EXHIBIT A
PINELLAS COUNTY WATER QUALITY ASSESSMENT PROGRAM

DIVISION OF ENVIRONMENTAL MANAGEMENT

MS4 NPDES PERMIT FLS000005-004

June 28, 2019

**PINELLAS COUNTY WATER QUALITY ASSESSMENT PROGRAM
IN COMPLIANCE WITH MS4 NPDES PERMIT FL000005-004**

The Pinellas County Division of Environmental Management (PCDEM) has conducted ambient surface water quality monitoring since 1991. The 1991-2002 monitoring program was designed to collect monthly surface water quality data at fixed stations in County streams, lakes, and marine waters. Beyond fulfilling the monitoring requirements of NPDES permit FLS000005, this monitoring effort provided important water quality data to support Pinellas County watershed planning initiatives, the Pinellas County Comprehensive Plan, and the Tampa Bay Estuary Program (TBEP) Comprehensive and Conservation Management Plan.

In January 2003, a revised ambient monitoring program was implemented to provide better geographical coverage of County waters and to provide more statistically defensible results in comparison to the original program (Janicki, 2003). The current ambient water quality monitoring program consists of two types of sample sites: fixed "land run" sites and stratified random "probabilistic" open water sites. Pinellas County and its 23 co-permittees have an interlocal agreement to share the costs of the Ambient Water Quality Monitoring Program. The City of St. Petersburg has implemented its own monitoring program, so watersheds solely in that jurisdiction are excluded from the PCDEM monitoring and assessment program.

A. Monitoring Plan Goals and Objectives

The PCDEM monitoring program combines multiple approaches and collects data to:

- Assess the status and long-term trends of water quality parameters in County watersheds.
- Measure the effectiveness of Stormwater Management Plan implementation in County watersheds.
- Identify potential water quality pollutant "hotspot" areas to be targeted for corrective action.
- Support the development and implementation of Total Maximum Daily Loads (TMDLs).

B. Monitoring Approach

The PCDEM monitoring program components are summarized below.

1. Probabilistic Monitoring

A probabilistic monitoring design is used for Lake Seminole, Lake Tarpon, and Pinellas County coastal waters, excluding City of St. Petersburg coastal waters (Figure 1). This design includes an Environmental Monitoring Assessment Program (EMAP)-based element and a stratified random

element, where each geographic segment ("strata") is overlaid with a hexagonal grid, and sample sites are chosen randomly from the hexagons each year. This design allows calculation of means and confidence limits for various water quality conditions within a broad geographic area ("stratum").

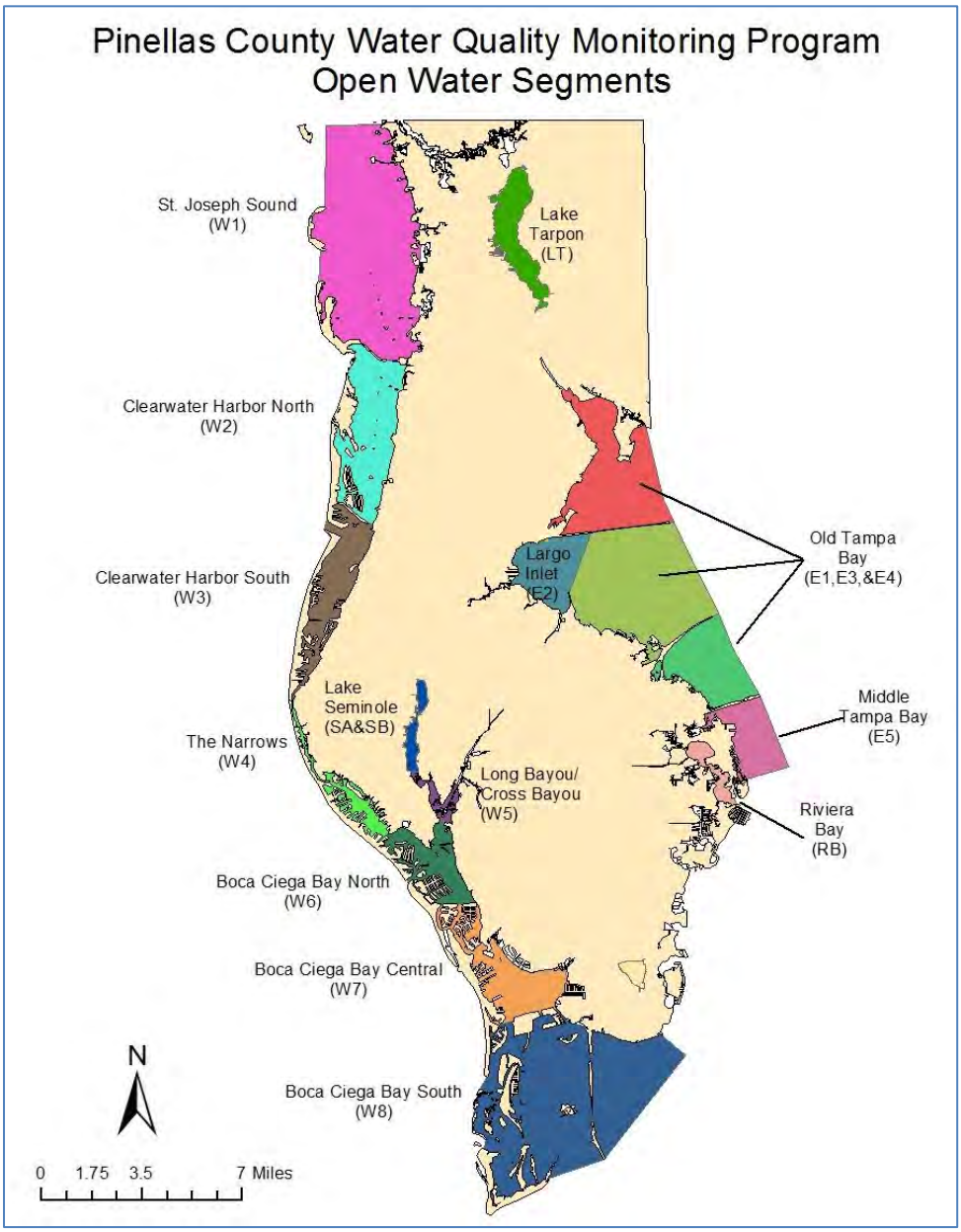

Figure 1. Pinellas County probabilistic water quality monitoring for open water strata.

Sites were originally sampled nine times per year, but in 2008, the fixed sampling was reduced to eight times a year. Monitoring occurs over four dry season (October through early June) sample periods, during which sites are visited every 50.75 days, and four wet season (June through September) sample periods of 40.5 days. Four sites are selected randomly each

monitoring period within each of the strata for a total of 32 samples per strata per year. In addition, two temporal units, morning and afternoon, are considered each day of sampling, and the order of visitation (i.e., morning vs. afternoon) within each stratum is randomized. The eastern strata sample effort is further stratified by depth, with six sample sites randomly selected from waters greater than two meters deep and 26 sites randomly selected from waters less than two meters deep. If a primary sampling site cannot be used for some reason (i.e., too shallow), sets of randomly selected alternate sites are available.

This monitoring component results in water quality status and trends calculations within geographical reporting units ("strata"), identification and prioritization of receiving waters not meeting designated uses, and statistical water quality comparisons among strata.

2. Fixed Site Monitoring

Streams and channels are monitored at fixed sites located in each basin within the permit coverage area, excluding the City of St. Petersburg (Figure 2). Lake Chautauqua and Alligator Lake are also monitored as fixed sites. The County is composed of 52 watersheds, and an additional 11 open water areas surround these land areas (Basins 53-63 in Figure 2). Most of the watersheds contain at least one fixed monitoring station near the final discharge point of the tributary or watershed and just upstream of tidal influence. Flow is measured either manually by PCDEM staff or continuously by USGS or Hydrologic Data-Collection, Inc. gages. Water quality is sampled for a few sites that are located in tidal portions of streams or channels, but flow is not measured at all of those sites.

Land run sites are grouped by proximity, with between six and eight sites sampled on a single day. Sites were originally sampled nine times per year, but in 2008, the fixed sampling was reduced to eight times a year. Monitoring occurs over four dry season (October through early June) sample periods, during which sites are visited every 50.75 days, and four wet season (June through September) sample periods of 40.5 days. A few sites may change from year to year based on work being done or planned in a basin that could impact results.

Long-term fixed site monitoring provides data to calculate pollutant loads, explore pollutant source tracking, identify and prioritize waterbodies not meeting designated uses, and perform long-term trend analyses. Pinellas County developed basin and landuse specific Event Mean Concentrations (EMCs) for all basins in 2016. These EMCs are adjusted as needed every permit cycle and included in the Year 3 NPDES Annual Report.

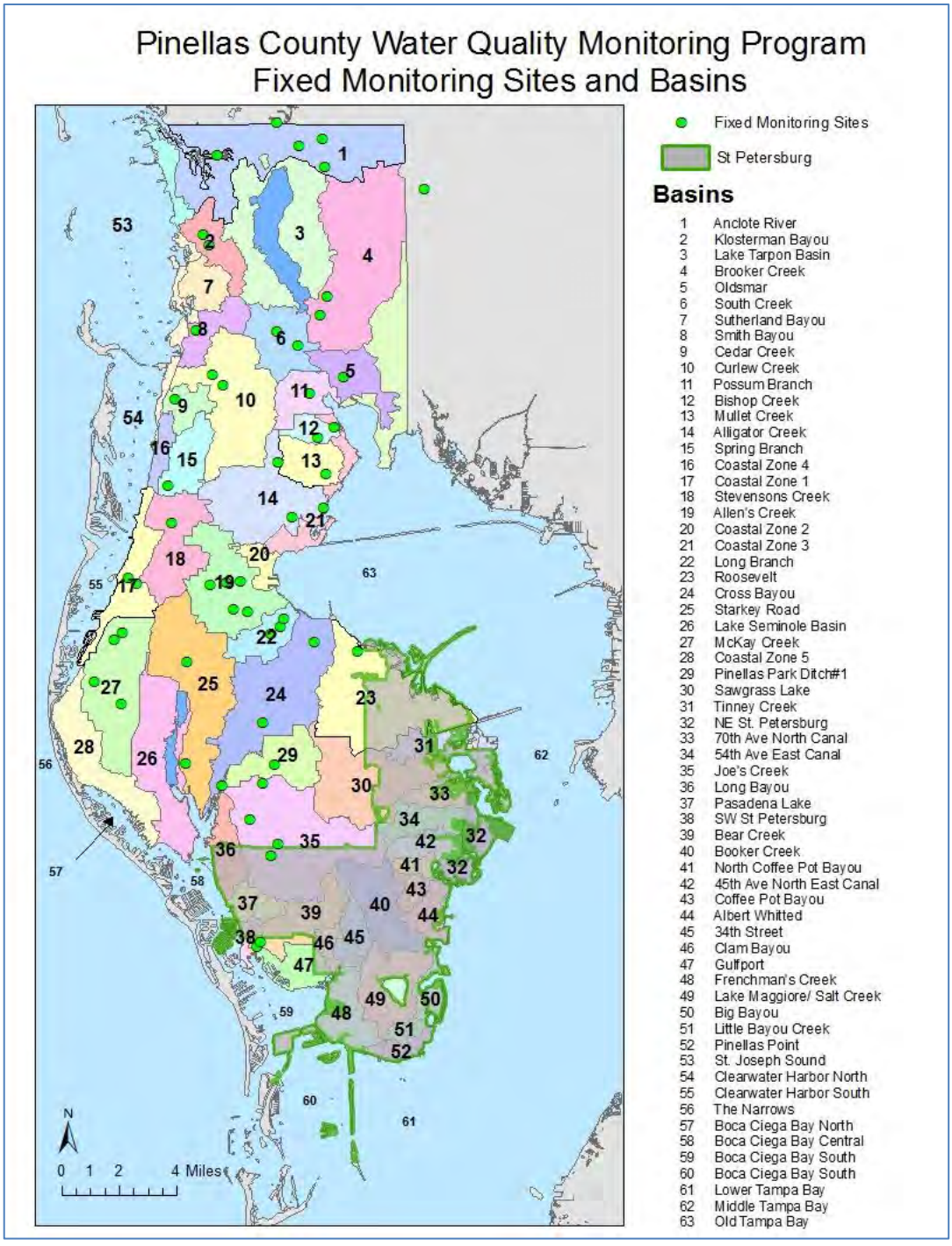

Figure 2. Pinellas County fixed site water quality monitoring for streams and channels.

3. Biological Monitoring

The PCDEM biological monitoring program began in 2014 and includes sampling and taxonomic analysis of benthic macroinvertebrates, aquatic macrophytes, and periphyton in streams and lakes (Figure 3). This monitoring component provides a direct measure as to whether the designated aquatic life use, defined as a "well-balanced population of fish and wildlife" (F.A.C 62.302-400), is being attained in waterbodies. Stream sites are sampled twice a year every other year, and lakes are sampled every summer.

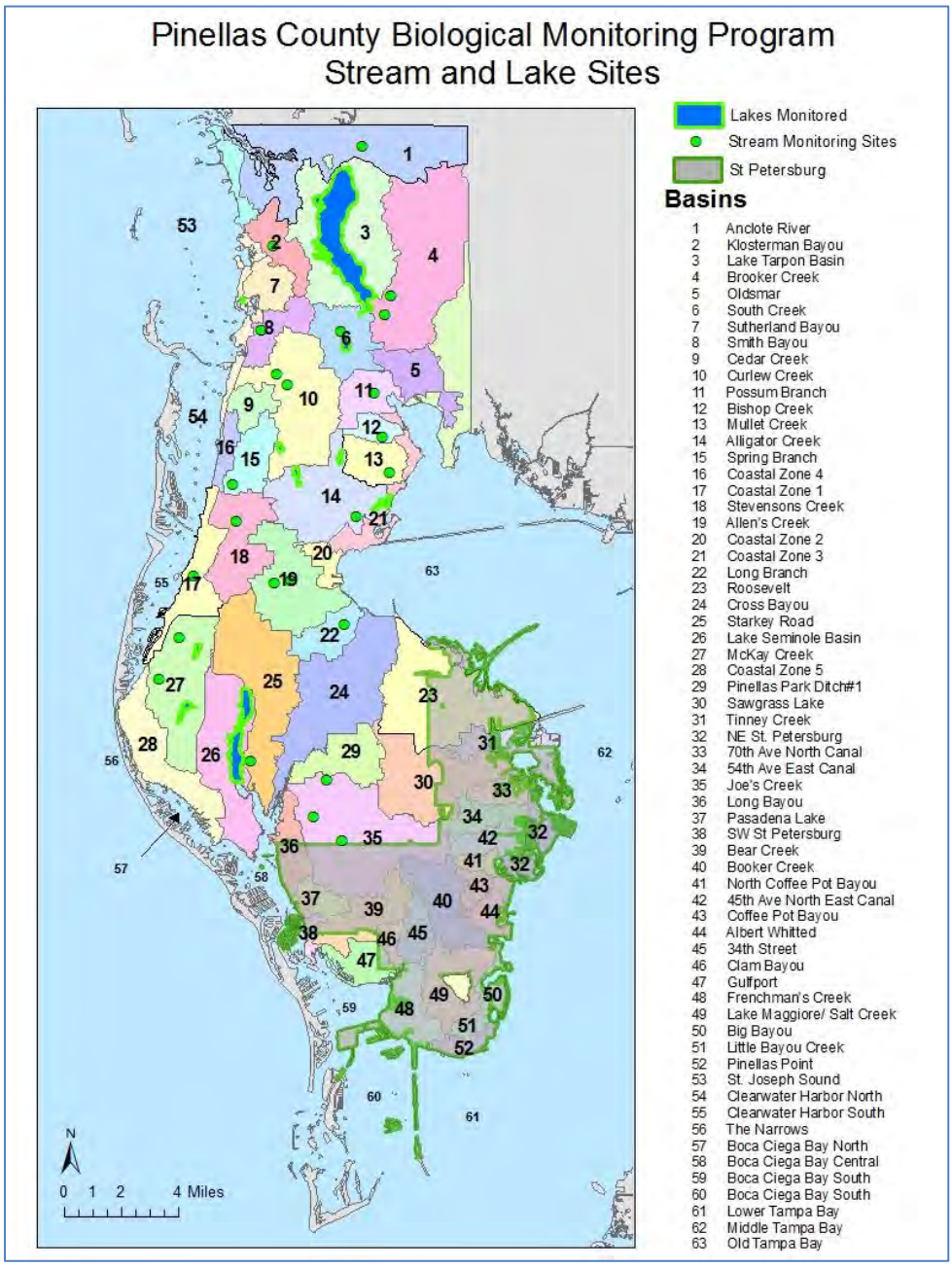

Figure 3. Pinellas County biological monitoring sites.

