed press ✓ to store and return to the Calibration menu.

`MaxVol`	For Volume and HRT mode only. Enter the maximum volume of the vertical or horizontal tank.
`Damping`	Minimum damping allows fast response to level changes. Increasing damping slows the OCF 5.0's response to level changes and is ideal to smooth the display and outputs in turbulent conditions. Damping value is shown in percent (0-99%). Some experimentation may be required to select the optimum damping value. A value of 1% is recommended for most applications and for fast level changes (up to ½ inch/sec - 13 mm/sec).
`LOE Time`	Press ➡ and ⬆ or ⬇ to change the number of seconds without receiving an echo before the OCF 5.0 displays ECHO LOSS, and Control relays change state as calibrated under Relay Parameters. Factory default is 30 seconds and is recommended for most applications, Minimum is 1 second and maximum is 99 seconds.

Press ✓ from the `Units/Mode` display to return to Menu Selections.



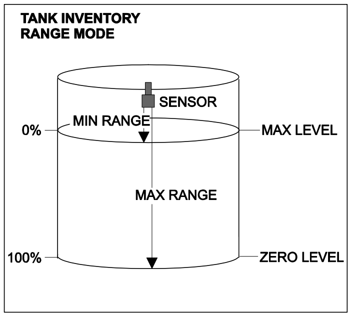
CALIBRATION
- for Level/Inventory Applications

1. Before starting the calibration determine:

a) MAX RANGE = ________________
(Maximum range = distance from Sensor to Zero level)

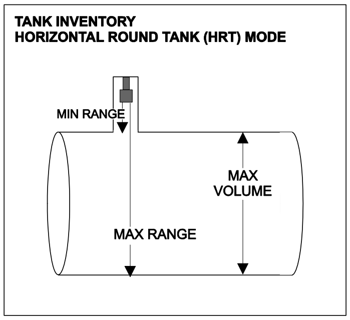
b) MAX LEVEL = ________________
(Maximum level of product being measured)

c) MIN RANGE = ________________
(Distance from sensor to Max Level)
Minimum range = MAX RANGE - MAX LEVEL
(must be at least 8" / 203 mm depending on sensor model)



2. Check the maximum range with the sensor installed:

a) When liquid is at zero level press ⬇ to view the Range reading in the Status menu. Use this range measured by the OCF 5.0 as the Max Range setting.
or
b) Carefully measure distance from sensor to zero level with a tape measure, and use this measurement as the Max Range setting.



MINIMUM RANGE:

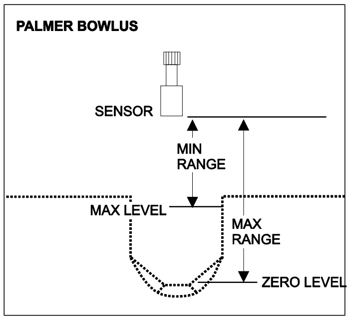
In the CALIBRATION menu

- Press ⬇ to get to Min Range
- Press ➡ to move the cursor under the digits
- Use ⬇ or ⬆ to set the minimum range

Note: Min Range must be at least 12" (30.5 cm) for PZ32T sensors, 16" (40.6 cm) for PZ52T and PZ34 sensors and 8" for PZ15 sensors. For correct tank volume calculation in Hrt mode Min Range must be the actual distance from the end of the sensor to the top of the tank.

MAXIMUM RANGE:

Press ⬇ to get to Max Range
Enter Max Range determined above.



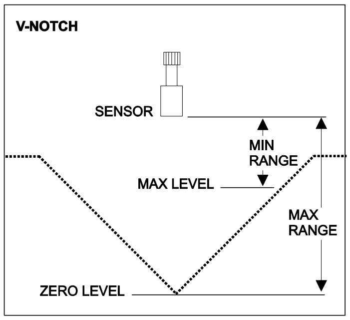
CALIBRATION
- for Open Channel Flow

1. Before starting the calibration determine:

a) MAX RANGE = ____________________
(Maximum range = distance from the Sensor to Zero flow point)

b) MAX LEVEL = ____________________
(Maximum level of flow through flume or weir)

c) MIN RANGE = __________________
(Distance from sensor to Max Level)
Minimum range = MAX RANGE - MAX LEVEL
(must be at least 8" / 20.3 cm depending on sensor model).



2. Check the maximum range with the sensor installed by:

a) When liquid is at zero level press ⬇ to view the Range reading in the Status menu. Use this range measured by the OCF 5.0 as the Max Range setting.
or
b) Carefully measure distance from sensor to zero level with a tape measure, and use this measurement as the Max Range setting.

NOTE: The OCF 5.0 will not detect targets beyond user entered Max Range.

CHANNEL SETUP

```
--Channel Setup------
>Type         V-notch
               Custom
              Khafagi
       Rect Weir w/EC
            Rect Weir
          Trapezoidal
         Leopld-Lagco
        Palmer Bowlus
             Parshall
```

```
--Channel Setup------
>Type         V-notch
 Size           22.5°
                 120°
                  90°
                  60°
                  45°
                  30°
```

```
--Channel Setup------
>Type          Custom
 K             0.0000
 n             0.0000
```

```
--Channel Setup------
>Type         Khafagi
 Height       0.000ft
```

```
--Channel Setup------
>Type  RECT Weir w/EC
 Height       0.000ft
```

```
--Channel Setup----
>Type       RECT Weir
 Height       0.000ft
```

```
--Channel Setup------
>Type     Trapezoidal
 Size Extra large 60°
            Large 60°
            Small 60°
      12in 45° SRCRC
         2in 45° WSC
             8in 60°
```

```
--Channel Setup------
>Type    Leopld-Lagco
 Size            36in
                 30in
                 24in
                 18in
                 12in
                 10in
                  8in
                  6in
```

```
--Channel Setup------
>Type   Palmer Bowlus
 Size            48in
                 42in
                 36in
                 30in
                 27in
                 24in
                 21in
                 18in
                 15in
                 12in
                 10in
                  8in
                  6in
                  4in
```

```
--Channel Setup------
>Type        Parshall
 Size            12ft
                 10ft
                  8ft
                  6ft
                  5ft
                  4ft
                  3ft
                  2ft
                 18in
                 12in
                  9in
                  6in
                  3in
                  2in
                  1in
```

```
 --Relay Parameters--
>Relay              1
 Function        Flow
 Mode            Pump
 On       10000 USG/m
 Off       8000 USG/m
 LOE mode         Off
 Alternate         NO
```

```
 --Relay Parameters--
>Relay              1
 Function Temperature
 On              0.0C
 Off             9.0C
```

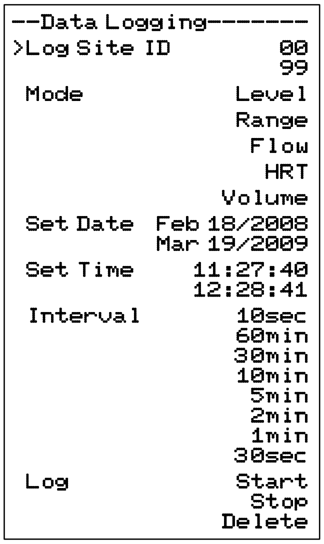
```
 --Relay Parameters--
>Relay              1
 Function       Pulse
 On          10.000ft³
```

```
 --Relay Parameters--
>Relay              1
 Function       Level
 Mode            Pump
 On          12.000ft
 Off          3.000ft
 LOE mode         Off
 Alternate         NO
```

RELAY PARAMETERS

Relay	Press ➡ and ⬇ or ⬆ to select a relay (2 relays are standard, 4 additional are optional).
Function	Press ⬇ or ⬆ to select Off, Temperature, Pulse and Level.
Temperature	Air temperature at the sensor location. Press ⬇ and ➡ and set the relay On and Off for specific temperatures.
Pulse	Press ⬇ and set digits to the flow volume increment required between relay pulses. Use this feature for remote samplers, chlorinators or totalizers. Minimum time between pulses is 2.25 seconds and pulse duration is 350 milliseconds.
Level	Level, Range, Volume or HRT modes only. Press ⬇ to R Function and ➡ to select Pump, LoAlm (low alarm) or HiAlm (high alarm).