4. BMP and Special Project Evaluations

Special monitoring is performed as needed to evaluate specific BMPs or verify source areas of pollution. This monitoring may be done in conjunction with the ambient monitoring using the same protocols and analyzing the same parameters. Occasionally, monitoring may be conducted using automated sampling systems. BMP / special project monitoring usually occurs over two to three years, depending on the project being evaluated. If a BMP is being assessed, it is optimal to obtain water quality data before installation of the BMP in addition to afterwards. Both base flow and storm event conditions should be captured over the project monitoring period.

C. Monitoring Parameters and Sampling

Monitoring is conducted during eight periods per year at all fixed sites and at four random sites in each open water segment. Parameters recorded/analyzed are listed in Table 1, and the analytical methods are in Table 2. Monitoring activities are performed in accordance with the PCDEM Standard Operating Procedures (SOPs) (Appendix A, page 20). The County has contracts to obtain continuous flow with the United States Geologic Survey (USGS) at 9 stream sites and with Hydrologic Data Inc. (HDI) at 10 sites. Continuous flow is obtained at two additional sites in cooperation with SWFWMD and Hillsborough County. PCDEM staff measure flow manually at other sites that are not tidally influenced, as well as at some tidally influenced sites.

Table 1. Monitoring parameters and sampling details.

Monitoring Station Type	Monitoring Parameters	Collection Method	Sampling Frequency (Times per Year)	Type of Monitoring
Fixed and Probabilistic Sites	Total Nitrogen (TN) (calculated)	Grab	8	Ambient
	Nitrate-Nitrite	Grab	8	
	Total Kjeldahl Nitrogen (TKN)	Grab	8	
	Ammonia	Grab	8	
	Total Phosphorus (TP)	Grab	8	
	Orthophosphate	Grab	8	
	Chlorophyll-a, b, c, and phaeophytin	Grab	8	
	Turbidity	Grab	8	
	Total Suspended Solids (TSS)	Grab	8	
	5-Day Biochemical Oxygen Demand (BOD)	Grab	4	
	pH	In-situ	8	
	Water Temperature	In-situ	8	
	Specific Conductance	In-situ	8	
	Salinity	In-situ	8	
	Dissolved Oxygen, conc and % saturation	In-situ	8	
Fixed Sites	Flow	In-situ	8	
	Bacteria	Grab	8	
All Lakes	Color	Grab	8	
	Alkalinity	Grab	8	
Lake Seminole and By-Pass Canal Fixed Sites	Dissolved Aluminum	Grab	8	
Probabilistic Sites and Lakes	Secchi Depth	In-situ	8	
	Transmissivity	Grab	8	

Table 2. Ambient monitoring parameters and analytical methods.

Parameter	Method
Total depth	FDEP-SOP-001/01 FT 1000
Flow	PCDEM SOP
Temperature	FDEP-SOP-001/01 FT 1400
pH	FDEP-SOP-001/01 FT 1100
Dissolved oxygen	FDEP-SOP-001/01 FT 1500
Specific conductivity	FDEP-SOP-001/01 FT 1200
Salinity	FDEP-SOP-001/01 FT 1300
Total Kjeldahl nitrogen	ASTM 3590-11
Ammonia	SM 4500 NH3-H
Nitrate-nitrite	SM 4500 NO3-F
Total phosphorus	EPA 365.1
Ortho-phosphate	SM 4500-PF
Chlorophyll series	SM 10200-H
Total suspended solids	SM 2540-D
Turbidity	SM 2130-B
Biochemical oxygen demand	SM 5210-B
Enterococci	Enterolert/ASTM D6503-99
E. coli	SM 9223-B
Color	SM 2120-B
Alkalinity	SM 2320-B
Dissolved Aluminum	EPA 200.7

The five indices provided by biological assessments are:

- Stream Condition Index (SCI) – (Determined from spring and fall samples every other year) The SCI is a composite macroinvertebrate index for use in flowing streams. Spring and fall sampling events consist of 20 dipnet sweeps of the most productive habitats found in a 100-meter (m) stretch of a stream. Organisms collected in these sweeps are preserved and brought back to the laboratory to identify taxonomy and calculate relative abundance.
- Habitat Assessment (HA) - (Determined from spring and fall surveys every other year) A habitat assessment is performed concurrent with each SCI collection. Eight attributes known to have potential effects on the stream biota are rated to produce a score; the higher the score indicating less human disturbance. This is important when determining potential causes of any biological imbalances because the stressors may be due to the inadequacy of physical habitat and proximity to human activities.
- Rapid Periphyton Survey (RPS) - (Determined from spring and fall surveys every other year) The RPS measures the relative abundance of algae growing on stream substrate in a 100-m stream segment and is performed concurrent with each SCI. Nine observations are made every 10-m for a total of 99 observations (11 transects, including 0- and 100-m marks). A canopy measurement is made at the mid-point of each transect using a spherical densiometer. A small amount of substrate is randomly collected at each transect point and is visually examined for the presence/absence of

algae. If present, the average length of the filament is measured and recorded.

- Linear Stream Index (LVS) - (Determined from spring and fall surveys every other year) The LVS is a rapid tool to document the plant community in a 100-m stream reach and is performed concurrent with each SCI. Aquatic plants growing in the stream are recorded for each of ten 10-m sections, and any domination of taxa is noted.
- Lake Vegetation Index (LVI) – (Determined from a single summer survey every other year) The LVI is a multi-metric tool which assesses lake health based on the plant community structure. An LVI is performed in the summer season every other year. The lake is divided into 12 equal units and 4 of the 12 units are surveyed using a visual boat "drive by" and a transect approach.

D. Monitoring locations

Please refer to figures 1, 2, and 3 for maps of open water monitoring segments, fixed sites, and biological monitoring sites. Table 3 contains specific information on the locations of the fixed monitoring sites, as well as major basin that is being monitored, landuse in the basin, and current impairment and TMDL status. Appendix B (page 164) shows the 266 outfalls in the Pinellas County unincorporated area.

Table 3. Monitoring site details.

BASIN	Watershed Size (approx. acres)	Landuse	% Acres	Monitoring Site	Site Name	Latitude	Longitude	Verified Impaired?	Adopted TMDL?
Allens Creek	4,919	**Multi Fam. Res.**	65%	19-02	Allens Creek	27.928130	-82.745980	Y	N
		Rec/Open Space	11%	19-10	Allens Creek	27.927120	-82.738440	Y	N
		Commercial	8%	19-08	Allens Creek	27.940400	-82.759800	Y	N
		Single Fam. Res.	6%	19-12	Allens Creek	27.941750	-82.750010	Y	N
		Pub/Semi Public	4%	19-13	Allens Creek	27.942100	-82.742200	Y	N
		Agricultural	4%						
		Roads	2%						
		Industrial	1%						
Alligator Creek	5,691	**Multi Fam. Res.**	45%	14-10	Alligator Creek	27.974700	-82.713550	Y	Y
		Rec/Open Space	20%	14-07	Alligator Lake	27.979590	-82.695250	Y	N
		Commercial	14%	14-02	Lake Chautauqua	28.002570	-82.721710	N	N
		Industrial	6%						
		Roads	5%						
		Single Fam. Res.	5%						
		Pub/Semi Public	5%						
		Agricultural	< 1%						
Anclote River	9,095	**Rec/Open Space**	51%	01-01	Anclote River downstrm	28.157200	-82.757040	Y	Y
		Multi Fam. Res.	26%	01-08	Anclote River upstrm	28.174030	-82.723490	Y	Y
		Single Fam. Res.	7%	01-09	Hollin Creek	28.162290	-82.710830	Y	Y
		Agricultural	6%						
		Commercial	4%						
		Industrial	2%						
		Roads	2%						
		Pub/Semi Public	2%						
		Vacant	< 1%						
Bear Creek	2,807	**Multi Fam. Res.**	75%	39-01	Bear Creek downstrm	27.757685	-82.731687	Y	N
		Commercial	13%	39-05	Bear Creek upstrm	27.760282	-82.729759	Y	N

BASIN	Watershed Size (approx. acres)	Landuse	% Acres	Monitoring Site	Site Name	Latitude	Longitude	Verified Impaired?	Adopted TMDL?
		Pub/Semi Public	7%						
		Rec/Open Space	3%						
		Roads	1%						
		Industrial	< 1%						
		Single Fam. Res.	< 1%						
Bishop Creek	874	**Multi Fam. Res.**	65%	12-02	Bishop Creek-North Br	28.020440	-82.690020	Y	Y
		Pub/Semi Public	14%	12-04	Bishop Creek-South Br	28.014890	-82.698880	Y	Y
		Single Fam. Res.	8%						
		Rec/Open Space	7%						
		Roads	3%						
		Commercial	2%						
		Agricultural	< 1%						
Brooker Creek	9,990	**Rec/Open Space**	67%	04-02	Brooker Creek	28.140870	-82.639450	Y	Y
		Multi Fam. Res.	20%	04-03	Brooker Creek	28.086330	-82.694150	Y	Y
		Single Fam. Res.	6%	04-04	Brooker Creek	28.076660	-82.697890	Y	Y
		Agricultural	4%						
		Roads	2%						
		Pub/Semi Public	1%						
		Commercial	< 1%						
Cedar Creek	1,229	**Multi Fam. Res.**	68%	09-02	Cedar Creek	28.033750	-82.780070	Y	N
		Rec/Open Space	20%						
		Pub/Semi Public	9%						
		Commercial	2%						
		Roads	1%						
Coastal Zone 1	2,905	**Multi Fam. Res.**	57%	17-01	Rattlesnake Creek downstrm	27.943530	-82.805970	Y	N
		Commercial	19%	17-03	Rattlesnake Creek upstrm	27.940680	-82.801350	Y	N
		Rec/Open Space	17%						
		Pub/Semi Public	3%						

BASIN	Watershed Size (approx. acres)	Landuse	% Acres	Monitoring Site	Site Name	Latitude	Longitude	Verified Impaired?	Adopted TMDL?
		Industrial	3%						
		Roads	< 1%						
		Single Fam. Res.	< 1%						
Cross Bayou	7,808	**Multi Fam. Res.**	33%	24-01	Cross Bayou-South	27.839030	-82.752200	Y	N
		Industrial	20%	24-02	Cross Bayou-North	27.911900	-82.700350	Y	Y
		Rec/Open Space	16%	24-07	Cross Bayou	27.871180	-82.729360	Y	N
		Commercial	13%						
		Roads	9%						
		Pub/Semi Public	6%						
		Single Fam. Res.	1%						
		Agricultural	< 1%						
		Vacant	< 1%						
Curlew Creek	6,711	**Multi Fam. Res.**	63%	10-02	Curlew Creek	28.046590	-82.759150	Y	Y
		Rec/Open Space	15%	10-06	Jerry Creek	28.041040	-82.753170	N	N
		Commercial	11%						
		Roads	6%						
		Single Fam. Res.	3%						
		Pub/Semi Public	2%						
		Agricultural	< 1%						
		Industrial	< 1%						
Joes Creek	9,257	**Multi Fam. Res.**	67%	35-10	Joes Creek	27.809920	-82.720530	N	Y
		Commercial	12%	35-12	Miles Creek	27.803730	-82.724120	N	Y
		Rec/Open Space	5%	35-01	PPD #5	27.840630	-82.728950	Y	Y
		Pub/Semi Public	5%	35-04	Bonn Creek	27.822110	-82.736272	Y	Y
		Industrial	4%						
		Roads	4%						
		Single Fam. Res.	2%						
		Agricultural	< 1%						

BASIN	Watershed Size (approx. acres)	Landuse	% Acres	Monitoring Site	Site Name	Latitude	Longitude	Verified Impaired?	Adopted TMDL?
Klosterman Bayou	2,063	**Rec/Open Space**	48%	02-02	Klosterman Creek downstrm	28.117164	-82.764944	Y	Y
		Multi Fam. Res.	39%	02-09	Klosterman Creek upstrm	28.111720	-82.761510	Y	Y
		Roads	5%						
		Single Fam. Res.	4%						
		Commercial	4%						
		Industrial	1%						
		Pub/Semi Public	< 1%						
Long Branch	1,804	**Multi Fam. Res.**	58%	22-12	Longbranch Creek	27.915660	-82.725140	Y	Y
		Commercial	15%	22-16	Longbranch Creek	27.919580	-82.719750	Y	Y
		Rec/Open Space	11%	22-01	Longbranch Creek	27.923230	-82.717810	Y	Y
		Roads	8%						
		Single Fam. Res.	4%						
		Industrial	3%						
		Pub/Semi Public	1%						
		Agricultural	< 1%						
McKay Creek	5,652	**Multi Fam. Res.**	64%	27-11	McKay Creek	27.912120	-82.813870	Y	Y
		Rec/Open Space	20%	27-10	McKay Creek	27.879800	-82.809510	Y	Y
		Commercial	7%	27-09	McKay Creek	27.915960	-82.808900	Y	Y
		Pub/Semi Public	5%	27-08	Church Creek	27.891050	-82.824900	Y	N
		Roads	2%						
		Single Fam. Res.	2%						
		Industrial	1%						
		Agricultural	1%						
Mullet Creek	1,961	**Multi Fam. Res.**	54%	13-05	Mullet Creek	27.996810	-82.694030	Y	Y
		Rec/Open Space	16%						
		Single Fam. Res.	12%						
		Commercial	5%						
		Pub/Semi Public	5%						

BASIN	Watershed Size (approx. acres)	Landuse	% Acres	Monitoring Site	Site Name	Latitude	Longitude	Verified Impaired?	Adopted TMDL?
		Industrial	4%						
		Roads	3%						
		Agricultural	1%						
Oldsmar	2,352	**Multi Fam. Res.**	41%	05-06	Moccasin Creek	28.045600	-82.684650	Y	Y
		Rec/Open Space	33%						
		Commercial	9%						
		Roads	8%						
		Industrial	6%						
		Pub/Semi Public	2%						
		Single Fam. Res.	1%						
Pinellas Park Ditch#1	2,753	**Multi Fam. Res.**	53%	29-11	PPD #1	27.849828	-82.722422	Y	Y
		Commercial	14%						
		Rec/Open Space	14%						
		Single Fam. Res.	8%						
		Pub/Semi Public	4%						
		Industrial	3%						
		Roads	2%						
		Agricultural	1%						
Possum Branch	1,967	**Multi Fam. Res.**	54%	11-05	Briar Creek	28.037300	-82.703730	Y	N
		Rec/Open Space	31%						
		Roads	6%						
		Pub/Semi Public	4%						
		Commercial	2%						
		Agricultural	1%						
		Single Fam. Res.	1%						
Roosevelt	8,117	**Rec/Open Space**	38%	23-08	Roosevelt Canal	27.907500	-82.676050	Y	N
		Roads	26%						
		Multi Fam. Res.	14%						

BASIN	Watershed Size (approx. acres)	Landuse	% Acres	Monitoring Site	Site Name	Latitude	Longitude	Verified Impaired?	Adopted TMDL?
		Industrial	13%						
		Commercial	9%						
		Pub/Semi Public	1%						
		Single Fam. Res.	< 1%						
Smith Bayou / Bee Branch	1,835	**Multi Fam. Res.**	69%	08-03	Bee Branch	28.068681	-82.768183	Y	N
		Rec/Open Space	10%						
		Commercial	6%						
		Single Fam. Res.	6%						
		Pub/Semi Public	5%						
		Roads	3%						
		Industrial	1%						
		Agricultural	< 1%						
South Creek	2,913	**Multi Fam. Res.**	60%	06-06	Tarpon Outfall Canal	28.061200	-82.710400		
		Rec/Open Space	23%	06-03	Cow Branch	28.068170	-82.722860	Y	N
		Commercial	8%						
		Roads	7%						
		Pub/Semi Public	2%						
		Agricultural	< 1%						
		Industrial	< 1%						
		Single Fam. Res.	< 1%						
Spring Branch	2,135	**Multi Fam. Res.**	73%	15-04	Spring Branch	27.990170	-82.784000	Y	N
		Rec/Open Space	10%						
		Pub/Semi Public	6%						
		Commercial	6%						
		Single Fam. Res.	2%						
		Roads	2%						
		Agricultural	< 1%						
Starkey Road	7,422	**Multi Fam. Res.**	51%	25-07	Seminole Bypass	27.850130	-82.772940	Y	N

BASIN	Watershed Size (approx. acres)	Landuse	% Acres	Monitoring Site	Site Name	Latitude	Longitude	Verified Impaired?	Adopted TMDL?
		Rec/Open Space	17%	25-08	Seminole Bypass	27.901559	-82.772740	Y	N
		Industrial	12%						
		Commercial	9%						
		Roads	4%						
		Pub/Semi Public	4%						
		Single Fam. Res.	3%						
		Agricultural	1%						
Stevensons Creek	3,879	**Multi Fam. Res.**	69%	18-06	Stevenson Creek	27.971480	-82.781530	Y	N
		Commercial	12%						
		Rec/Open Space	11%						
		Pub/Semi Public	4%						
		Roads	2%						
		Industrial	1%						
		Single Fam. Res.	< 1%						
		Agricultural	< 1%						

E. Identification of Responsible Authorities and Partnerships

PCDEM staff coordinate and perform monitoring activities. All 23 co-permittees, listed in Table 4 below, are partners in this monitoring plan. The Pinellas County Utilities Laboratory (PCUL) performs laboratory analysis of samples.

Table 4. Co-permittees for Cycle 4 Assessment Program.

Co-Permittees		
Belleair	Kenneth City	Redington Shores
Belleair Beach	Largo	Safety Harbor
Belleair Bluffs	Madeira Beach	St. Pete Beach
Clearwater	North Redington Beach	Seminole
Dunedin	Oldsmar	South Pasadena
Florida Dept of Transportation	Pinellas County	Tarpon Springs
Gulfport	Pinellas Park	Treasure Island
Indian Rocks Beach	Redington Beach	

F. Quality Assurance

PCDEM staff conduct all sampling activities in accordance with the applicable FDEP SOPs found in F.A.C. Chapter 62-160 and in accord with PCDEM SOPs (Appendix A, page 20). Field and lab equipment is quality assured and calibrated regularly according to SOPs and Quality Assurance Project Plans (QAPPs). All monitoring staff are audited regularly.

Water samples are analyzed by the Pinellas County Utilities Laboratory (PCUL), which is a National Environmental Laboratory Accreditation Program (NELAP) certified lab. Lab analysis is performed in accord with the PCUL Quality Manual (Appendix C, page 166).

G. Records and Reporting

Hard copies of field sheets will be scanned into electronic format and retained at PCDEM for a minimum of seven years. Data will be entered into Excel spreadsheets from field sheets, electronic monitoring data will be uploaded from equipment, and electronic data will be transmitted from the lab. Monitoring information will include date, place, and time of sample collection, names of field samplers, date and time of analyses, and results of analyses, as well as field condition notes and instrument calibration information. This data will be kept indefinitely on the PCDEM server which is regularly backed up.

Ambient monitoring data will be uploaded to the FDEP's Watershed Information Network (WIN) at least annually and made available to the public on the Water Atlas website. Data collected as

part of the ambient program will be used to assess attainment of State water quality standards in accord with the Impaired Waters Rule Chapters 62-302 and 62-303, Florida Administrative Code.

Annual reports and analyses will be stored on the PCDEM server indefinitely. PCDEM plans to include the following analyses in the NPDES permit reports to FDEP:

Annually:

- Data summaries including descriptive statistics for open water strata and stream sites.
- Long-term trend analysis results for each parameter for each site and strata.
- Estimates of the percent of impaired waters within each open water stratum.

Every five years:

- Stream pollutant loading estimates will be included in the NPDES Year 3 Annual Report.
- Spatial interpolations relating a quantitative water quality condition or value with a percentage of area within each stratum will be included in the NPDES Year 5 Annual Report.

BMP and special project monitoring data will be analyzed at the end of the set project period. This data will be used to assess the effectiveness of projects and identify portions of the MS4 which can be targeted for loading reduction/corrective action with additional pollutant reduction measures. Results from this type of sampling will be summarized in the appropriate project reports.

APPENDIX A

PINELLAS COUNTY DIVISION OF ENVIRONMENTAL MANAGEMENT

STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURES

FOR

WATER QUALITY MONITORING

AND MEASUREMENT ACTIVITIES

PINELLAS COUNTY PUBLIC WORKS DEPARTMENT

DIVISION OF ENVIRONMENTAL MANAGEMENT

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Pinellas County Division of Environmental Management Division (DEM) Standard Operating Procedures (SOPs) are adapted from published methods or developed by in-house technical experts. Most of the methods are based on Florida Department of Environmental Quality (FDEP) methods, which are referenced throughout the document. This document is intended primarily for internal DEM use. This SOP document should not replace any official published methods.

Any reference within this document to specific equipment, manufacturers, or supplies is only for descriptive purposes and does not constitute an endorsement of a particular product or service by the DEM. Additionally, any distribution of this SOP does not constitute an endorsement of a particular procedure or method.

Although the DEM will follow these SOPs in most instances, there may be instances in which an alternative methodology, procedure, or process will be used.

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Preparation for Fieldwork: Assembling Necessary Equipment

Effective Date 06/01/2017

1.0 PROCEDURAL SECTION

1.1 Scope and Application

There are currently eight water sampling periods per year which allows sampling of the wet and dry seasons. Each period, ten probabilistic site "water runs" and seven fixed site "land runs" are scheduled. Water runs consist of accessing eight randomly preselected sites by boat with GPS equipment to locate sites. Land runs consist of six to nine fixed sites per day. Two staff members are required for each run, where certified volunteers can substitute for one staff member. Staff and volunteer training can result in a three or four crew member team.

Field sampling days and all shared duties are scheduled on the EM Water Resources calendar in Microsoft Outlook. Those without access to Outlook will be sent a tentative schedule by email to review and confirm.

Staff will report to work at 7:00 am on their scheduled sampling days. Sampling crews should be prepared to leave by 8:00 am. Special circumstances may arise where crew members cannot report at 7:00 am, and alternative report times can be discussed with a supervisor or scheduler prior to the sampling date. Volunteers, staff with morning childcare duties, and afternoon runs may require later report times.

Any available staff not scheduled for sampling should assist with morning preparation and/or afternoon clean up duties and be prepared to assist with bacteria transport and equipment or emergency assistance throughout the day.

1.2 Summary of Method

Bottle preparations are done ahead of time, as described in the "Preparations for Fieldwork: Bottle Prep and Acid Washing SOP." Checklists should be consulted to assure that all necessary equipment is assembled at the start of each sampling day. This SOP provides the checklists of field equipment needed and describes the tasks necessary prior to fieldwork.

1.3 Definitions

Not applicable.

1.4 Health and Safety Warnings

Some field equipment is heavy. Be aware of straining your back or dropping these heavy items. Ask for help when loading and unloading these items.

1.5 Cautions

Not applicable.

1.6 Interferences

Not applicable.

1.7 Personnel Qualification

Personnel must be trained and evaluated on proper preparation methods. Use of equipment and reagents are subject to approval by the QA Officer and/or the Environmental Monitoring Coordinator. Training will be done through dry run exercises in the laboratory to familiarize personnel with operation,

calibration, and maintenance. Staff must be familiar with the SOP document and user's manual, when applicable.

1.8 Equipment

See appropriate checklists below for land run equipment versus water run equipment:

1.8.1 Field Sampling Checklist for <u>All Trips</u>

- Sulfuric acid 2-ml dispenser squeeze bottle, small green cooler, and ice pak
- Nitrile gloves for handling acid dispenser (one pair per sample, sizes to match crew)
- Site bottle kits (preassembled according to *Bottle Volume and Kit Counts* guide)
- Coolers and ice
- DI water (one carboy in one crate; if collecting blanks, two carboys in two crates)
- Field book (field sheets (2), DEI Lab COCs (2), strata maps, lat/long sheets, road maps)
- Hydrolab (sonde, cable, surveyor), in crate with tap water in PVC tube
- Toolbox (with extra Litmus paper, filter papers, anemometer, filter set-up, syringe, batteries, tools, pens, permanent markers, gloves, alcohol disinfectant get)
- Ziploc bag for waste
- Personal gear – hip waders, tall boots, insulated waders, boots, booties, raingear, hats, sunscreen
- Radio

1.8.2 Checklist for <u>All Land Runs</u>

- Site book (site descriptions, site photos, 0464 key, Tarpon Bypass combination 7211)
- Check tide information for low/high tides at all sample sites
- Flow data sheet (confirm it is in site book)
- Safety vests
- Flow meter with extra batteries (D-cell)
- Short and long adjustable rods for flow meter
- Measuring tape, stakes, meter stick, machete
- BOD collection bottle (for periods 2, 4, 6, and 8)
- Whirl-pak containers (write lot # on field sheet)
- Red bacteria coolers (2) with tray and ice slurry using DI water
- One bucket and one alpha sampler
- Nitrile gloves for handling bacteria whirlpaks (one pair per sample, sizes to match crew)
- Alcohol disinfectant gel

1.8.3 Checklist for Land Run with Lake Sites 14-02 and 14-07

- Secchi disk
- Sludge Judge and bucket
- Phytoplankton collection containers (2)
- Land run COC (to distinguish lakes sites needing color analysis)

1.8.4 Checklist for All Boat Runs

- Secchi Disk
- Sludge Judge and bucket if June-October
- Transmissometer bottles transport cooler (no ice)
- Boat backpack, GPS, and boat keys
- Plug for boat (put it in)
- Fire extinguisher, PFD's & throwable PFD
- Fill out pre-trip portion of boat maintenance log sheet

1.8.5 Checklist for Lake Tarpon Boat Run

- BOD collection bottles (for periods 2, 4, 6, and 8)
- Phytoplankton collection containers (4)
- Sludge Judge and bucket
- Whirl-pak containers
- Nitrile gloves (one pair per sample, sizes to match crew)
- Red bacteria cooler with tray and ice slurry using DI water
- Fixed phytoplankton location map (confirm it is in field book)

1.8.6 Checklist for Lake Seminole Boat Run

- Bring equipment listed for *Lake Tarpon Boat Run*
- Aluminum collection bottles (4) (nitric acid preservation done at laboratory when relinquished)
- Pre-filter tower and glass fiber filter paper tube
- Inverter and peristaltic vacuum pump with tubing (to connect to boat battery)

1.9 Procedure

Refer to the relevant Ambient Checklists above that outline preparation needs. Morning set up includes preparing for all daily runs and grouping equipment so that it is easy to see what equipment still needs to be gathered. The primary **pre-sampling field preparation duties** include:

- Fill coolers with ice (some vessels may require a cooler to act as a dry box)
- Assemble bottle sets (can be completed prior to sampling day)
- Set up and calibrate Hydrolab (refer to Hydrolab SOP)
- Obtain clean filter setups, DI water, and preservation acid from laboratory
- Fetch necessary vehicles and boats
- Complete boat pre-sampling safety and maintenance checks
- Sign off on vehicle and boat maintenance sheets
- Complete review of Ambient Checklists while loading equipment

At the end of the day:

- Unload vehicle.
- Wash and rinse sampling gear in fresh water, according to SOP, and store in appropriate storage or drying areas.
- Perform the post-check for calibration with the Hydrolab:
    - Fill in calibration sheets and pass/fail box on field sheet.
    - Rinse the Sonde and protective stir cap with fresh water to remove any dirt or salt.
    - Place the Hydrolab Surveyor units, still attached to the cable, on shelf in lab and plug in to charger.
    - Put away Hydrolab Sonde (store with some tap water in the storage cap), cable, protective cap, and calibration log.
    - Fill up any empty or low calibration standards.
- Place acid container in the hood, rinse acid cooler and ice pack, then store in designated area.
- Place unused bottles and containers back in their storage place in the garage, making sure to put with matching lot numbers. Hang up empty bag to dry.
- Empty orange field boxes, rinse and dry before re-loading for next trip.
- Rinse off boat and trailer with plenty of fresh water if on a saltwater run.
- Run the motor with fresh water for approximately five minutes, followed by salt away.
- Turn off boat battery.
- Fill out the boat log with hours used, field personnel, date, the run you were on, and gas added.
- Sign off on equipment cleaning sheets, mark calibration check results on field sheet, and sign off on any vehicle maintenance sheets after tasks are completed.
- Return field books and Hydrolab surveyors to the lab counter.

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Preparation for Fieldwork: Bottle Preparation, Acid Washing, and Assembly of Bottle Sets

Effective Date 06/01/2017

1.0 PROCEDURAL SECTION

1.1 Scope and Application
Preparation of bottles and sampling equipment is required by State and Federal guidelines for water quality sample collection.

1.2 Summary of Method
Bottle preparation and acid washing is done prior to all scheduled ambient sampling on a usual weekly basis. The rotating staff member scheduled for acid washing duties the last week of the sampling period will perform toolbox inventory, acid container cleaning, stock acid preparation, and ensure cleaned equipment is properly stored. See Florida Department of Environmental Protection SOPs, specifically SOP FQ 1000.

1.3 Definitions
Not applicable.

1.4 Health and Safety Warnings
Acid washing procedures require the use of hydrochloric acid, sulfuric acid, and concentrated phosphorus free detergent. Use caution and wear appropriate Personal Protective Equipment, as these substances can cause skin and eye irritation and burns.

1.5 Cautions
Rinse everything thoroughly with DI water before letting air dry in the lab.

1.6 Interferences
Not applicable.

1.7 Personnel Qualification
Personal must be trained and evaluated on proper preparation methods. Use of equipment and reagents are subject to approval by the QA Officer and/or the Environmental Monitoring Coordinator. Training will be done through dry run exercises in the laboratory to familiarize personnel with operation, calibration, and maintenance. Staff must be familiar with the SOP document and user's manual, when applicable.

1.8 Equipment
- Lab coat
- Closed-toed shoes
- Protective acid-resistant laboratory gloves
- Protective eyewear
- Baking Soda for neutralization
- Deionized water
- Containers to clean including: Carboys, Transmissivity, Chlorophyll
- Syringes and filters to clean
- Laboratory glass measuring equipment including graduated cylinders, beakers, and flasks
- Sample bottle preparation bags

1.9 Procedure

Before cleaning, make sure all necessary Personal Protective Wear is on and functioning.

1.9.1 Dishwashing Instructions for Bottle Washing

- All used or "dirty" bottles are stored in the garage in baskets marked "dirty" after being retrieved from the Pinellas County Utilities Lab. Transmissivity bottles are stored in the basket marked "Dirty Trans." We do not send bottles back to the contracted laboratory.
- Transmissivity and chlorophyll bottles (all amber bottles) are cleaned using the dishwasher in the laboratory.
- Remove caps and dump any excess liquid down the sink. Caps go in the square metal baskets on the top rack with the threads facing down and the wire basket lid in place.
- Fill the left chamber of the well in the dishwashing machine half way with Alcojet for dishwashing bottles. Alcojet is located in the lab under the sink next to the dishwasher. Close the door containing the Alcojet.
- Turn on the power by pressing the button on the left side of the inside dishwasher door.
- Next, push the start button on the right side of the dishwasher door.
- Close the dishwasher door and the cycle will start. It will take about 1.5 hours to run the load.
- Empty the bottles when the load is finished and place them on counter top to dry.
- Bottles should be left to air dry on the lab counter before being capped and stored in the garage.
- All clean bottles are stored in their designated areas by type to discourage cross contamination. Bottles are designated for specific analyses and should not be used for alternative sample collection without prior discussion about use and preservation requirements. Special projects may require the purchase or request of additional containers. Plant specimens and unpreserved phytoplankton samples can be collected in spare transmissivity bottles in the field.