Press ✓ to return to Menu Selections.



```
--Data Logging-------
>Log Site ID       00
                   99
 Mode           Level
                Range
                 Flow
                  HRT
               Volume
 Set Date  Feb 18/2008
           Mar 19/2009
 Set Time     11:27:40
              12:28:41
 Interval        10sec
                 60min
                 30min
                 10min
                  5min
                  2min
                  1min
                 30sec
 Log            Start
                 Stop
               Delete
```

DATA LOGGING

Setup

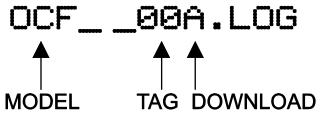
Select Data Logging from Menu Selections.

Log Site ID	Enter a number from 00 to 99. The site ID will become part of the downloaded file name to help distinguish downloads from different instruments. Press ✓ to store the setting.
Mode	Select Level, Range, Flow, HRT and Volume . Flow (e.g. USGPM or l/sec). Press ✓ to store the setting.
Set Date	Press ⬆ or ⬇ to scroll and select Month, Day and Year. Press ✓ to store the setting.
Set Time	Press ⬆ or ⬇ to select the current time in Hours, Minutes and Seconds. Press ✓ to store the setting.
Interval	Press ⬆ or ⬇ to select the logging interval. Flow rate reading will be stored at each time interval. Press ✓ to store the setting. Note: Press ⬇ to Log ➡ and ⬆ or ⬇ to Delete and ✓ to delete the log file. Press ➡ and ⬆ or ⬇ to Start and ✓ to restart the logger.
Log	Stop, Start or Delete the log file. Delete old file and start a new log to apply any changes that have been made to the Log Site ID, Mode or Interval.

RETRIEVE LOG FILE

Plug a USB Flash Memory Drive (not supplied by Greyline) into the USB output cable from the instrument. The instrument display will show the message Downloading until the log file is transferred to the memory card and then display Completed. The USB flash drive may be removed.

Download file names will appear in this format:



Tag is set according to the Log Site ID entered in the instrument Data Logging menu.

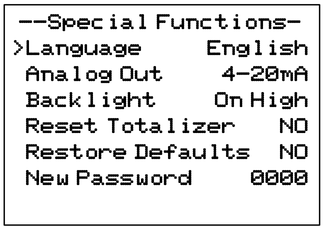
Download letter will be A for the first download from an instrument. B for the second, then C etc. At the letter Z a - character will appear indicating that the maximum number of downloads for that instrument are on the USB flash drive. Older files can be erased or moved from the flash memory drive or a new memory drive can be used.

OPENING LOG FILES

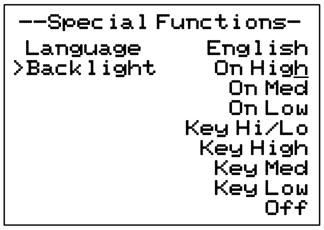
Install Greyline Logger on your PC or laptop. Refer to the Help menu in the program for detailed instructions.

Select File/Open/Instrument Log (.log) to open the log file from your USB flash drive.

SPECIAL FUNCTIONS



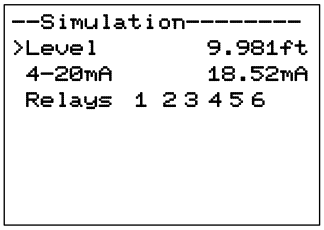
```
 --Special Functions-
>Language       English
 Analog Out      4-20mA
 Backlight      On High
 Reset Totalizer     NO
 Restore Defaults    NO
 New Password      0000
```



```
 --Special Functions-
 Language       English
>Backlight      On High
                 On Med
                 On Low
              Key Hi/Lo
               Key High
                Key Med
                Key Low
                    Off
```

Language	Select English, French or Spanish and press ✓.
Analog Out	Select 4-20mA or 0-5V mode for the analog output.
Backlight	Select On High, Medium or Low for continuous backlight. Select Key Hi/Lo for high backlight (for 1 minute) after a keypress and then Lo backlight until a key is pressed again. Select Key High, Med or Low for backlight after a keypress and then backlight off until a key is pressed again.
Reset Totalizer	Press ➨ and select Yes to erase and restart the totalizer at zero.
Restore Defaults	Select Yes and press ✓ to erase all user settings and return the instrument to factory default settings
New Password	Select any number from 0000 to 9999 and press ✓. Default setting of 0000 will allow direct access to the calibration menus. Setting of any password greater than 0000 will require the password to be entered to access the calibration menus.

Press ✓ to return to Menu Selections.



```
--Simulation--------
>Level        9.981ft
 4-20mA       18.52mA
 Relays  1 2 3 4 5 6
```

SIMULATION

Exercises the 4-20mA output, digital display and control relays.

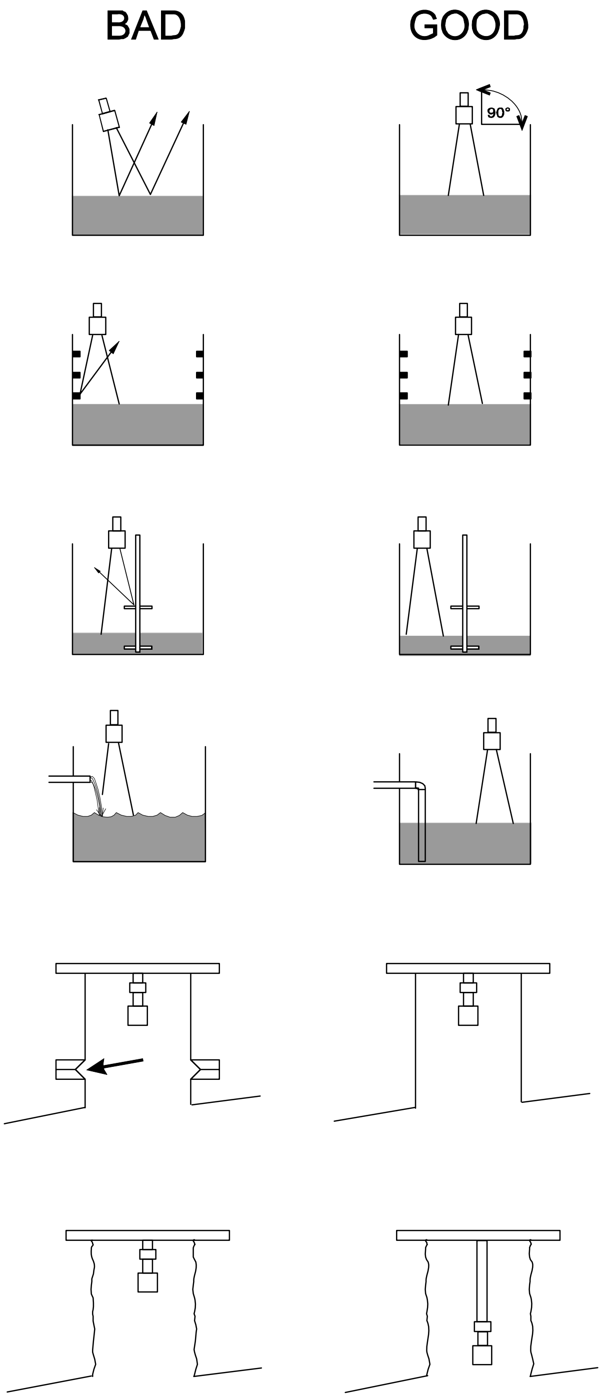
Press ➡ and then ⬇ or ⬆ to change the simulated output. Press ✓ to begin simulation. The 4-20mA value and relay states will be displayed.