1.9.2 Acid Washing

The following are always worn when performing acid washing duties:

1. **Lab goggles or glasses**
2. **Protective laboratory acid-resistant gloves**
3. **Protective laboratory coat**
4. **Closed-toed shoes**

The following equipment is cleaned by Staff:

1. Deionized water carboys
2. Reusable plastic syringes (unless at the end of the sampling period when they are discarded)
3. Filter setups
4. Field toolboxes
5. Transmissivity (500 mL amber HDPE bottles)
6. Chlorophyll bottles (1000 mL amber HDPE bottles)
7. Vacuum pump filter set up (only for the week that SA/SB is scheduled)
8. Miscellaneous sample bottles can be cleaned on an as needed basis
    a. Check "dirty" bottle storage baskets in garage
    b. RAMP sample collection

c. Phytoplankton bottles

Repeated acid washing duties during the scheduled week will be needed based on the number of field days since there are a limited number of carboys and filters. Neutralize countertops after all acid washing events. Use sodium bicarbonate (baking soda), $NaHCO_3$ to neutralize acids and wipe dry with a laboratory towel.

A 10% diluted hydrochloric acid solution is used to perform acid washing.

For stock solution use the 1000 mL volumetric flask and measure the following with a graduated cylinder:

333 mL HCl 1M acid + 667 mL deionized (DI) water ≈ 1000 mL

For the 500 mL (red bottle) container use a graduated cylinder to measure the following:

167 mL HCl 1M acid + 333 mL DI water ≈ 500 mL

These solutions are used to perform the acid washes for the filter setup, syringes, and deionized water carboys. The following are bottle and acid washing procedures for the necessary bottles and equipment:

Syringes and filters:

1. Disassemble filters and syringes.
2. Squirt acid into holding container to wash or acid spray each piece. Acid denatures after 5-6 transfers or pieces.
3. Rinse each piece 3 times with DI water.
4. Invert on rack to dry.
5. Confirm pH near 7 to ensure adequate rinse (pH paper is located in the laboratory bench drawer).

Deionized Water Carboys

1. Rinse the outside of the container with tap water to remove any dirt or debris.
2. Rinse with 10% HCl acid solution.
3. Run acid solution through open spigot or remove spigot to acid wash separately.
4. Rinse 3 times with DI running water through open spigot..
5. Confirm pH near 7 to ensure adequate rinse.
6. Place or invert carboys in laboratory to air dry or fill with DI water for sampling.
7. Refill the DI jug adjacent to the cleaning sink when acid washing is complete (see Section 1.9.4).

1.9.3 Bottle Tracking Guidelines

- Bottle quality control tracking is done by documenting lot reference numbers. Lot reference numbers will be recorded on field sheets when bottles are used for collection. Note singular lot reference numbers in the comment area as individual kits may differ on a sampling day.
- In-house lot numbers are assigned as the date cleaned (i.e. bottles cleaned on January 1, 2000 will be assigned the lot number 010100). Lot numbers for in-house washed bottles are recorded on the cleaning log located on the laboratory counter. Lot numbers are not recorded for transmissivity and phytoplankton bottles.
- All bottles from the contracted lab will have a bottle order or lot reference number. These numbers will be noted on site location documents and attached notes and need to be

recorded on the field sheets. Laboratory lot numbers correspond to quality control analysis reports provided by the laboratory.

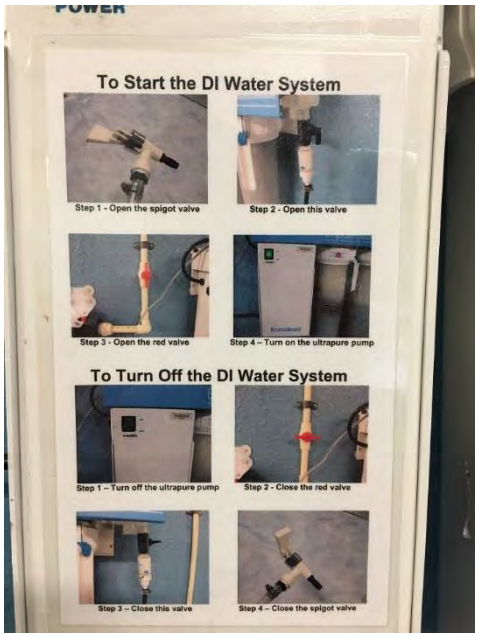
- To help alleviate lost lot numbers use one of the following methods:
    - Write lot numbers on bottle caps or kit bags with a permanent marker
    - Refer to bottle order sheets and notate dates and count used
- All lot numbers need to be retained for tracking and are recorded on the field sheets on sampling days or when bottle sets are set up. If bottle sets are completed before the sampling event date then duct tape should be applied to the bottle bag strap and notated to ensure lot numbers are retained for field sheet notation.
- Any unused or clean containers that were used as an extra bottle in a field bottle set are returned to their designated areas. Bottles that are assigned lot numbers are returned to their designated areas with their corresponding lot numbers. All other bottles are placed in the "dirty" basket.

1.9.4 Deionized Water Carboy Filling Guidelines

- Filled carboys have a 3 day (72 hour) shelf life when stored in the temperature controlled laboratory.
- Deionized water carboys taken into the field must be emptied after each sampling event. Any extra DI from the event day can be used to fill calibration containers in the garage.
- Cleaned carboys that have been used in the field can be refilled for subsequent sampling days when the carboys are emptied and capped.
- Carboys used in the field have a shelf life of 1 day (24 hours) when emptied and capped; therefore, carboys must be acid washed at the end of each sampling week.
- Caps are removed from empty carboys that will no longer be used in the field to indicate that acid washing is needed.
- Uncapped, ready to be washed carboys are stored in the garage on the bottom shelf of the drying rack.

Procedure for turning ON the DI System:

There are photos and instructions on the DI system, as shown below. Follow all steps in order.



To start the Building 6 DI system:

1) Open the spigot

2) Open this black valve

3) Open the red valve

4) Turn on the pump

Once the reading on the ohm meter is 12 mega-ohms, the water can be used. To shut down the system, performs the steps above in reverse, shutting off the pump and closing the valves.

1.9.5 Storage Container Cleaning and Inventory

Orange Toolbox

1. Remove contents from toolbox, refer to the toolbox checklist, and determine if anything needs to be replaced.
2. Clean salt and dirt from toolbox and tool surfaces.
3. Let air dry.
4. Restock toolboxes with necessary items as required by the Ambient Sampling Checklist.

Sulfuric (H_2SO_4) Preservation Acid Containers

Before each sample run:

1. Inspect the dispensing containers for leaks and ensure caps and internal reservoir are secure.
2. Fill plastic acid dispensing containers with approximately 1 inch of acid at the bottom.
3. Rinse the outside of the containers with DI to remove any residual acid.

After each sample period:

1. Acid should not be stored in plastic dispensing containers between sampling periods.
2. Inspect dispensing containers and look for dark tint discoloration.
3. Empty residual acid into designated storage vessel.
4. Add baking soda to neutralize residual acid and rinse.

5. Clean bottle, reservoir, and cap with detergent solution and rinse with DI water.
6. Check container for a pH of 7 and let dry on drying rack.

Vacuum Pump (Lake Seminole) Filter Apparatus

1. Locate filter, generator, vacuum pump, hose, and filter papers.
   Filter Components include:
   - Top and bottom chambers that thread together
   - Small gauge red o-ring
   - Filter paper flow through disk
   - Four plastic caps for tube connection openings
   - One threaded lid for top chamber
2. Dilute Contrad detergent solution to 5% v/v concentration.
3. Soak or scrub separated filter apparatus to clean all surface areas.
4. Rinse detergent away with tap water.
5. Rinse filter apparatus with 10% HCl acid solution.
6. Rinse 3 times with DI water.
7. Invert filter apparatus parts to air dry on laboratory bench drying rack.

1.10 Data Management & Records Management

Record items cleaned in the Item Cleaned Log. See Table 1 below.

Table 1: Items Cleaned Log

		Item Cleaned FDEP SOP#						
Date Cleaned	**Cleaned By**	**Chl-a Bottles**	**OrthoP Bottles**	**Syringes**	**Filter Holders**	**1 Gallon Jugs**	**Lot Number**	Storage Conditions and Location
		FC 1320	FC 1320	FC 1150	FC 1150	FC 1180		Dried, capped, & stored in staging area

2.0 QA/QC SECTION

2.1 Training

Training of personnel will be done through dry run exercises in the laboratory to familiarize them with instrument operation, calibration, and maintenance. All operators are required to become familiar with the SOP document and owner's manual. Prior to solo sample collection, field personnel are evaluated in a field setting for proper use of equipment and sample collection protocol. Annual field audits are performed on sample collectors following procedures outlined in the Quality Management Plan.

2.2 Maintenance

Not Applicable.

2.3 QC Procedures

Cleaning procedures are tested in the field by collecting equipment and field blank samples. See Florida DEP SOP Method FQ 1000.

3.0 REFERENCES

Florida Department of Environmental Protection Water Quality Sampling SOPs:
http://www.dep.state.fl.us/water/sas/sop/sops.htm

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Preparation for Fieldwork: Hydrolab HL4 Multiprobes Calibration and Verification

Effective Date 06/01/2017

1.0 PROCEDURAL SECTION

1.1 Scope and Application

Reliable water quality field readings are an essential part of any water quality monitoring program. Field readings are typically a measure of current water quality conditions at the time of water sample collection. Pinellas County uses Hydrolab MiniSonde® water quality multiprobes (Hydrolabs) during water sample collection. If deployed for longer periods, Hydrolabs can be used to record temporal changes in water quality.

1.2 Summary of Method

Hydrolabs are used to simultaneously measure pH[1] (standard units), luminescent dissolved oxygen (LDO) concentration (mg/L), LDO percent saturation (% sat), specific conductance (ms/cm),[2] salinity (ppm),[3] temperature (°C),[4] and depth (m). Hydrolabs are calibrated daily before use in the field and are maintained according to a regular maintenance schedule.[5]

1.3 Definitions

Not applicable

1.4 Health and Safety Warnings

- When loosening removable parts from a multiprobe, point the instrument away from your body and other people. Pressure may build up under the removable parts, causing them to disengage with force, potentially causing bodily harm.
- Take care during battery replacement to not mix depleted and fresh batteries, make sure batteries are installed in the correct orientation, and remove the thumbscrew to access the battery compartment slowly and carefully – failure to do so may result in bodily harm and/or damage to the instrument.

1.5 Cautions

The information discussed in this SOP is not a substitute for Hydrolab user manuals or other technical documentation. Consult the appropriate manual for a complete guide to the proper use, calibration, maintenance, storage, deployment, and troubleshooting of Hydrolab instruments. This SOP is to be used as a reference, but the complete user manual should consulted if issues arise.

The instructions in this SOP and in the applicable Hydrolab user manual must be followed by all field personnel to avoid damage or loss of expensive equipment. Use the supplied sensor guard to protect the sensors on the sonde during use. Failure to cover the sensors with the sensor guard could result in irreparable damage to the sensors.

Always store the sonde as recommended. Transport the sonde in the carrier and make sure an appropriate amount of tap water is available to submerge the probes. If stored improperly, this could

[1] FDEP FT Field Measurement of Hydrogen Ion Activity (pH)

[2] FDEP FT 1500 Field Measurement of Dissolved Oxygen (DO)
[3] FDEP FT 1300 Field Measurement of Salinity (salinity)
[4] FDEP FT 1400 Field Measurement of Temperature (temperature)
[5] FDEP FT 1000 2.1 General field Testing and Measurement (calibration)

result in inaccurate readings. If stored improperly for long periods of time (the sensors are allowed to dry out completely), the sensors may be irreparably damaged.

1.6 Interferences

Not applicable

1.7 Personnel Qualification

Personnel collecting field readings must be familiar with Hydrolab calibration and use, safety procedures, proper handling, and record keeping.[6] New staff will be trained in the field by experienced personnel. New personnel must be checked out by the QC officer in order to be able to perform calibration independently. Staff are responsible for attending refresher meetings held each year to review calibration procedures and use. The procedures discussed in this SOP can change over time as a result of the technological changes being implemented; such information generally is available from the manufacturer, either online or in an updated user manual or other technical guidance document. Monitors operating Hydrolabs must stay current as to how their instrument operates and is maintained.

1.8 Equipment

A complete Hydrolab apparatus includes a sonde, cord, and datalogger, as shown below:

Additional items necessary for calibration, operation, and maintenance include:

- Copy of SOP
- Hydrolab Sonde Calibration book for sonde
- Hydrolab MiniSonde and Surveyor with cable of appropriate length
- Extra batteries for sonde
- Maintenance tool kit
- Hydrolab MiniSonde calibration cup and cap
- Hydrolab MiniSonde sensor guard
- Container of tap water at room temperature
- Container of DI (deionized) water at room temperature
- pH calibration standard solutions at pH 7, pH 10, and pH 4
- Conductivity calibration standard solutions (2 values) near or bracketing expected value of water to be sampled (0 in air, 0.710, 10.0, 53.0)
- Lint-free cloth (such as Kimwipes)

[6] FDEP FT 1000 2.1 General field Testing and Measurement (calibration)

1.9 Procedure

1.9.1 Calibration

A. Equipment Set-Up

1. Connect the surveyor and sonde with the cable.
2. Use the raised alignment guides and match the pin to the socket adapter to attach the cord to the sonde. Once aligned screw the cord down onto the sonde. Be careful not to strip this as it should go on easily.
3. Connect the cord to the surveyor by aligning the guide into the proper orientation and then screw into the surveyor. Be careful not to bend any of the posts. Be careful not to strip this as it should go on easily.
4. Turn on the surveyor by pressing the power button. Confirm that the battery level is at least 50% charged by going to the Overview section of the Surveyor HL section. If it is less than 50% then use another surveyor or charge before going out into the field.

B. Calibration Log Sheet

1. The calibration log sheet is used to track equipment efficiency and accuracy.
2. Use the log sheet as a guide when performing calibration to ensure that everything is completed before going into the field.
3. Fill in all fields of the log sheet and place a dash through those that are not applicable or grayed out. This confirms that we are did not miss anything.
4. If there is a HL4 or HL Surveyor that needs maintenance, note the issue on the field sheet and put the equipment on the responsible person's desk with a note stating the concern.

C. Calibration

1. To ensure reliability of readings, the instruments are calibrated each morning prior to sampling and at any time during the day following a reading that may be unusual or exceeding standards.[7]
2. Ideally, choose calibration standards that are close to or bracket values expected in the field. Refer to run book located on calibration table.
3. A two point conductivity calibration is used, which consists of zero (in air) and an anticipated conductivity value based on expected readings for a given run.[8]
4. A two point pH calibration (7, 10) is used on all runs.[9]
5. 100% saturated DI water is used is used to calibrate LDO % Saturation (DO) using current barometric pressure (calculated by the Surveyor HL).[10]
6. To avoid cross-contamination, never insert a sensor into a buffer stock solution bottle during calibration; pour the buffer solution off into a separate container before calibration. Before calibration, inspect the sensors and perform any necessary cleaning.
7. Because pH buffer solutions typically have conductivities higher than conductivity standards or environmental waters, the following calibration order is recommended: conductivity-pH-DO.

- **Conductivity Calibration**
    1. Remove the lid from the calibration cup and dump any liquid into the waste bucket.

[7] FDEP FT 1000 2.1 General field Testing and Measurement (calibration)
[8] FDEP FT 1200 3 Field Measurement of Specific Conductance (conductivity)
[9] FDEP FT 2 Field Measurement of Hydrogen Ion Activity (pH)
[10] FDEP 1500 2 Field Measurement of Dissolved Oxygen (DO)

2. Use the deionized (DI) water jug to rinse the calibration cup and contained probes three times (triple rinse):
    - Fill calibration cup with DI to submerge all probes.
    - Empty liquid into the waste bucket.
    - Repeat two more times to complete a triple rinse.
3. Turn on the surveyor. It will open in the real time menu so you will need to press the back key in order to get out of the real time menu.
4. Press the arrow to the right button on the surveyor to reach the Sonde HL4 menu screen.
5. Scroll down to highlight Calibration and press OK.
6. Scroll down to highlight Conductivity and press OK.
7. You will be on SpCond 2-point Calibration ms/cm press OK.
8. You should have 0.000 in the box. If it does then you can press OK. If it does not erase the value by pressing the x button and press OK.
9. There will now be a stabilization screen and you will see a progress bar and it will complete when the reading has stabilized.
10. Record the value of the conductivity on the calibration log sheet or you can wait until the end of the calibration and you can write it down then.
11. At this point you can press OK.
12. Now the box will have 0.000 in the same box as in step 1.4.6.1 before. It will now be on point 2.
13. Use the X button to erase the 0.000 and put in your new calibration number (0.710,10.00, or 53.00).
14. Locate the appropriate conductivity standard calibration and perform a triple rinse with the standard.
15. If there is standard in the reuse rinse jug then use that to fill the calibration cup and submerse the probes.
16. Dump any reuse rinse standard into the waste bucket.
17. If there is no reuse then use the regular unrecycled standard to fill the calibration cup.
18. Dump any regular first use standard into the reuse rinse jug to be recycled.
19. When three rinses are completed fill the calibration cup to submerse the probes with the known standard (2 reuse rinses get dumped into the disposal bucket, 1 unrecycled standard goes into the reuse jug).
20. Then you will fill the calibration cup with unrecycled standard and press OK.
21. There will now be a stabilization screen and you will see a progress bar and it will complete when the reading has stabilized.
22. Record the value of the conductivity on the calibration log sheet or you can wait until the end of the calibration and you can write it down then.
23. At this point you can press OK.
24. The calibration procedure is now complete and you can press OK to save the calibration. You are now back at the main calibration screen.
25. Pour the standard into the reuse jug.

- **pH Calibration**[11]
    1. Scroll down to pH and press OK.
    2. You will be on 2 point pH calibration.

[11] FDEP FT Field Measurement of Hydrogen Ion Activity (pH)

3. Press OK.
4. Triple rinse with DI water.
5. The calibration box should have 7.00. If it is not 7.00 then use the x button to erase what is in the box and type in 7.00 or you can use the up or down arrows to select 7.00.
6. Locate the appropriate conductivity standard calibration and perform a triple rinse with the standard.
7. If there is standard in the reuse rinse jug then use that to fill the calibration cup and submerse the probes.
8. Dump any reuse rinse standard into the waste bucket.
9. If there is no reuse rinse then use the regular unrecycled standard to fill the calibration cup.
10. Dump any regular first use standard into the reuse rinse jug to be recycled.
11. When three rinses are completed fill the calibration cup to submerse the probes with the known standard (2 reuse rinses get dumped into the disposal bucket, 1 unrecycled standard goes into the reuse jug).
12. Then you will fill the calibration cup with unrecycled standard and press OK.
13. There will now be a stabilization screen and you will see a progress bar and it will complete when the reading has stabilized.
14. Record the value of the pH on the calibration log sheet or you can wait until the end of the calibration and you can write it down then.
15. At this point you can press OK.
16. Triple rinse with DI water.
17. You are now on point 2. The calibration box should have 7.00. Use the x button to erase what is in the box and type in 10.00 or you can use the up or down arrows to select 10.00.
18. Locate the pH 10.00 conductivity standard and perform a triple rinse.
19. Fill the cup with pH 10.00 standard.
20. Press OK.
21. There will now be a stabilization screen and you will see a progress bar and it will complete when the reading has stabilized.
22. Press OK.
23. Record the value of the pH on the calibration log sheet.
24. Press OK to save calibration. You are now back at the main calibration screen.
25. Pour the solution back into the reuse jug.

- **Luminescent Dissolved Oxygen (LDO) Calibration**
  1. Scroll down to highlight Hach LDO press OK.
  2. You should be on DO % Sat Calibration press OK.
  3. You should now see 100.0. If you don't, type in 100.0 and press OK.
  4. Shake the LDO jug for 40 seconds.
  5. Fill the calibration cup and place the lid on upside down on top.
  6. Press OK.
  7. There will now be a stabilization screen and you will see a progress bar and it will complete when the reading has stabilized.
  8. At this point you can press OK.
  9. Check the box that says check box. This is to show that you have calibrated to 100% saturation.
  10. Press OK to save calibration.

D. Calibration Verification

- Perform a calibration check for the specific conductivity of 0.100 for expected low field readings as we are no longer allowed to verify with air per FDEP. If you are on a marine run use 10.00 as your check as we should not have anything lower than that on a marine run.
- Since we only calibrate to 2 points for pH (7 and 10) it is recommended to do a check of linearity with the 4 pH standard to verify that the meter is reading correctly. If you had calibrated to 3 points then you could choose any pH to verify with.
- Verify LDO with air saturated water and compare temperature and mg/l to saturation table located in the run book located on the calibration table.
- Triple rinse with DI water and triple rinse with each standard.
- Record the value from the surveyor for each standard result on the calibration log sheet along the Verification line that corresponds with each listed parameter.
- Readings should be near the known standard value and within range (refer to the Pass/Fail Criteria row at the bottom of the calibration log sheet).
    1. Conductivity needs to be within +/- 5% of the known value.
    2. pH needs to be +/- 0.20 units.
    3. Dissolved Oxygen needs to be +/- 0.30 mg/L.
    4. If readings are not within range recalibrate that standard with the solution present in the calibration cup and recheck.
- When all verifications are within range then calibration is successful and the setup is ready for the field (if you can't get one of the parameters to verify in range then you must calibrate another sonde). Notify the person in charge of maintenance and place the equipment on their desk with a note stating the problem.

E. Hydrolab Field Preparation

- Dump any liquid remaining in the calibration cup into the bucket.
- Replace the calibration cup lid and unscrew the calibration cup exposing the probes.
- Locate the weighted probe guard from the sonde storage shelf.
- Thread the weighted probe guard until it is secured.
- Depth Calibration
    1. Place guard on sonde and place with guard down towards the ground to calibrate depth in air.
    2. Scroll down to highlight Calibration and press OK.
    3. Scroll down to highlight Depth 25m and press OK.
    4. Highlight Depth Calibration meters and press OK.
    5. Flashing curser should be in box and it should have 0.000 press OK.
    6. Press OK to save calibration.
    7. Depth should be checked after calibration by placing in white bucket with enough water to place the sonde into a depth of 0.2m. This line is marked on the sondes. Read depth from the surveyor and compare with the 0.2m mark on the sonde. The range is within +/- 0.05 meters for passing.
    8. Recalibrate to zero in the field as needed to achieve accurate depth measurements.
    9. If problems still continue then put the sonde into the water at the 0.2m depth marked on the sonde and calibrate it to 0.2m.

F. Post Monitoring Procedures

- Using the "real-time" setting on the HL, perform a post monitoring check for conductivity, pH, and DO. Triple rinse with DI water and triple rinse with each standard. Record the value from the surveyor for each standard result on the calibration log sheet along the Verification line that corresponds with each listed parameter.
    1. For conductivity, use the conductivity standards that bracket the day's actual field readings. **For the low end of the bracket use 0.100 for freshwater runs and 10.00 for marine runs.** Bracket this with either 0.710, 10.00, or 53.00 depending on field readings.
    2. Post calibration of pH is either 7 and 10 or 4 and 10 depending on field readings.
    3. DO post calibration is done using the 100% saturated LDO.
    4. All readings should be near the known standard value and within range (refer to the Pass/Fail Criteria row at the bottom of the calibration log sheet).
        a. Specific conductivity needs to be within +/- 5% of the known value (values are shown on calibration sheet).
        b. pH within +/- 0.20 units.
        c. Dissolved Oxygen within +/- 0.30 mg/L.
    5. If readings are within range place a "P" in the box at the bottom of the calibration sheet. If readings are not within range, then attempt the post calibration again. If it does not pass, place a "F" in the box at the bottom of the field sheet.
    6. Notify the person in charge of maintenance that the meter failed post calibration and place the equipment on their desk with a note stating the issue.
    7. Record pass/fail information on the Water Quality Data Sheet (WQDS).

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Reagents and Standards Receiving and Storage

Effective Date 06/01/2017

1.0 PROCEDURAL SECTION

1.1 Scope and Application

Reagents and standards used in the analysis of environmental samples do not have an infinite life. Almost all of these substances will degrade beyond an acceptable level, after which they should be disposed of properly. Some reagents have a listed shelf-life which makes this easy to discern; however, many do not have a listed expiration date.

1.2 Procedure

1. All reagents and standards containers should be labeled with the date received, and the check-in log should be filled out. There is a log under the fume hood for acids and a log on the garage wall for other reagents.

2. All of the containers should be re-dated when first opened.

3. The QA Officer will determine the shelf-life of reagents and standards which are not labeled by the manufacturer.

4. Many standards and reagents have different shelf lives after opening than they do when unopened. Also, high temperature or exposure to light or humidity may shorten shelf life. Store chemicals according to accepted practices or as specified by the manufacturer.

5. No reagent or standard shall be used after the expiration date.

6. Any reagent or standard that takes on a different appearance, such as a color change or the presence of particulate matter, should be discarded.

7. All reagents and standards should be disposed of in an appropriate manner. If you have questions, consult the Safety Data Sheet (SDS) or the analytical laboratory.

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Data Sheets, Chain of Custody Forms, and Sample Labelling in the Field

Effective 06/01/2017

1.0 PROCEDURAL SECTION

1.1 Scope and Application[12]

The Water Quality Data Sheet (WQDS) is the primary document tracking field sample collection activities. Collected samples and/or non-sampled sites are recorded on the WQDS. In addition, at sites where manual flow is required, flow information will be recorded on the Flow Measurements field sheet. Collected samples must be accurately labeled and accompanied by a Chain of Custody (COC) form[13] or be recorded in the "Extra Samples" column on the Water Quality Data Sheet.[14] It is necessary to label and trace the possession[15] and handling of each sample and/or container to maintain integrity for legal and practical applications.

1.2 Summary of Method

The WQDS documents and describes the field circumstances and characteristics of pre-determined sampling locations. The WQDS allows for tracking of project-based samples evaluated by Division staff and may be used to justify allocated time for scheduling, funding, or management decision making.[16] The Comment section of the WQDS can be used to further describe "Extra Sample" characteristics.

The Flow Measurements field sheet indicates sites requiring manual flow measurements for each land run. Staff must record sample date, indicate staff, and document total depth, velocity values, and check mark which method is used based on depth. Space for comments about flow characteristics, site conditions, or equipment issues is available for recording observations or providing diagrams. The hardcopy document is used to enter data into Excel spreadsheets to calculate total flow, Q, and is retained to be electronically filed and serve as a record and reference.

A COC form ensures the samples are collected, transferred, stored, analyzed, and destroyed only by authorized personnel. Every person that collects, analyzes, or takes responsibility for the samples must sign and date the form. The COC form includes the project name, staff, site name, the collection date and time, requested analytes and methods, the number of containers, and any relevant comments or physical measurements. The hardcopy document is returned to the Division's data manager to be electronically filed and serve as a record and reference.

Field staff will affix pre-printed labels on sample containers in the field and confirm that the label corresponds with the reference on the WQDS & COC form. The laboratory will use the field label to match and apply the laboratory's LIMS tracking label.

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[12] FDEP FD 1100 Universal Documentation Requirements

[13] Chain of Custody documents are required for any samples submitted to the Pinellas County Utilities Laboratory or a contracted laboratory.

[14] Sample collection documented on the Water Quality Field Sheet are samples analyzed or evaluated by Pinellas County Environmental Management staff. Examples are transmissivity, phytoplankton, plant identification, or in-kind sample collection which may or may not be documented on a separate Chain of Custody. Additional Water Quality Data Sheet codes may be added or defined depending on the project or program need.

[15] According to Standard Methods (APHA, AWWA, WPCF, 1992), possession is when "a sample is considered to be under a person's custody if it is in the individual's physical possession, in the individual's sight, secured in a tamper-proof way by that individual, or is secured in an area restricted to authorized personnel."

[16] Examples include time allocated for sampling FDEP WBIDs, grant funded source tracking projects, HAB presence, transmissivity, and if special sampling should be added to routine monitoring or not.

1.3 Definitions
Not applicable.

1.4 Health and Safety Warnings
Staff should continue to be aware of their surroundings when focused on documentation.

1.5 Cautions
"Right-first-time" approach for the documents is "good documentation practice" to ensure identity, authenticity, and accuracy of records. If a mistake is made, a single line must be drawn through the mistake and the writer's initials will be written next to this mistake.

1.6 Interference
- Staff **must** avoid illegible writing and gel ink when filling out the labels, WQDS, and/or COC.
- Staff should try to avoid exposing WQDS, COCs, and other field related forms to heavy precipitation and sample water.
- Water-resistant or water-proof paper options are available for routine monitoring if conditions are expected to be rainy.

1.7 Personnel Qualification
Field personnel are trained and certified on proper container labelling and use of WQDS and COC forms. Adequate training and/or certification is determined by the QA Officer[17] and the Monitoring Coordinator.[18]

1.8 Apparatus or Sampling Guidebook and Field Book Materials
- Water Quality Data Sheet
- Flow Data Sheet, if applicable
- Chain of Custody Form
- Pre-printed Labels
- Writing Utensils (ball point pen, permanent markers)
- Fixed site direction sheets or Probabilistic site location maps (with latitude/longitude list, if applicable)
- Rite-in-Rain WQDS and COC, if applicable
- Laboratory Hold Times and Contact Information
- Special or Extra Sample Instructions

1.9 Procedure

1.9.1 Water Quality Data Sheet
Field staff should use the WQDS as a guide to record the required data for regulatory and project-based requirements. Staff are requested to record container lot numbers, sample year, sample period, sampling date, sampling region, site name, sample time,[19] total depth, surface sample depth, secchi measurement[20] (if applicable), latitude & longitude (if applicable),

[17] Environmental Monitoring and Assessment QA Officer is Susan Myers.
[18] Environmental Monitoring and Assessment Coordinator is Stacey Day.
[19] FDEP FD 2000 Documentation of Cleaned Equipment, Sample Containers, Reagents and Supplies (information on containers)
[20] FDEP FT 1700 Field Measurement of Light Penetration (secchi)

presence or absence of submerged vegetation, submerged vegetation species ID code (if applicable), bottom type, collection method code, extra sample code, field observations, collection comments, weather conditions, field logistics, and indicate if there is a recent precipitation event, post calibration check outcomes, and staff on the WQDS.

Staff must document on the field sheet that contents have been collected, observed, or considered by recording notations for all columns associated with the pre-determined sample sites (See WQDS example):

- Codes for submerged aquatic vegetation (SAV), bottom type, sampling methods and extra samples codes are listed on the WQDS for use and reference. Staff can record notes on extra or special sample types that do not have codes in this column (e.g. FDEP, research, or partner references).
- If more room is needed for comments beyond the single site line, comments can be continued on the next line(s). It is recommended to make the association clear from the site column (see WQDS example) to avoid misinterpretation of site(s) and recorded data.
- If a column is not applicable, a null symbol, line, "n/a", "X" or other notation should be present in the space (see WQDS example).
- Any photographs taken to associate with data recorded on the WQDS should be indicated in the comments on the field sheet and photos should be downloaded and saved to the year's Records Management folder on the server.[21] Photo label format is: yyyy-mmdd P[#] [Group] [Site] [Photo #] (e.g. 2017-0223 P1 LR2 08-03 Photo 1). Alternately, downloaded and format labeled photo files can be emailed to the data manager to electronically file on the server.[22]

These practices will ensure data integrity by distinguishing between data not observed and information unintentionally omitted. **If a mistake is made on any documentation,** a single horizontal line should be drawn through the incorrect value, the initials of the person making the correction should be written next to the error, and the correct value should be written in the box. See the Example Water Quality Data Sheet below for illustration of the proper way to fill out the information.

[21] ..\..\Data\Data Formatting\2017\Records Management

[22] Field comments such as "see photos" are encouraged if photos begin to replace text field comments on the WQDS.