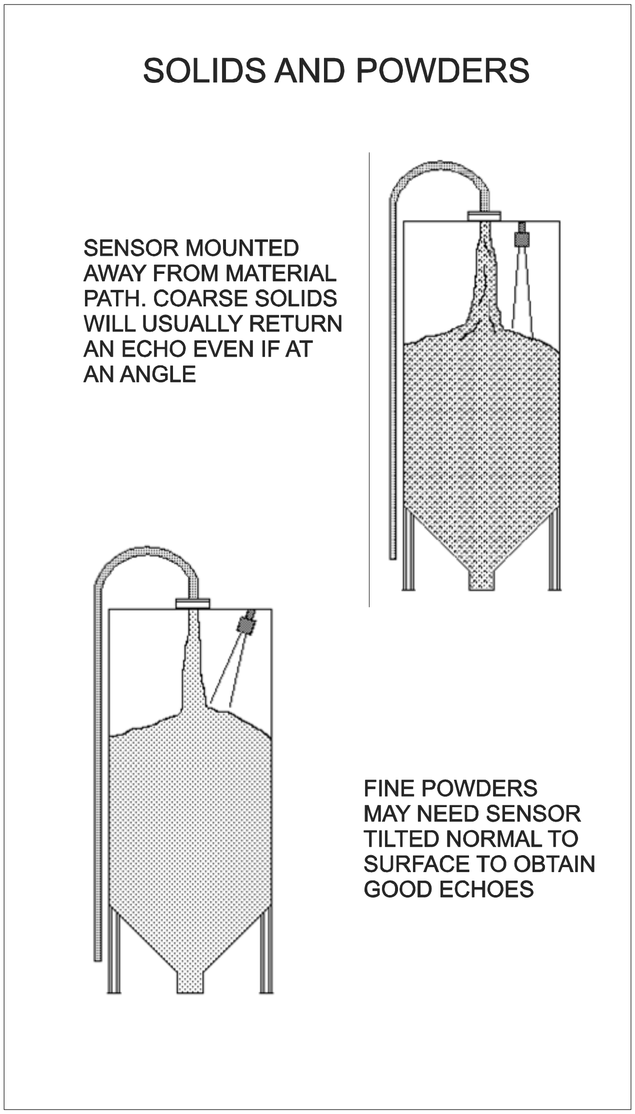
Press the ✓ to terminate simulation and return to the Menu Selections screen.

SENSOR MOUNTING/LOCATION
- Tank Level/Inventory Applications

Each OCF 5.0 Level Transmitter includes a non-contacting ultrasonic sensor. The sensor must be installed in a position to obtain unobstructed echoes from the liquid or material being measured.

Mount the sensor away from pipes, ladders, or structural members which might cause continuous false echoes.

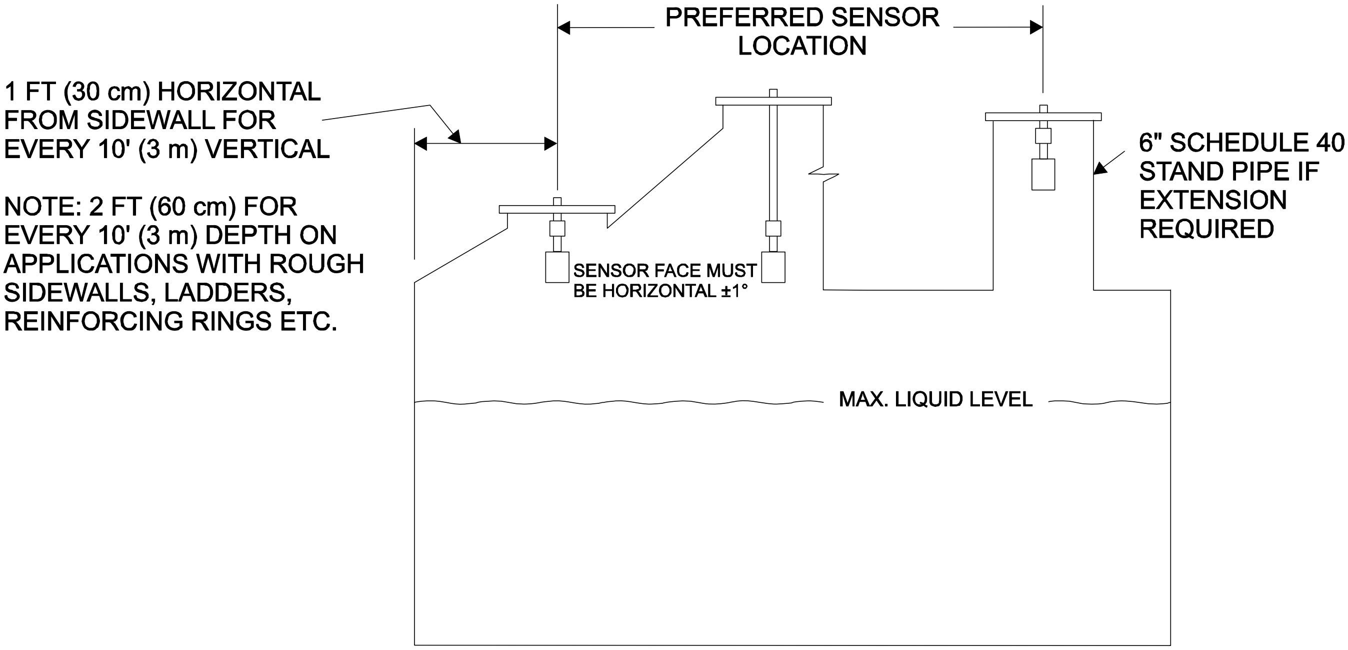



SOLIDS AND POWDERS

SENSOR MOUNTED AWAY FROM MATERIAL PATH. COARSE SOLIDS WILL USUALLY RETURN AN ECHO EVEN IF AT AN ANGLE

FINE POWDERS MAY NEED SENSOR TILTED NORMAL TO SURFACE TO OBTAIN GOOD ECHOES

SENSOR MOUNTING LOCATION
- Tank Level/Inventory Applications



SENSOR MOUNTING

Each sensor is equipped with a ¾ inch "isolation coupling" which MUST be used in your installation. A threaded nipple or length of conduit may be used to position the sensor at the desired height.

The sensor should be hand-tightened (like a light bulb) by turning the sensor stem only. DO NOT use a wrench and do not over tighten. DO NOT clamp the sensor below the isolation coupling.

ENCLOSURE INSTALLATION

Locate the enclosure within 20 ft (6 m) of the sensor (500 ft -150 m optional). The enclosure can be wall mounted with the four mounting screws (included) or panel mounted with Option PM Panel Mount kit from Greyline Instruments.

Avoid mounting the enclosure in direct sunlight to protect the electronics from damage due to overheating and condensate. In high humidity atmospheres, or where temperatures fall below freezing, Option TH Enclosure Heater and Thermostat is recommended. Seal conduit entries to prevent moisture from entering enclosure.

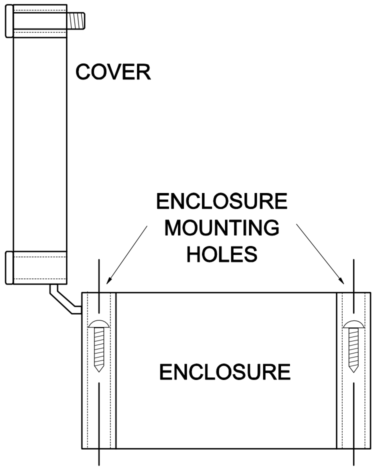
NEMA4X (IP66) WITH CLEAR COVER

1. Open hinged enclosure cover.

2. Insert #8 screws (supplied) through the four enclosure mounting holes to secure the enclosure to the wall or mounting stand.

Additional conduit holes can be cut in the bottom of the enclosure when required. Use a hole saw or Greenlee-type hole cutter to cut the required holes.

DO NOT make conduit/wiring entries into the top of the enclosure.



END VIEW

Note: This non-metallic enclosure does not automatically provide grounding between conduit connections. Grounding must be provided as part of the installation. Ground in accordance with the requirements of the National Electrical Code. System grounding is provided by connecting grounding wires from all conduit entries to the steel mounting plate or another point which provides continuity.

CLEANING

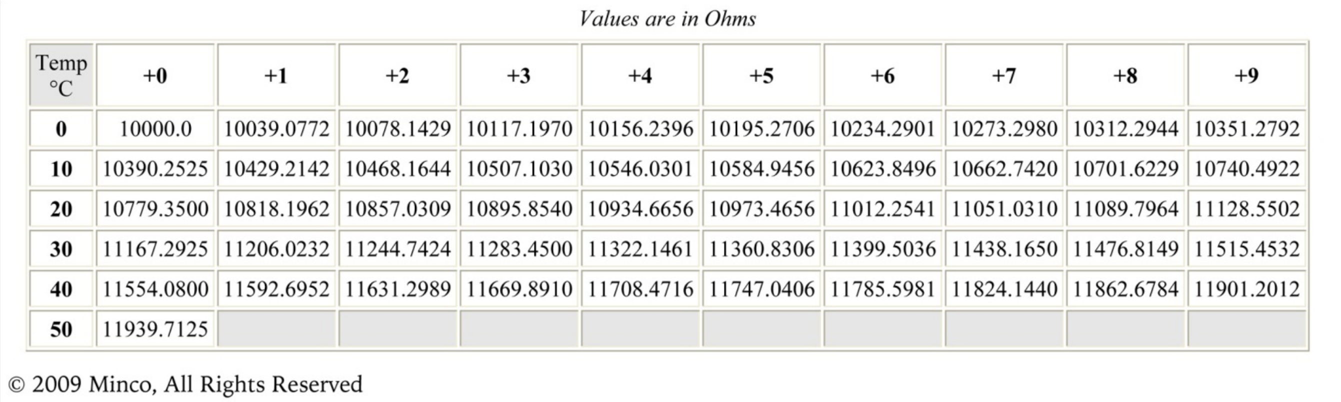
Cleaning is not required as a part of normal maintenance.

PZxx Series Sensors

Troubleshooting

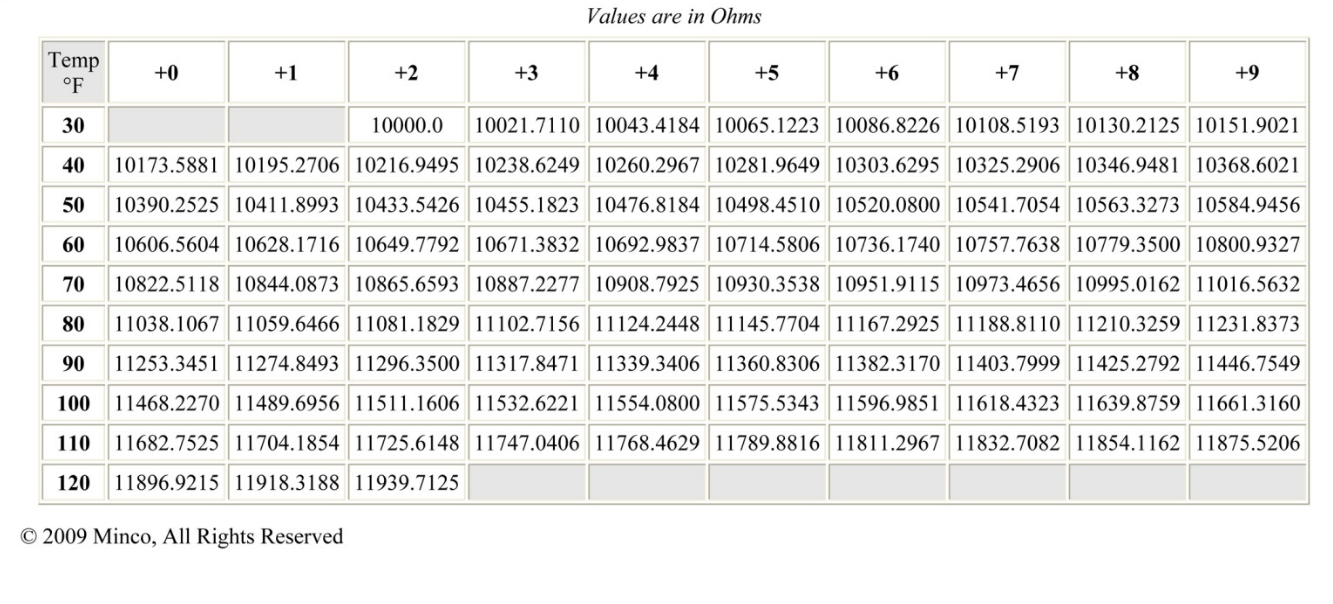
Resistance measured (between the shield and centre wire) across the coaxial cable ends by mulitmeter indicates ambient temperature.

Resistance vs. Temperature



Values are in Ohms

Temp °C	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
0	10000.0	10039.0772	10078.1429	10117.1970	10156.2396	10195.2706	10234.2901	10273.2980	10312.2944	10351.2792
10	10390.2525	10429.2142	10468.1644	10507.1030	10546.0301	10584.9456	10623.8496	10662.7420	10701.6229	10740.4922
20	10779.3500	10818.1962	10857.0309	10895.8540	10934.6656	10973.4656	11012.2541	11051.0310	11089.7964	11128.5502
30	11167.2925	11206.0232	11244.7424	11283.4500	11322.1461	11360.8306	11399.5036	11438.1650	11476.8149	11515.4532
40	11554.0800	11592.6952	11631.2989	11669.8910	11708.4716	11747.0406	11785.5981	11824.1440	11862.6784	11901.2012
50	11939.7125									



Values are in Ohms

Temp °F	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
30			10000.0	10021.7110	10043.4184	10065.1223	10086.8226	10108.5193	10130.2125	10151.9021
40	10173.5881	10195.2706	10216.9495	10238.6249	10260.2967	10281.9649	10303.6295	10325.2906	10346.9481	10368.6021
50	10390.2525	10411.8993	10433.5426	10455.1823	10476.8184	10498.4510	10520.0800	10541.7054	10563.3273	10584.9456
60	10606.5604	10628.1716	10649.7792	10671.3832	10692.9837	10714.5806	10736.1740	10757.7638	10779.3500	10800.9327
70	10822.5118	10844.0873	10865.6593	10887.2277	10908.7925	10930.3538	10951.9115	10973.4656	10995.0162	11016.5632
80	11038.1067	11059.6466	11081.1829	11102.7156	11124.2448	11145.7704	11167.2925	11188.8110	11210.3259	11231.8373
90	11253.3451	11274.8493	11296.3500	11317.8471	11339.3406	11360.8306	11382.3170	11403.7999	11425.2792	11446.7549
100	11468.2270	11489.6956	11511.1606	11532.6221	11554.0800	11575.5343	11596.9851	11618.4323	11639.8759	11661.3160
110	11682.7525	11704.1854	11725.6148	11747.0406	11768.4629	11789.8816	11811.2967	11832.7082	11854.1162	11875.5206
120	11896.9215	11918.3188	11939.7125							

APPLICATIONS HOTLINE

For applications assistance, advice or information on any Greyline Instrument contact your Sales Representative, write to Greyline or phone the Applications Hotline below:

United States:	Tel: 315-788-9500	Fax: 315-764-0419
Canada:	Tel: 613-938-8956	Fax: 613-938-4857
Toll Free:	888-473-9546	
Email:	info@greyline.com	
Web Site:	www.greyline.com	

Greyline Instruments Inc.