WE WILL UPDATE THIS TO REFLECT THE NEW DATA SHEET

(EXAMPLE)

Water Quality Data Sheet

Sampling Date: 02/30/10 **Sampling Strata:** Lake / Outfall

Equipment Information

Surveyor # 101
Sonde # A
Cable # 10
Lake Level: n/a (if applicable)

Lot whirlpak: 12345
Lot BOD5: 010101
Lot Al/Alk: 021402
Lot OP: 021402
Lot Nutrients: 011701
Lot TSS/turb: 011701
Lot chlorophyll: 020202

CODES:

SAV

Tt= Thalassia
Hw= Halodule
Sf= Syringodium
Rm= Ruppia
C= Caulerpa sp
H= Halophila sp
Hp= Hygrophila sp
Ct= Ceratophyllum sp
Ch= Chara sp
Ma= Myriophyllum sp
Pw= Pondweed sp
V= Valesnaria sp
Hx= Hydrilla sp
RA= Rooted Algae
FA= Filamentous algae
DA= Drift Algae
AA= Attached Algae
Cc= Cabomba sp

Bottom Type

1= Mud
2= Sand
3= Muddy Sand
4= Rocks/Cement
5= Shell/Sand
6= Shell/Mud
7= Oyster

Yr 01 Per 09 Site	Time	Total Depth (meters)	Sample Depth (meters)	Secchi (meters)	Lat/Long (Actual GPS Reading)	SAV Species	Bottom Type	Method Code (See Below)	Extra Samples (See Below)	Comments / Observations / Alternate Sites i.e. Flow, Color, Level, Odor, Clarity, Plants, Debris, Tide, Wildlife, Precipitation, etc.
LM-A	0815	1.29	0.20	1.30 VOB	N 28.00000 W 82.11100	Y / N / ? Ch, Pw	3	B, D I	T, P 1.0 m	visible gray particles, schooling fish, tunicates - in sediment, blue color, high level
LM-B	0840	3.21	0.20	2.75	N 27.00000 W 82.00011	Y / N / ? V, tt, Hw	2	B, D I	T, P 2.0 m	manatees foraging SAV, teal color, turbid, spa odor, schooling fish, picnic
						Y / N / ?		B, D I		trash, SAV and organic debris, active precipitation, evidence of tidal influence
LM-C9	0955	1.75	0.20	1.70 not VOB!	N 28.11111 W 82.00000	Y / N / ? Ct, FA	1,5	B, D I	T, P 1.5 m	9th alternate used - sinkhole at original site; stagnant, dense SAV, alligator foraging
LM-blank1	1015	Ø	Ø	Ø	— —	~~Y / N / ?~~ —	Ø	B, D I	Ø	equipment blank OP, nutrients
LM-D	1020	9.70	0.20	3.5 + ~~n/a~~	N 28.88888 W 82.88888	Y / N / ? n/a	4	B, D I	T, P 2.0 m	too deep for secchi, not VOB, minimal flow over structure, turbid, brown
LM-E	1210	Ø	Ø	Ø	— —	Y / N / ? —	7	B, D I	Ø	not sampled, dry, drained by sinkhole,
						Y / N / ?		B, D I		exposed bottom, no flow, oysters!
99-01	1730	0.47	0.20	n/a	— —	Y / N / ? Hx, ?	2	B, D I	plant (SAV)	photo taken of unknown plant, swift flow, leaf litter, not turbid, tadpoles
99-17	1745	3.25	0.20	n/a	— —	Y / N / ? FA	3	B, D I	FDEP bacteria sample	evidence of high flows, neon green particle film, mutant turtles, pizza debris
99-blank2	1800	Ø	Ø	Ø	— —	~~Y / N / ?~~ —	—	B, D I	Ø	field blank OP + nutrients
						Y / N / ?		B, D I		

Sampling Method (FDEP SOP FT1000-FT1500): I = Container Immersion ; B = Bucket ; D = Discrete depth sampler; Ø = No sample taken; Extra Samples Codes: T = Transmissivity; P = Phytoplankton

Post Check pH ☑ Pass ☐ Fail DO ☑ Pass ☐ Fail Cond ☐ Pass ☑ Fail

0.100 failed
10.0 passed

Samplers: Billy Goat (Signature) [signature] (Signature)

Conductivity Range 0.87 to 3.91
pH Range 7.85 to 8.03

1.9.2 Flow Measurements Data Sheet

Field staff use the Flow Measurements sheet to record stream transect measurements based on methods to support program-based loading estimate summaries.[23] Flow measurements are collected at sites that do not have a corresponding, autonomous real-time or 15-minute interval County-contracted USGS or HDI field station. Staff must record the time visited, total width of the stream, transect widths, total depth from the rod in decimal feet, velocities from the flow meter display, and indicate with method is used based on stream depth and width. The method to collect flow measurements is described in the flow SOP.

1.9.3 Sample Labelling

Field staff are provided pre-printed labels and are responsible for affixing the label to the correct containers based on the method volume and preservation requirements as indicated on the COC. Staff are required to record the date and the actual sample time on the label. This is the time that the surface reading (~0.2 m) is taken using the Hydrolab, and it can be viewed in the log files of the Hydrolab surveyor (refer to Hydrolab Usage SOP). **If something needs to be altered on a label,** a single horizontal line should be drawn through the incorrect value, the initials of the person making the correction should be written next to the error, and the correct value should be written.

1.9.4 Chain of Custody

The Pinellas County Utilities Laboratory or contracted laboratory provides templated COC forms compliant with Florida DEP, NELAC, and DOH requirements. Staff are required to record the sampling date, sample time, site name, number of containers,[24] and indicate requested analytes, pH[25], salinity[26], and staff on the COC forms. There are three different COCs, to be used according to the type of sampling: land run, boat run, or lake run.

After sample collection, field staff will either transport samples and relinquish samples directly to laboratory personnel or relinquish samples to be delivered by another authorized person to meet sample/analysis/preparation holding times. Samples are relinquished by having the field staff sign and record the date and time that the samples are transferred to an authorized person or laboratory personnel, and then the authorized person or laboratory personnel accepts custody of the samples by signing and indicating the receipt date and time. The relinquish date and time should match the receipt date and time to show complete custody and transfer between authorized personnel. The COC will accompany the collected samples through transport and be retained by laboratory personnel upon relinquishing samples.

[23] Flow Measurements collected by staff in the field do not adhere to FDEP SOP, USGS, or HDI method guidelines because of stream level, characteristics, quantity of measurements and ability to meet QA/QC threshold requirements, therefore, these values are coded to reflect use in Pinellas County management program summaries only.

[24] FD 2000 Documentation of Cleaned Equipment, Sample Containers, Reagents and Supplies

[25] FDEP FT Field Measurement of Hydrogen Ion Activity (pH)

[26] FDEP FT 1300 Field Measurement of Salinity (salinity)

1.10 Data Management & Records Management

The WQDS remains with the field crew throughout the sampling event and post calibration check so that any observations, comments, and post calibration checks can be recorded. The WQDS is kept in the sampling event clipboard or site guidebook to be retrieved by the Data Manager[27].

There is no need for the laboratory personnel to provide a copy of the COC to the field staff or authorized person when relinquishing samples. Laboratory reports based on the COC are delivered electronically, and the COC is returned to the Data Manager via interoffice mail.

2.0 QA/QC SECTION

WQDS and COC template forms are reviewed and revised based on program, project, records management, or laboratory process audit on a pre-determined basis.

Staff are advised to record enough information so that clarifications, interpretations, or explanations of the data are not required from the originator of the documentation. Refer to DEP SOPS **FD 1000** (Documentation Procedures), **FS 1000** (General Sampling), **FS 2000** (General Water Sampling), and **FS 2100** (Surface Water Sampling) for guidance and reference regarding documentation with water quality sampling.

3.0 REFERENCES

APHA, AWWA, and WPCF (1992) Standard Methods for the Examination of Water and Wastewater, 17th edition, eds. L.S. Clesceri, A.E. Greenberg, and R.R. Trussell, American Public Health Association, Washington, D.C.

YSI (2009). The Dissolved Oxygen Handbook. YSI Incorporated. www.ysi.com/weknowdo
Sawyer, C.N. P.L. McCarty and G.F. Parkin (1994) Chemistry for Environmental Engineering, 4th edition, McGraw-Hill, Inc, New York, New York.

[27] Environmental Monitoring and Assessment Data Manager is Natasha Dickrell.

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Flow Measurement
(OTT MF Pro)

Effective Date 11/01/2018

1.0 PROCEDURAL SECTION

1.1 Scope and Application

The flow meter measures water velocity in terms of distance travelled per unit time (e.g., feet per second). Determining velocity is necessary to calculate discharge, Q, which is the measure of the volume of water per unit time (cubic feet per second=cfs). Flow can be measured by a variety of techniques, but Pinellas County uses the OTT MF Pro. Flow is collected at land run sites that do not have a continuous discharge gage (i.e., USGS or Hydrologic Data Collection, Inc.) nearby. The method employed by Pinellas County and described here is based on FDEP SOP FT 1800.

1.8 Summary of Method

The OTT MF Pro is a hand-held unit that measures flow using an electromagnetic sensor. As water moves through and cuts the lines of magnetic flux, a voltage is produced. The magnitude of the generated voltage is directly proportional to the velocity at which the water moves through the magnetic field. The velocity measurement is displayed digitally as distance/unit time. Calculations of volume discharge are performed by staff using an Excel calculation spreadsheet.

To achieve the most accurate estimate of flow, each flow reading should represent 5% of the width of the stream, equating to 20 readings, although 10% representation (at least 10 readings) is acceptable if a stream is too narrow to get more readings.

1.8 Definitions

- Velocity—measure of water movement in terms of distance travelled per unit time; feet per second
- Discharge—measure of volume of water travelled per unit time; cubic feet per second (cfs)

1.8 Health and Safety Warnings

Flow should not be measured by wading in the stream if the velocity is high or the stage is deep.

1.8 Cautions

Not applicable.

1.6 Interferences

Water moving less than the instrument detection method (0.05 cfs) may provide inaccurate data, so flow should not be collected the readings are less than this value.

Debris in front of the probe will affect the accuracy of readings and should be cleared before collecting data.

1.7 Personnel Qualifications

Personnel collecting field readings must be trained in OTT MF Pro calibration and use, safety procedures, proper handling, and record keeping. New staff will be trained in the field by experienced personnel. New personnel must be checked out by the QC officer to be able to collect flow independently. Staff are responsible for attending refresher meetings held each year to review procedures for use. The procedures discussed in this SOP can change over time as a result of the technological changes being implemented; such information generally is available from the manufacturer, either online or in an updated user manual or other technical guidance document.

1.8 Equipment

- OTT MF Pro surveyor with wading rod, sensor, and cord attached. See Figure 1.
- Tape measure
- 2 metal stakes
- Data sheet

Figure 1: OTT MF Pro surveyor with wading rod, sensor, and cord attached.

1.9 Procedure

1.9.2 Calibration

The OTT MF Pro Surveyor and sensor self-calibrates to zero in air each time it is turned on. Perform the following process at each site:

- Turn on the data logger with the sensor in air.
- Wait for the start-up screen to display (Figure 2a).
- Note in the upper right hand corner a pair of small open circles (Fig. 2b).
- The blinking red dot indicates the system is calibrating. A solid green dot indicates calibration for zero is complete (Fig. 2c).

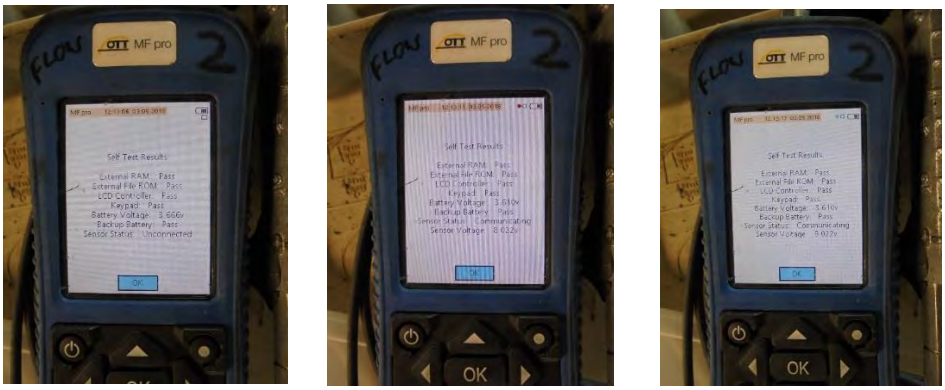


Figure 2a-c: Start-up screen 1, with red dot, and with green dot.

1.9.3

- **Equipment Set-Up**
  If necessary, connect the surveyor and sensor with the cable. The sensor should already be attached to the wading rod. Use the raised alignment guides and match the pin to the socket adapter to attach the cord to the sensor. Once aligned, screw the cord down onto the sensor. Be careful not to strip this as it should go on easily.

If stream/culvert/pipe does not have visible flow and at least 0.05 cfs measured flow in the fastest moving area, do not collect flow data.

- **Site Selection**
  Ideally, 20 flow measurements will be taken at no less than 0.5 ft increments, so a location with a width of at least 10 feet is desired. However, a minimum width of 5 feet (to achieve at least 10 measurements) is acceptable if there are no sections of the stream that are wider.

  The portion of the stream where flow is to be measured should be as uniform as possible. The ideal shape is a rectangle, which can be found under some cement bridges. Avoid stagnant areas or those with irregular bottoms, obvious turbulence (e.g., riffles), standing waves, or strongly sloping bottoms if possible. Clear away debris directly upstream of the area that flow readings will be taken, if necessary.

- **Data Collection**
  1. Turn on the OTT MF Pro surveyor and allow zero air-calibration to complete.
  2. Hit ‘OK’ to move on to the menu display (Figure 3a).
  3. Arrow up to real-time data and hit OK to move to the real-time data screen (Figure 3b). The real-time data screen has the sensor depth and velocity read-out.
  4. Hit the upper right “dot” button to see just the values without the graph.

Figure 3a-b: Menu screen and real-time data screen.

- **Obtaining Readings**

  "Natural" Stream (no pipes at site)

  To achieve the most accurate flow estimate, a cross-section of a stream is measured in at least 0.5 foot increments approximately 20 times across the stream, which equates to the measurement at each subsection contributing approximately 5% of the total calculated discharge. The increment widths between readings will vary across sites, as needed to meet the 5% target. The 5% target may not be achievable at some sites (narrow streams, for example), so a 10% limit is acceptable, as described below.

  1. **Determine the total width** of the stream/culvert by stretching a measuring tape across the stream. A minimum stream width of 10 feet is desired, but at least 5 feet is acceptable.
     - **i.** Stretch a tape measure across the stream and attach it on both sides to stakes to measure the width of the stream/culvert where you will collect flow. Make sure the tape is tightly stretched and perpendicular to the flow.
     - **ii.** Record total width on flow data sheet.
  2. **Determine the width increments** between each flow measurement and record increment on flow data sheet:
     - **i.** If total width is less than or equal to 10 feet, collect data every 0.5 foot. Record the width interval as 0.5 ft on the data sheet.
     - **ii.** If total width of the stream is greater than 10 feet, collect 20 evenly divided measurements across the entire stream. Record the width interval on data sheet.

Use the chart on the next page to determine width intervals.

Use the chart below to determine interval of readings.