Canada
16456 Sixsmith Drive
Long Sault, Ont. K0C 1P0

USA:
105 Water Street
Massena, NY 13662

PRODUCT RETURN PROCEDURE

Instruments may be returned to Greyline for service or warranty repair.

1) Obtain an RMA Number from Greyline -
Before shipping a product to the factory please contact Greyline by telephone, fax or email to obtain an RMA number (Returned Merchandise Authorization). This ensures fast service and correct billing or credit.

When you contact Greyline please have the following information available:

1. Model number / Software Version
2. Serial number
3. Date of Purchase
4. Reason for return (description of fault or modification required)
5. Your name, company name, address and phone number

2) Clean the Sensor/Product -

Important: unclean products will not be serviced and will be returned to the sender at their expense.

1. Rinse sensor and cable to remove debris.

2. If the sensor has been exposed to sewage, immerse both sensor and cable in a solution of 1 part household bleach (Javex, Clorox etc.) to 20 parts water for 5 minutes. Important: do not immerse open end of sensor cable.

3. Dry with paper towels and pack sensor and cable in a sealed plastic bag.

4. Wipe the outside of the enclosure to remove dirt or deposits.

5. Return to Greyline for service.

3) Ship to Greyline -

After obtaining an RMA number please ship the product to the appropriate address below:

Canadian and International
Customers:

Greyline Instruments Inc.
16456 Sixsmith Drive
Long Sault, Ont. K0C 1P0

RMA#

USA
Customers:

Greyline Instruments Inc.
204 150th Avenue
Madeira Beach, FL 33708

RMA#

LIMITED WARRANTY

Greyline Instruments warrants, to the original purchaser, its products to be free from defects in material and workmanship for a period of one year from date of invoice. Greyline will replace or repair, free of charge, any Greyline product if it has been proven to be defective within the warranty period. This warranty does not cover any expenses incurred in the removal and re-installation of the product.

If a product manufactured by Greyline should prove defective within the first year, return it freight prepaid to Greyline Instruments along with a copy of your invoice.

This warranty does not cover damages due to improper installation or handling, acts of nature, or unauthorized service. Modifications to or tampering with any part shall void this warranty. This warranty does not cover any equipment used in connection with the product or consequential damages due to a defect in the product.

All implied warranties are limited to the duration of this warranty. This is the complete warranty by Greyline and no other warranty is valid against Greyline. Some states do not allow limitations on how long an implied warranty lasts or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

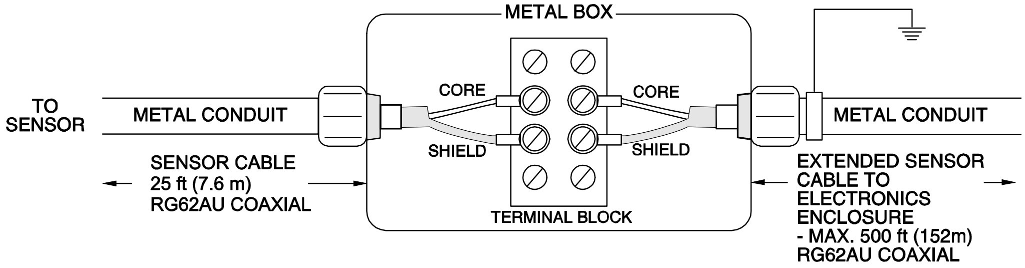
Greyline Instruments Inc.

APPENDIX A - OPTIONS

EXTRA SENSOR CABLE (OPTION XC)

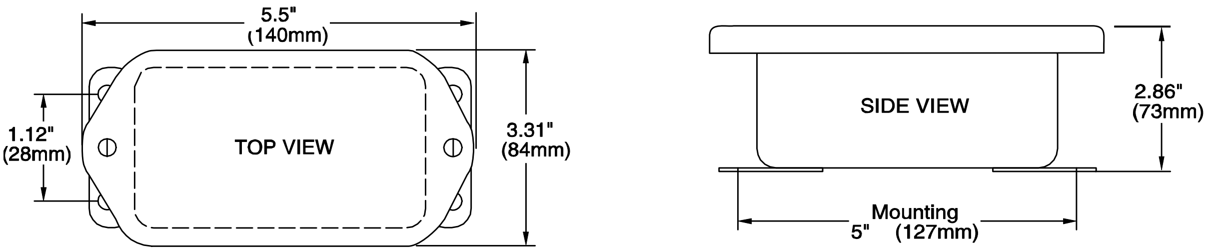
Each Greyline OCF 5.0 includes 25 ft. (7.6m) RG62AU coaxial cable. Additional RG62AU coaxial cable and Cable Junction Box (Option JB) may be ordered with the Flow Monitor, or the cable may be spliced and extended up to 500 ft (152m) as required during installation. No adjustment is required when the sensor cable is extended or shortened. Use only RG62AU (or RG62U) coaxial cable which is available from Greyline Instruments or your local distributor. Nominal impedance of RG62AU cable is 93 ohms.

Extended sensor cable must be installed in metal conduit to prevent interference. Do not use BNC coaxial connectors (TV cable type). Recommended installation with a metal junction box is illustrated below:



Note: Optional Watertight steel NEMA4 Junction Boxes with terminal strips (Option JB) are available from Greyline Instruments.

DIMENSIONS
OPTION JB - JUNCTION BOX



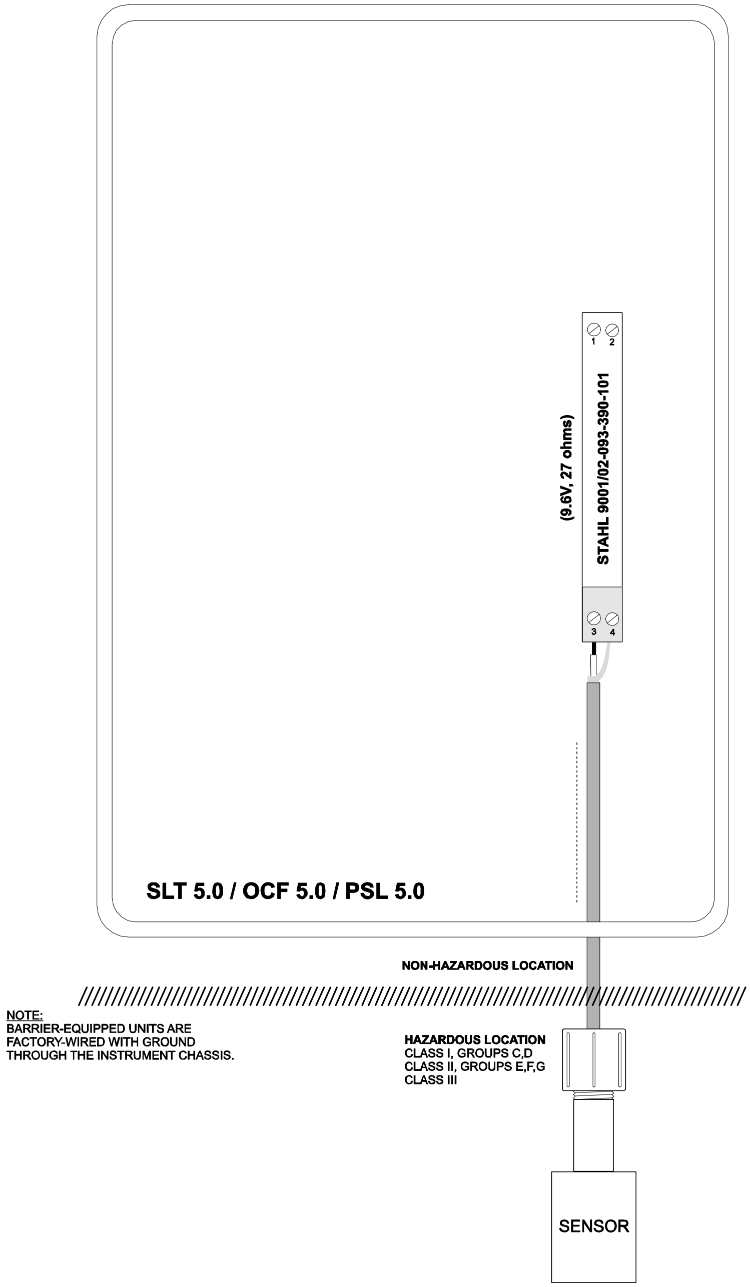
SENSOR INTRINSIC SAFETY (OPTION ISB)

When connected through Intrinsic Safety Barriers, Greyline PZ** Series sensors are certified for installation in a hazardous location rated:

Class I, Groups C,D
Class II, Groups E,F,G
Class III

The Intrinsic Safety Barrier may be ordered with the Greyline instrument and is supplied mounted in the Greyline instrument enclosure. Replacement barrier fuses (Part No. ISB- 011239) may be purchased separately. The instrument enclosure containing the ISB Intrinsic Safety Barrier must be installed in a non-hazardous location.

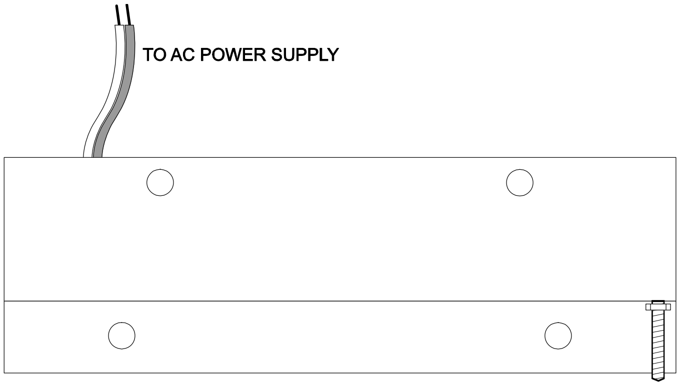
DRAWING NO: GN3SPEC-INST-03



NOTE:
BARRIER-EQUIPPED UNITS ARE FACTORY-WIRED WITH GROUND THROUGH THE INSTRUMENT CHASSIS.

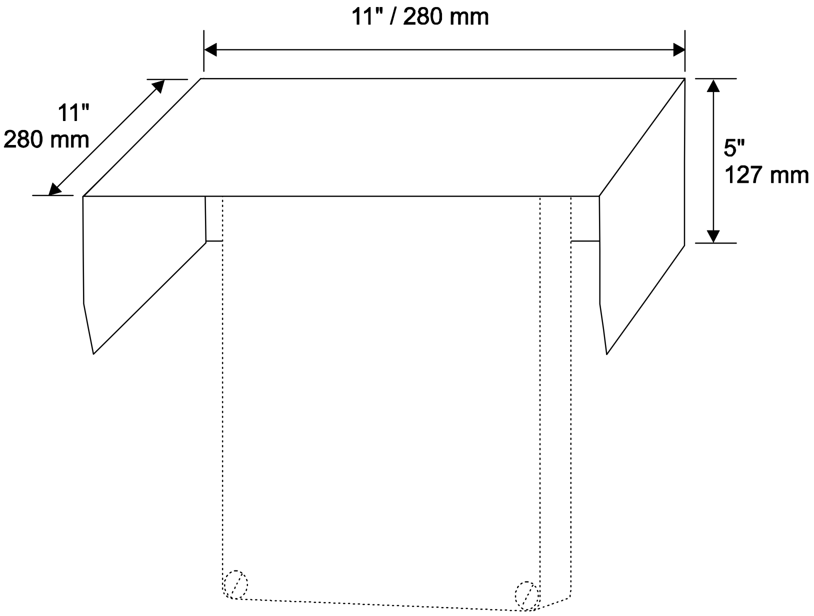
ENCLOSURE HEATER AND THERMOSTAT - Option TH

Instruments can be factory-equipped with an Enclosure Heater and Thermostat or the module can be customer-installed. The Thermostat is factory set to turn ON at 40°F (4.5°C) and OFF at 60°F (15.5°C). Power consumption is 15 Watts.



ENCLOSURE SUNSCREEN - Option SCR

Do not mount instrument electronics in direct sunlight. Overheating will reduce the life of electronic components and condensate may form during the heat/cool cycles and cause electrical shorts.



Note:

Exposure to direct sunlight can cause overheating and moisture condensation which will reduce the operating life of electronics.

Protect Instruments from direct sunlight with this iridite finished aluminum sun screen (Greyline Option SCR).

Seal conduit entries with caulking compound to further reduce moisture condensation.

POWER INPUT OPTION
9-32VDC

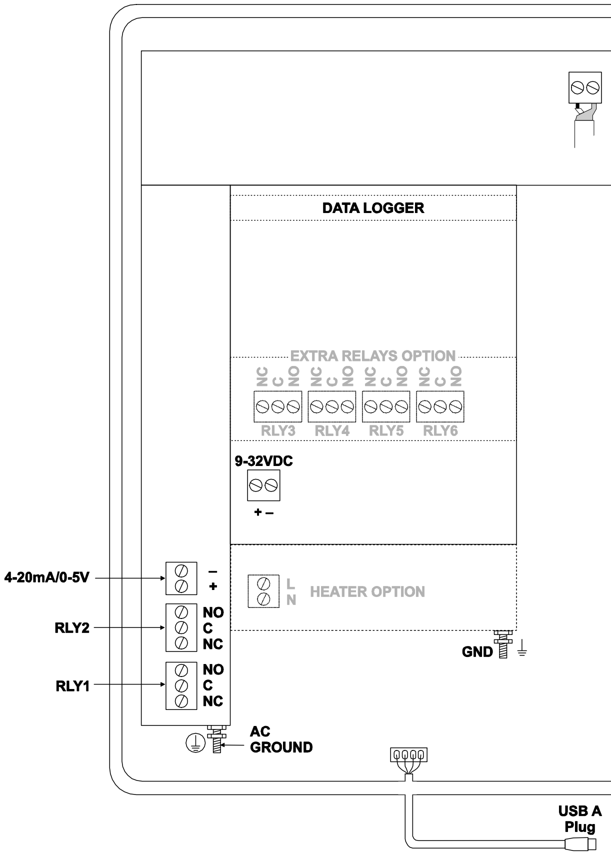
OCF 5.0 Level & Flow Monitors may be ordered factory-configured for 9-32VDC power input.

QUICK BENCH TEST:

Connect Sensor as shown below, then Power. When properly connected figures will show on the large LCD display. Test operation of the OCF 5.0 by holding the sensor steadily and aiming at a flat, stable target 12 to 28" (305 to 711 mm) away from the end of the sensor. Allow a few seconds for the OCF 5.0 to lock onto the target before displaying its distance. The OCF 5.0 will now display Range in ft or cm (factory calibration).