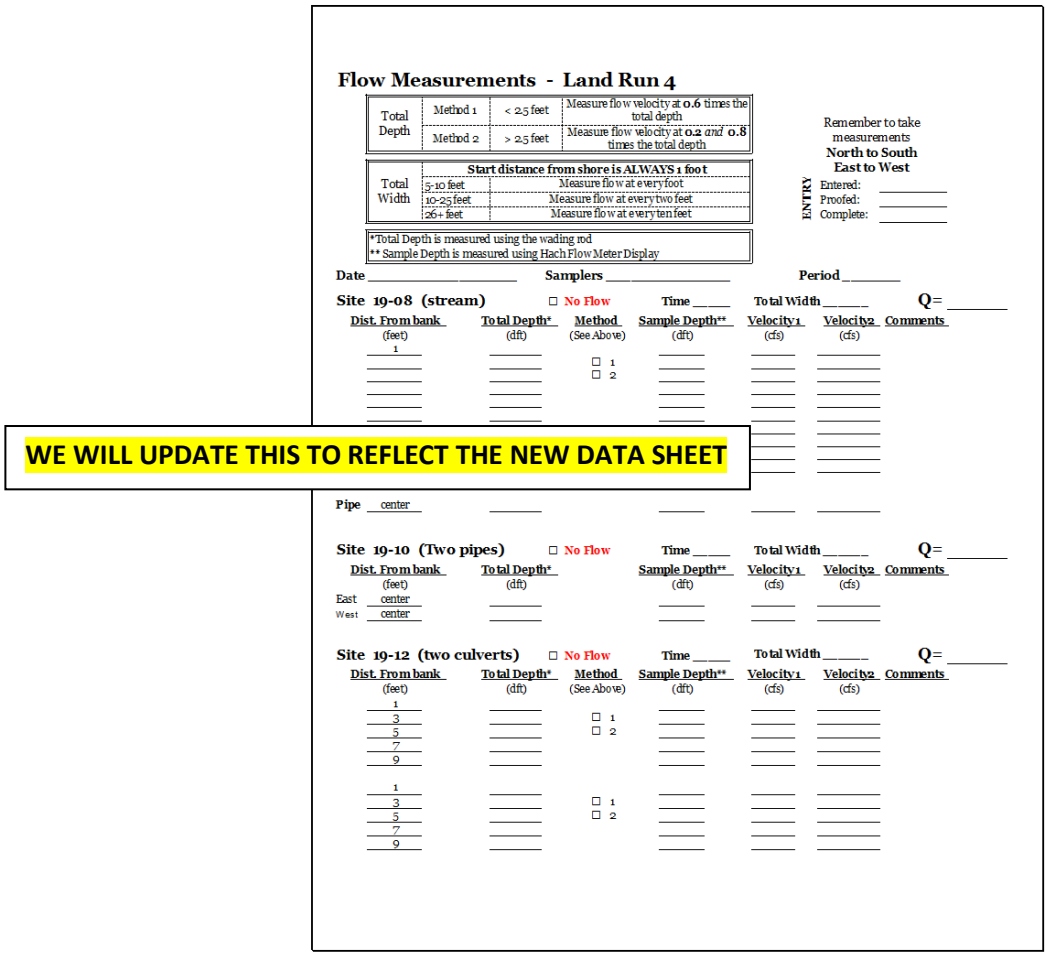
MEASURE THIS	USE THIS			WILL RECORD
Total Stream Width (ft)	**Increment (ft)**	**Increment (inches)**	**Take First Reading at ___ From Edge of Stream:**	**Number of Readings**
1	0.5	6	3 inches	2
2	0.5	6	3 inches	4
3	0.5	6	3 inches	6
4	0.5	6	3 inches	8
5	0.5	6	3 inches	10
6	0.5	6	3 inches	12
7	0.5	6	3 inches	14
8	0.5	6	3 inches	16
9	0.5	6	3 inches	18
10	0.5	6	3 inches	20
11	0.6	7	3.5 inches	20
12	0.6	7	3.5 inches	20
13	0.7	8	4 inches	20
14	0.7	8	4 inches	20
15	0.8	9	4.5 inches	20
16	0.8	9	4.5 inches	20
17	0.9	11	5.5 inches	20
18	0.9	11	5.5 inches	20
19	1.0	12	6 inches	20
20	1.0	12	6 inches	20
21	1.1	13	6.5 inches	20
22	1.1	13	6.5 inches	20
23	1.2	14	7 inches	20
24	1.2	14	7 inches	20
25	1.3	16	8 inches	20
26	1.3	16	8 inches	20
27	1.4	17	8.5 inches	20
28	1.4	17	8.5 inches	20
29	1.5	18	9 inches	20
30	1.5	18	9 inches	20

20 flow measurements is the goal, but at least 10 measurements is acceptable.

Sites with Pipes or Culverts

- Flow at **pipes** is taken in the middle of the pipe.
- If there are **multiple culverts**, measure velocity through each culvert separately, as indicated on the flow sheet for those specific sites.

3. Take the first flow reading.
    i. **Stand on the downstream side** of the measuring tape and flow meter.
    ii. **The first measurement will be taken at half of the determined width interval from the edge**. So, if the interval is a foot, the first reading will be at 0.5 ft from the edge of stream. If the interval is 0.5 ft, the first reading will be at 0.25 ft from the edge of stream.
    iii. **Determine total depth** at the first point by looking at where the water surface hits the wading rod when it is resting on the bottom of the stream. Each single mark indicates a tenth of a foot (0.1 ft), each double tick mark indicates 0.5 foot increments, and triple marks indicate one foot increments. Record the depth of the first point in the total depth column on the data sheet. See Figure 4.



Flow Measurements - Land Run 4

Total Depth	Method 1	< 2.5 feet	Measure flow velocity at **0.6** times the total depth
	Method 2	> 2.5 feet	Measure flow velocity at **0.2** *and* **0.8** times the total depth

	Start distance from shore is ALWAYS 1 foot	
Total Width	5-10 feet	Measure flow at every foot
	10-25 feet	Measure flow at every two feet
	26+ feet	Measure flow at every ten feet

*Total Depth is measured using the wading rod
** Sample Depth is measured using Hach Flow Meter Display

Remember to take measurements
North to South
East to West

ENTRY
Entered: _____
Proofed: _____
Complete: _____

Date _____ Samplers _____ Period _____

Site 19-08 (stream) ☐ No Flow Time _____ Total Width _____ Q= _____

Dist. From bank (feet)	Total Depth* (dft)	Method (See Above)	Sample Depth** (dft)	Velocity1 (cfs)	Velocity2 (cfs)	Comments
1		☐ 1 ☐ 2				
Pipe center						

Site 19-10 (Two pipes) ☐ No Flow Time _____ Total Width _____ Q= _____

Dist. From bank (feet)	Total Depth* (dft)	Sample Depth** (dft)	Velocity1 (cfs)	Velocity2 (cfs)	Comments
East center					
West center					

Site 19-12 (two culverts) ☐ No Flow Time _____ Total Width _____ Q= _____

Dist. From bank (feet)	Total Depth* (dft)	Method (See Above)	Sample Depth** (dft)	Velocity1 (cfs)	Velocity2 (cfs)	Comments
1		☐ 1 ☐ 2				
3						
5						
7						
9						
1		☐ 1 ☐ 2				
3						
5						
7						
9						

WE WILL UPDATE THIS TO REFLECT THE NEW DATA SHEET

Figure 4: Example of a flow data sheet showing a stream site, pipe, and culvert.

iv. **Determine which flow measurement is needed based on total depth**. The wading rod is a top adjusting model, which allows the sensor depth on the rod to be adjusted up or down depending on total depth at each point.
    - For most Pinellas County sites, depth will be less than 2.5 feet, so velocity will be measured at the 60% level. The wading rod is marked to allow the sensor to be at 60% of the total depth if the total depth is indicated by the combination of marks on the smaller and larger rods. If total depth is less than 2.5 feet, slide the smaller rod up so that the mark on that rod, which indicates the number of feet (0, 1, 2, etc.) of the total depth, is aligned with the mark on the scale at the top of the stationary rod that indicates the tenths of a foot of the total depth (see Figure 5a-d).

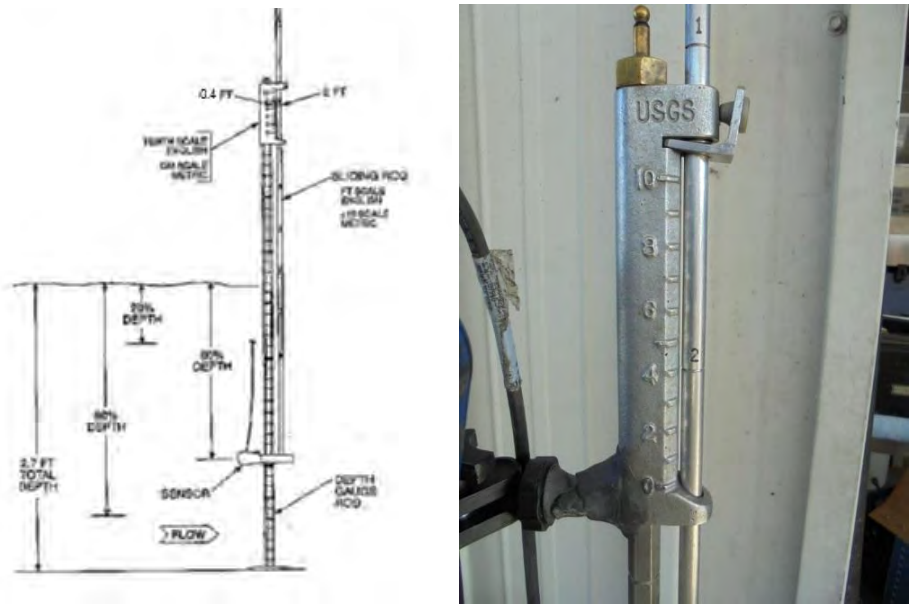


Figure 5a and b. Example of how to set rod to measure velocity at 60% of 2.4 ft depth. Align "2" mark on sliding rod with the 0.4 mark on the larger rod.

Figure 5c and d. Example of how to set rod to measure velocity at 60% of 0.6 feet total depth, and for 1.7 feet total depth.

- For deeper sites where total depth is greater than 2.5 feet, velocity is measured at 20% and 80% of the surface depth and recorded on the data sheet. Then an average velocity is calculated. If total depth is greater than 2.5 feet, collect flow at 20% and 80% of total depth.
- To place the sensor at 20% of the total depth, divide the total depth by 2 and set the rods to that number. To place the sensor at 80% of the total depth, double the total depth and set the rods to that number. See Figure 6a and b below for an example of total depth = 3.2 feet. Readings will be collected with probe set at 1.6 and 6.4.

Figure 6a and b. Example of how to set rod to measure velocity at 20% and 80% for 3.2 feet total depth.

v. After adjusting the wading rod to the appropriate depth, **position the sensor so that it is facing directly into the flow**.
vi. **Stand downstream and to the side of the rod** so as not to interfere with the flow path around the sensor.
vii. The flow around the sensor may not be stable and may fluctuate on the OTT MF Surveyor. **Hold the sensor steady, allow a few cycles of recording, and then read the velocity** to the data recording person.
viii. **Record readings at each interval across the stream.** Record velocity readings taken at 60% total depth in the velocity 1 column. Record velocity readings taken at 20% total depth in the velocity 1 column. Record velocity readings taken at 80% total depth in the velocity 2 column. Record negative velocity values as 0.0.

4. <u>At each point across the stream/culvert, determine the depth of the stream and collect flow measurements based on depth as described above</u>.

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Hydrolab HL4 Multiprobes: Use in the Field

Effective Date 06/01/2017

1.0 PROCEDURAL SECTION

1.1 Scope and Application

Reliable water quality field readings are an essential part of any water quality monitoring program. Field readings are typically measurements of current water quality conditions at the time of water sample collection. Pinellas County uses Hydrolab MiniSonde® water quality multiprobes (Hydrolabs) during water sample collection. If deployed for longer periods, Hydrolabs can be used to record temporal changes in water quality.

1.2 Summary of Method

Hydrolabs are used to simultaneously measure pH (standard units)[28], luminescent dissolved oxygen (LDO) concentration (mg/L), LDO percent saturation (% sat),[29] specific conductance (ms/cm),[30] salinity (ppm),[31] temperature (°C),[32] and depth (m). Hydrolabs are calibrated daily before use in the field, as described in this document and are maintained according to a regular maintenance schedule.[33]

1.3 Definitions

Not applicable

1.4 Health and Safety Warnings

When loosening removable parts from a multiprobe, point the instrument away from your body and other people. Pressure may build up under the removable parts, causing them to disengage with force, potentially causing bodily harm. Take care during battery replacement to not mix depleted and fresh batteries, make sure batteries are installed in the correct orientation, and remove the thumbscrew to access the battery compartment slowly and carefully – failure to do so may result in bodily harm and/or damage to the instrument.

1.5 Cautions

The information discussed in this SOP is not a substitute for Hydrolab user manuals or other technical documentation. Consult the appropriate manual for a complete guide to the proper use, calibration, maintenance, storage, deployment, and troubleshooting of Hydrolab instruments. This SOP is to be used as a reference, but the complete user manual should always accompany the operator.

The instructions in this SOP and in the applicable Hydrolab user manual must be followed by all field personnel to avoid damage or loss of expensive equipment. Use the supplied sensor guard to protect the sensors on the sonde during use. Failure to cover the sensors with the sensor guard could result in irreparable damage to the sensors.

Always store the sonde properly. Between sampling sites, make sure that the sonde goes into the carrier and make sure an appropriate amount of tap water is inside. If stored improperly for short periods of time (between sampling sites), the Hydrolab may give inaccurate readings. If stored improperly for long

[28] FDEP FT Field Measurement of Hydrogen Ion Activity (pH)
[29] FDEP FT 1500 Field Measurement of Dissolved Oxygen (DO)
[30] FDEP FT 1200 Field Measurement of Specific Conductance (conductivity)
[31] FDEP FT 1300 Field Measurement of Salinity (salinity)
[32] FDEP FT 1400 Field Measurement of Temperature (temperature)
[33] FDEP FT 1000 2.1 General field Testing and Measurement (calibration)

periods of time (the sensors are allowed to dry out completely), the sensors may be irreparably damaged.

1.6 Interferences
Not applicable

1.7 Personnel Qualification
Personnel collecting field readings must be familiar with Hydrolab calibration and use, safety procedures, proper handling, and record keeping.[34] New staff will be trained in the field by experienced personnel. New personnel must be checked out by the QC officer in order to be able to perform calibration independently. Monitors are responsible for attending refresher meetings held each year to review calibration procedures and use. The procedures discussed in this SOP can change over time as a result of the technological changes being implemented; such information generally is available from the manufacturer, either online or in an updated user manual or other technical guidance document. Monitors operating Hydrolabs must stay current as to how their instrument operates and is maintained.

1.8 Equipment
A complete Hydrolab apparatus includes a sonde, cord, and datalogger, as shown below:

Additional items necessary for calibration, operation, and maintenance include:

- Copy of SOP
- Hydrolab Sonde Calibration book for sonde
- Hydrolab MiniSonde and Surveyor with cable of appropriate length
- Extra batteries for sonde
- Maintenance tool kit
- Hydrolab MiniSonde calibration cup and cap
- Hydrolab MiniSonde sensor guard
- Container of tap water at room temperature
- Container of DI (deionized) water at room temperature
- pH calibration standard solutions at pH 7, pH 10, and pH 4
- Conductivity calibration standard solutions (2 values) near or bracketing expected value of water to be sampled (0 in air, 0.710, 10.0, 53.0)
- Lint-free cloth (such as Kimwipes)

[34] FDEP FT100 2.1 General field Testing and Measurement (calibration)

1.9 Procedure

1.9.1 Calibration and Verification

Hydrolabs must be calibrated prior to use, as described in the Hydrolab Calibration and Verification SOP. After all those steps are followed, proceed.

1.9.2 Hydrolab Use

- Turn the surveyor on. The power button is the circle with the line through it on the top left.
- Click on the arrow right button to get to the Sonde HL4 menu.
- Select **Real Time** and press OK.
- Click OK so you are inside of the name field.
- Use the x key to go back so you can name the site you are currently at and press OK.
- Press the right arrow key.
- Drop the surveyor to the bottom of the water to get your **total depth**, as described below:

Surface Depth, Mid Depth, Near Bottom Depth, and Total Depth:

- All sites are sampled at the surface depth for physical and chemical components. The defined surface depth is 0.2 meters.
- The total depth is measured for each site and used to determine if multiple readings need to be collected, and if so, at what additional depths (see figures 1-3 below).
- The **total depth** is recorded on the field sheet as the depth when the sonde is laying horizontal on the bottom (only do this if the substrate is hard/not mucky) **or** the depth where the sonde reaches the bottom substrate when upright/vertical. Special care must be taken when sampling sites with muck bottoms since the probes cannot be allowed to sink into muck or soft sediments.
- If total depth is determined with the sonde laying down, circle "H" on the data sheet (to indicate "horizontal"); if total depth is determined with the sonde upright, circle "V" on the data sheet (to indicate "vertical").
    - For sites with **total depth greater than 1.0 meters**, readings must be taken at surface depth (0.2 meters), at a middle depth (half of the total depth value), and at the near bottom depth (0.1 – 0.2 meters above the total depth) (Fig. 1 below). All values are collected with the sonde in a vertical position.