CONNECTIONS:

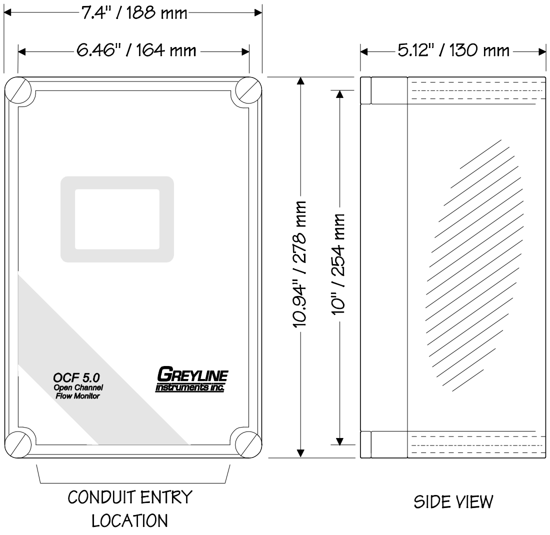
POWER INPUT: Connect 9-32VDC/0.5 Amps to the + and - terminals. The Power Input GND must be connected to the nearest Ground pole. A 1 amp fuse in line is recommended.



CONVERSION GUIDE		
FROM	TO	MULTIPLY BY
US GALLONS	CUBIC FEET	0.1337
US GALLONS	IMPERIAL GALS	0.8327
US GALLONS	LITRES	3.785
US GALLONS	CUBIC METERS	0.003785
LITRES/SEC	GPM	15.85
LITRES	CUBIC METERS	0.001
BARRELS	US GALLONS	42
BARRELS	IMPERIAL GALS	34.9726
BARRELS	LITRES	158.9886
INCHES	MM	25.4
DEGREES F	DEGREES C	(°F-32) x 0.556
POUNDS	KILOGRAMS	0.453
PSI	BAR	0.0676
FOOT^2	METER^2	0.0929

VOLUME CALCULATION FOR ROUND TANKS: 3.142 x R^2 x H
R = TANK RADIUS (½ TANK DIAMETER)
H = TANK HEIGHT

SPECIFICATIONS



Accuracy: ±0.25% of Range or 2 mm, whichever is greater Repeatability and Linearity: 0.1% F.S.

Displays: White, backlit matrix - displays flow rate, totalizer, relay states, operating mode and calibration menu

Calibration: built-in 5-key calibrator with English, French or Spanish language

Power Input: 100-240VAC, 50/60Hz, 30 Watts or 9-32VDC, 9 Watts max

Output: Isolated 4-20mA (1000 ohm load max.)

Control Relays: Qty 2, rated 5 amp 240VAC SPDT, programmable flow alarm and/or proportional pulse

Enclosure: watertight, dust tight NEMA4X (IP 66) polycarbonate with a clear shatter-proof face

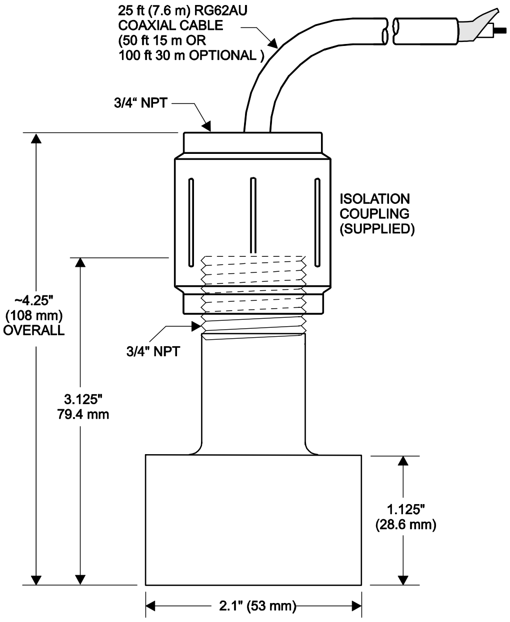
Environmental Conditions: Relative humidity up to 80% -23 to 60°C ambient temperature, maximum 5000 m altitude, pollution degree 4, Installation Category II.

Sensitivity: adjustable. Damping: adjustable

Electrical Surge Protection: Sensor, 4-20mA output and AC power input

Approximate Shipping Weight: 10 lbs (4.5 kg)

Standard Sensor PZ15



Maximum Range: 15 ft (4.57 m)

Minimum Range (Deadband): 8" (203.2 mm)

Operating Frequency: 92 KHz

Beam Angle: 8°

Operating Temperature: -40° to 150° (-40° to 65°C)

Temperature Compensation: Automatic, continuous

Max. Operating Pressure: 20 psi (1.35 bar)

Sensor Face: PVC

Sensor Body: PVC

Mounting: ¾" NPT

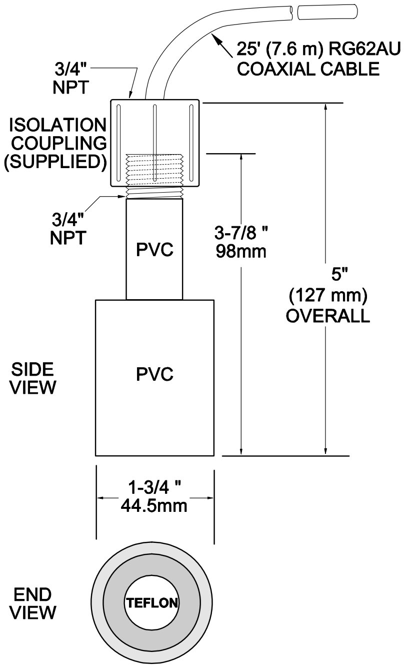
Cable Length: 25 ft. (7.6 m) continuous RG62AU coaxial. Optional 50 ft. (15 m) continuous

Max. Cable Length: 500 ft. (152 m) RG62AU coaxial (splice)

Hazardous Rating: CSA rated Intrinsically Safe Class I, Groups C,D, Class II, Groups E,F,G with Optional Intrinsic Safety Barrier.

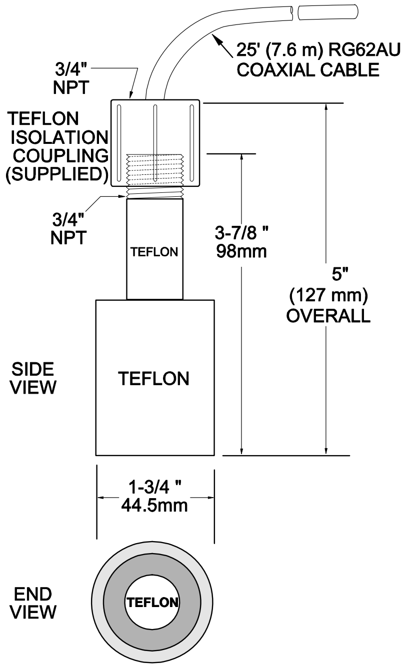
Optional Sensor PZ32T

Maximum Range:	32 ft. (10 m)
Deadband (blanking):	Programmable, minimum 12” (305 mm)
Beam Angle:	8° at 3 DB
Temperature Compensation:	Automatic, continuous
Operating Frequency:	42 KHz
Exposed Materials:	PVC and Teflon
Operating Temperature:	- 40° to 150°F (-40° to 65°C)
Operating Pressure:	20 psi (1.35 Bar) maximum
Mounting:	¾” NPT (PVC isolation coupling supplied)
Sensor Cable:	RG62AU coaxial, 25 ft. (7.6 m) standard
Hazardous Rating:	with optional Intrinsic Safety Barrier: CSA, Class I,II,III, Div. I,II, Groups C,D,E,F,G Note: Max Range reduced to 25 ft (7.6 m) with ISB option.



Optional Sensor PZ32TE

Maximum Range:	32 ft. (10 m)
Deadband (blanking):	Programmable, minimum 12” (305 mm)
Beam Angle:	8° at 3 DB
Temperature Compensation:	Automatic, continuous
Operating Frequency:	42 KHz
Exposed Materials:	Teflon
Operating Temperature:	-40° to 170°F (-40° to 76°C)
Operating Pressure:	20 psi (1.35 Bar) maximum
Mounting:	¾” NPT (Teflon isolation coupling supplied)
Sensor Cable:	RG62AU coaxial, 25 ft. (7.6 m) standard
Hazardous Rating:	with optional Intrinsic Safety Barrier: CSA, Class I,II,III, Div. I,II, Groups C,D,E,F,G, Note: Max Range reduced to 25 ft (7.6 m) with ISB option.



600XLM V2-1 SONDES

NEW

600XL V2-1 and 600XLM V2-1 Sondes

Measure multiple parameters simultaneously


Left: 600XL V2-1 with two-piece probe guard; right: 600XLM V2-1 sonde with optical DO sensor (bottom) and batteries (top)

The YSI 600XL V2 and YSI 600XLM V2 compact sondes measure multiple parameters simultaneously, including:

Temperature	Specific Conductance
Conductivity	Salinity
pH	Resistivity
ORP	TDS
Depth or Level	

Both sondes have one optical port, allowing for measurement of an additional parameter with one of the following optical sensors:

ROX™ Optical Dissolved Oxygen
Turbidity
Chlorophyll
Blue-Green Algae (freshwater or marine)
Rhodamine WT

Each optical sensor has an integrated anti-fouling wiper which prolongs deployment times (thus reducing operating costs) and improves the quality of data.

Economical Logging and Spot Sampling System

The YSI 600XLM V2 is an economical logging system for long-term, *in situ* monitoring, profiling, and spot sampling. It will log all parameters at programmable intervals and store 150,000 readings. At one-hour intervals, the instrument will log data for about 75 days utilizing its own power source. The 600XL V2 can also be used in the same manner with user-supplied external power.

- **Either sonde fits down 2" wells (1.65" OD)**
- **Optical sensor port provides a multipurpose platform**
- **Field-replaceable sensors for quicker maintenance**
- **Easily connects to data collection platforms**
- **Anti-fouling wipers on optical sensors extend deployment times**
- **Compatible with YSI 650 Multiparameter Display System**
- **Flow cell available for pump-through applications**
- **Horizontal measurements in very shallow waters**

Connect with Data Collection Platforms

Either sonde can easily connect to the YSI 650 handheld logger/display, YSI 6200 DAS (Data Acquisition System), web-enabled YSI EcoNet® or your own data collection platform, via SDI-12, for remote and real-time monitoring applications.

Pure
Data for a
Healthy
Planet.®

Multiparameter sampling or logging in a compact sonde for ground water, dredging, and spot sampling applications

To order, or for more information, contact YSI
+1 937 767 7241
800 897 4151 (US)
www.ysi.com

YSI Environmental
+1 937 767 7241
Fax +1 937 767 9353
environmental@ysi.com

YSI Integrated Systems & Services
+1 508 748 0366
Fax +1 508 748 2543
systems@ysi.com

SonTek/YSI
+1 858 546 8327
Fax +1 858 546 8150
inquiry@sontek.com

YSI Gulf Coast
+1 225 753 2650
Fax +1 225 753 8669
environmental@ysi.com

YSI Hydrodata (UK)
+44 1462 673 581
Fax +44 1462 673 582
europe@ysi.com

YSI Middle East (Bahrain)
+973 1753 6222
Fax +973 1753 6333
halsalem@ysi.com

YSI (Hong Kong) Limited
+852 2891 8154
Fax +852 2834 0034
hongkong@ysi.com

YSI (China) Limited
+86 10 5203 9675
Fax +86 10 5203 9679
beijing@ysi-china.com

YSI Nanotech (Japan)
+81 44 222 0009
Fax +81 44 221 1102
nanotech@ysi.com

ISO 9001
ISO 14001
Yellow Springs, Ohio Facility

Printed in USA 0407 E77

YSI incorporated
Who's Minding the Planet?®

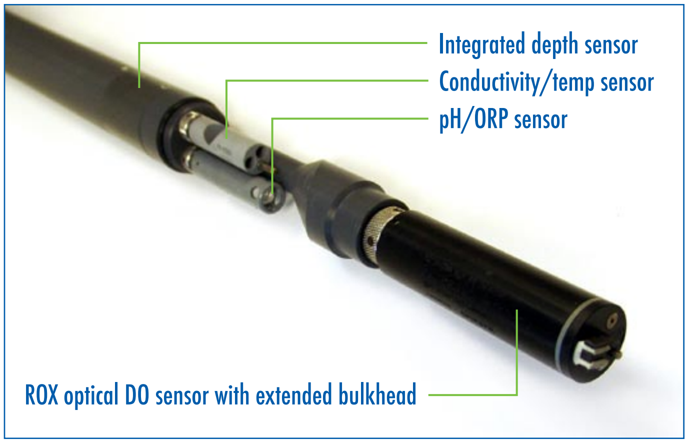
Sonde Features

- **ROX™ Optical DO:** An extremely durable DO sensor with excellent stability, insensitivity to hydrogen sulfide, and integrated anti-fouling wiper, which results in the longest deployment times while reducing operating costs.
- **Field-Replaceable Sensors** allow users to quickly and easily replace damaged sensors in the field or reconfigure a sonde for multiple applications by switching optical sensors.
- **Power Management:** Battery life is 34 days at a 15-minute interval or 75 days at a 1-hour interval with optical DO sensor installed.
- **Key Applications:** ground water monitoring, dredging, spot sampling, education, and long-term monitoring studies.

YSI 600XL V2-1 and 600XLM V2-1 Sonde Specifications

Available Sensors*		Temperature, conductivity, pH, ORP, optional depth (shallow, medium, or shallow vented), and one optical sensor (dissolved oxygen, turbidity, chlorophyll, rhodamine, or blue-green algae)
Operating Environment		
	Medium	Fresh, sea, or polluted water
	Temperature	-5 to 50°C
	Depth	0 to 200 ft (61 m) for sonde
Storage Temperature		-40 to 60°C for sonde and sensors except pH and pH/ORP -10 to 60°C for pH and pH/ORP sensors
Material		PVC, stainless steel
Diameter		1.65 in (4.19 cm)
Length	600XL V2	25.1 in (63.8 cm) without depth sensor; 27.1 in (68.8 cm) with depth and no bottom weight
	600XLM V2	28.5 in (72.4 cm) without depth sensor; 30.5 in (77.5 cm) with depth and no bottom weight
Weight	600XL V2	1.96 lbs. (0.87 kg) with depth and no bottom weight
	600XLM V2	2.15 lbs. (1.05 kg) with depth and no bottom weight
Communications		RS-232C, SDI-12
Memory		384 kb (150,000 individual parameter readings)
Power	600XL V2	External 12 V DC
	600XLM V2	4 AA Alkaline batteries or external 12 V DC
Battery Life		Approximately 30 days at 20°C at a 15-minute logging interval with optical DO, temperature, conductivity, pH/ORP, and depth sensors operative

** Note: Rapid Pulse™ polarographic-style DO sensor is not available on the V2 sondes. Please refer to the 600XL or 600XLM sondes.*



Standard Accessories

- Two-piece probe guard with bottom weight
- Carrying case
- 8, 25, 50, and 100 ft cables (other lengths available)
- Long calibration cup
- EcoWatch® software
- Maintenance kit
- Flow cell kit (optional)