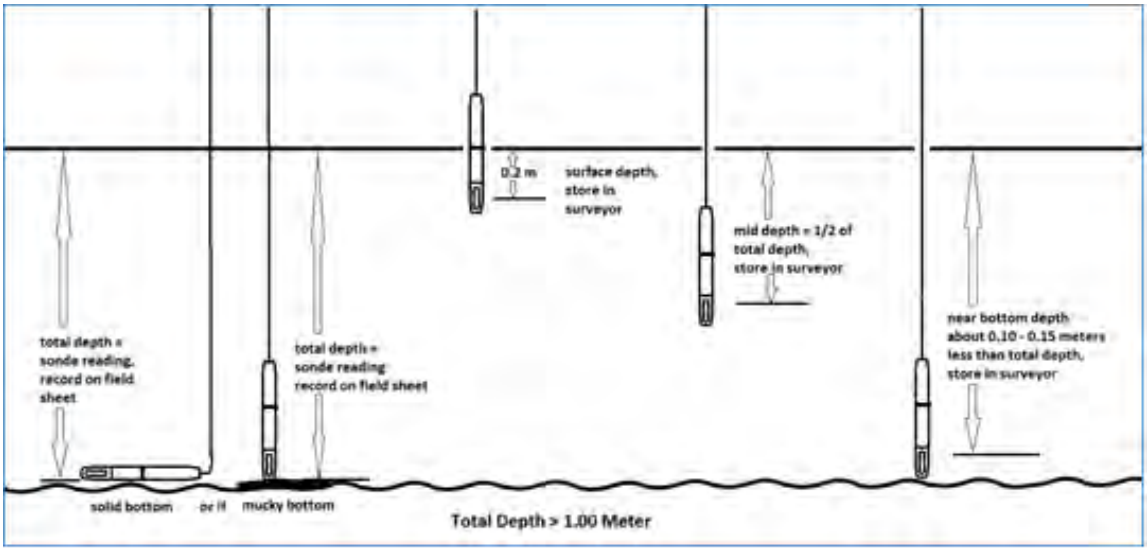


Figure1.

- For sites with **total depths greater than 0.5 meters but less than 1.0 meter** only readings at surface and near bottom depths are recorded (Fig. 2 below). <u>All values are collected with the sonde in a vertical position.</u>

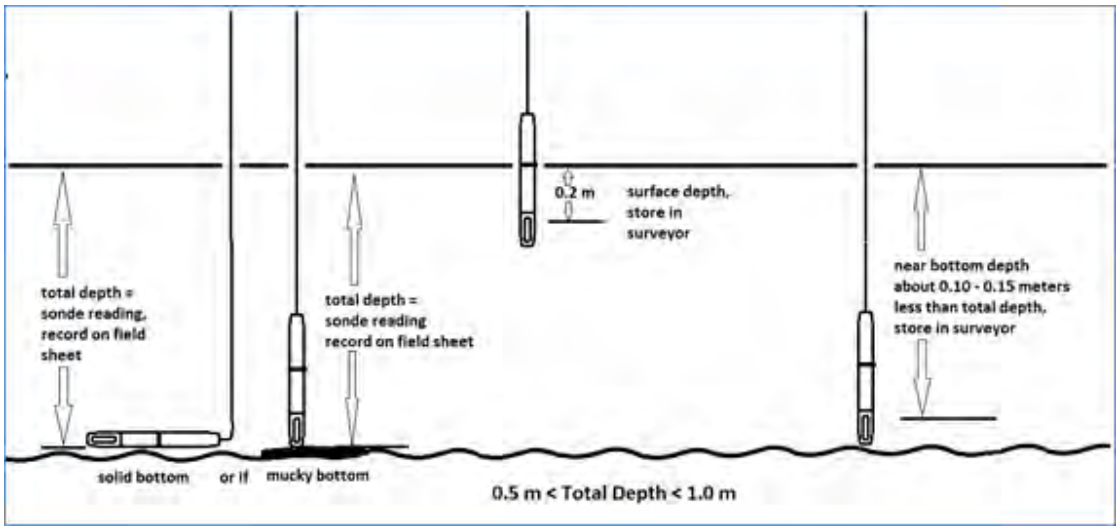


Figure 2.

- For sites with **total depths less than 0.5 meters** only readings at surface depth (0.2 m) are stored (Fig. 3 below). Values are collected with the sonde in a vertical position unless the site has shallow (less than 0.3 m), flowing water with a solid bottom substrate.

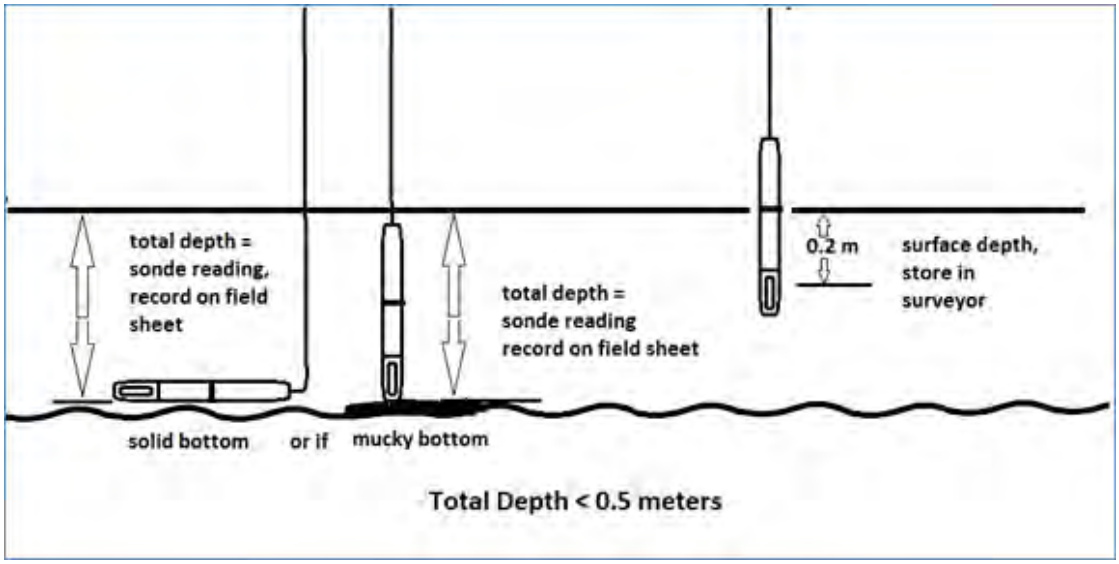


Figure 3.

- **Make sure to record the total depth value on the field sheet before bringing the sonde to the surface depth to collect the first Hydrolab reading at 0.2 meters**. Continue to middle depth if needed, allowing at least 60 seconds to pass before taking the next reading, and end by collecting a reading at the near bottom depth, which is 0.1 – 0.2 meters above the total depth. Again, allow at least 60 seconds to pass before taking the bottom reading.
  The definition of near bottom depth is not the same as total depth since it is important to avoid the impact of anoxic sediments that can be released when the sonde hits the bottom substrate. **The order of collecting readings at the surface, middle, and near bottom depths is followed to eliminate these effects.**

In summary:

- Remember to first record the total depth on the field sheet.
- Return the sonde to the surface (0.2 m) to take first reading. When the readings have stabilized on the surveyor, press the "dot" button. If the total depth is <0.5m, then only this surface (0.2 m) level reading is stored.
- If total depth is greater than 1.0 meter, lower the sonde to the middle of the total depth. When the readings have stabilized on the surveyor and at least 60 seconds have passed since the first reading was collected, press the "dot" button. Then, continue to the near bottom depth. When the readings have stabilized on the surveyor and at least 60 seconds have passed since the last reading was collected, press the "dot" button. If total depth is between 0.5 - 1.0 meter, lower the sonde to the near bottom level. When the readings have stabilized on the surveyor and at least 60 seconds have passed since the first reading was collected, press the "dot" button.

- To review the reading
  - Press the Menu Button.
  - Scroll down to view log files.
  - Click OK.
  - Scroll down to the file you want.
  - Click OK and you will see a graph.
  - Click OK again to view details.
  - You will be on your last reading. Use the left arrow key to go to the surface reading.
  - Record the pH and salinity of the surface reading on the lab chain of custody form.

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Surface Water Sampling for Laboratory Analysis

Effective Date 06/01/2017

1.0 PROCEDURAL SECTION

1.1 Scope and Application

The primary mission of the Environmental Monitoring and Assessment Section (EMAS) is to monitor the condition of designated Pinellas County surface waters as defined by the Surface Water Ambient Regional Monitoring (SWARM) Program that provides water quality information required by Federal and State mandated National Pollutant Discharge Elimination System (NPDES) permit, the Total Maximum Daily Load (TMDL) assessment, and Pinellas County Comprehensive Management Plan. Surface water sampling usually includes operation of the Hach Hydrolab to get *in situ* measurements of water quality as well as collection of water samples to be submitted to a lab for analysis. This SOP will describe how to collect water samples for laboratory analysis of various parameters. Refer to the Hydrolab SOPs for descriptions of calibration of this equipment and use in the field.

1.2 Summary of Method

There are currently eight sampling periods per year to incorporate the wet and dry seasons. Sampling runs have 4-11 sites per day and sometimes include extra quality control samples (blank and/or duplicates). The Environmental Monitoring and Assessment Section will follow Florida Department of Environmental Protection (FDEP) and Pinellas County Standard Operating Procedures (SOP) while collecting water quality samples.

1.3 Definitions

- H2SO4-- Sulfuric Acid
- HCl-- Hydrochloric Acid
- PFD-- Personal Flotation Device

1.4 Health and Safety Warnings

- When arriving at a site, always assess the area for any safety or access issues.
- PFD's must be worn at all times while sample collection is being done from a boat, and orange safety vests should be worn when sampling near busy streets.
- Eye protection should be worn and care should be taken when using sulfuric acid for preservation of the orthophosphate sample.

1.5 Cautions

- Try to avoid disturbing sediments in immediate area of sample collection. Especially for waters with low or no flow, use extreme caution to avoid disturbing the sediment.
- Avoid debris on the surface of the water. Samples should be collected beneath the water's surface within the top 0.3 meters.
- Do not collect a sample from water less than 10 cm deep due to the risk of disturbing sediment or flocculent bottom material.
- Collect surface water samples from downstream towards upstream.
- When collecting samples while wading in the water, be sure to collect samples upstream from your body.
- When sampling from a boat, take samples near the bow, away and upwind from any gasoline outboard motor. Orient watercraft so that bow is positioned in the upstream direction.
- Consider the representativeness of selected sampling locations, for example, when attempting to characterize a water body that may be stratified or heterogeneous.

1.6 Interferences
Not applicable

1.7 Personnel Qualification
Field personal must be trained and evaluated on field techniques and the use of equipment prior to collecting samples or data. Use of the equipment is subject to approval by the QA Officer. Training will consist of new staff first observing certified field personnel performing field operation/collection methods during actual field trips. Once familiar with field methods, on subsequent trips, staff then perform field methods under supervision of certified staff. Final certification is achieved by field staff correctly performing field operations/collections under supervision by the QA officer. The QA officer will complete certification documentation. Investigators must be familiar with the SOP document and FDEP documents, when applicable.

1.8 Equipment
Monitoring of sites is accomplished on a regularly scheduled basis, with sites grouped by location into "runs." Land run sites require certain equipment that water run sites do not, and vice-versa. Refer to the *Preparation for Fieldwork: Assembling Necessary Equipment* SOP and the current Ambient Monitoring Field Checklists at the end of this SOP to ensure that all necessary equipment is brought to the field. Refer to the *Preparation for Fieldwork: Bottle Preparation, Acid Washing, and Assemble of Bottle Sets* SOP for a description of how bottles are prepped for fieldwork. Refer to the *Hydrolab HL4 Multiprobes: Calibration and Verification* and *Hydrolab HL4 Multiprobes: Use in the Field* SOPs for a description of calibration and use of that equipment.

1.9 Procedure
Water run (coastal, lake, or marine) sampling sites are selected on an annual basis using a random stratified sampling program and are accessed by using a boat and GPS equipment to locate sites. Samples may be collected within 100 meters of the sample point. Water run sites may require use of provided alternate sites because of a number of circumstances that prevent obtaining a sample at the predetermined location.

Land run (tidal and freshwater stream) sampling sites are fixed sites and are accessed by foot with vehicle transport. When arriving at a site, always assess the area for any safety or access issues. Land runs may result in no sample collection if flow, level, or vegetation creates characteristics that are not ambient conditions; however, it is important to look upstream and downstream 100 meters of the site to see if a sample can be collected appropriately anywhere within that distance.

This SOP will describe the proper procedures to collect water samples for laboratory analysis of various parameters. Surface water sampling may be accomplished by grab samples or by using alpha samplers. Samples may be collected in a variety of specific containers and may be acidified or placed on ice for preservation. Table 1, below, indicates the preservation methods, holding times, and container information for parameters collected.

Table 1. Sample preservation, holding times, and container types.

Parameter	Preservation Method	Max. Holding Time	Container Type
Nutrients (TKN, TP, ammonia, NOx)	2mL H_2SO_4 to pH<2, then cool to 4°C	28 days	Plastic 1 qt bottle
Color	Cool to 4°C	48 hours	Plastic 1 qt bottle/may be pulled from 2 qt bottle with TSS and Turbidity
TSS and Turbidity	Cool to 4°C	48 hours	Plastic 1 qt bottle/may be pulled from 2 qt bottle with Color
Chlorophyll a, b, c, and phaeophytin	Cool to 4°C, 14 days in dark storage	30 days	Opaque / amber 1000 ml polypropylene bottle
Ortho-phosphate	Filter immediately, then cool to 4°C	48 hours	High density 125 ml polypropylene bottle
BOD	Cool to 4°C	48 hours	Plastic 2 qt bottle
Bacteria (*E. coli* or Enterococcus)	Cool to 4°C	8 hours	WhirlPak
Transmissivity	none	3 days	Opaque / amber 500 ml polypropylene bottle
Alkalinity	Cool to 4°C	14 days	High density 250 ml square polypropylene bottle
Aluminum	Filter immediately, then cool to 4°C, lab adds nitric acid	14 days	High density 250 ml square polypropylene bottle

1.9.1 Surface Grab Samples

Collect surface grab samples within the top 0.3 meters (1 foot) of the water column. **Avoid skimming the surface of the water during collection.** Very shallow water bodies require careful techniques of sample collection to avoid disturbing bottom sediments. Samples should not be collected from areas less than 10 cm deep.

For land run sites, samples should only be collected if there is visible flow in the channel. If in doubt about whether there is flow, use the flow meter to measure a few areas in the stream. Velocity should be at least 0.05 cfs to proceed with collecting water samples. **Do not collect samples from stagnant areas. Write "no flow" or "insufficient flow" on the data sheet.**

TSS/turbidity/color, nutrients, chlorophyll, BOD, and transmissivity sample collection:

- A separate container is filled for most of these parameters. Use the specified bottles for each of these samples: clear 2-quart plastic bottle with black lid for TSS/turbidity/color (just one bottle for these three parameters), clear quart squat bottle with white lid and red X for nutrients, larger brown bottle for chlorophyll, smaller brown bottle for transmissivity, and clear 2-quart plastic bottle with black lid for BOD when that parameter is sampled.

- Remove the container cap, invert the bottle, and slowly submerge the container with the mouth of the bottle entering the water first.
- Rinse the container with site water three times and discard contents downstream/down-current from where the sample will be collected.
- When ready to collect the sample, submerge bottle as before, then invert the bottle so the mouth is upright under the water surface and pointing upstream/up-current into the oncoming direction of water flow (if applicable). Allow water to flow 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, alkalinity, or other analytes where headspace is not allowed in the sample container.
- **For the nutrients sample only**: Add preservative (2 ml of concentrated H2SO4 for 1 liter) into the nutrients squat quart bottle, cap the bottle, and shake thoroughly. Check preservation of the sample by pouring a small amount from the sample bottle onto a strip of pH paper, and adjust pH with additional preservative if pH is greater than 2. ***Do not over or under acidify as this can lead to laboratory errors in the sample**.
- Place all samples into appropriate cooler with ice for transport to lab.
- Transmissivity samples do not need to be iced. They should be placed in a separate, smaller cooler with no ice.

Alkalinity sample collection:

- Use the specified bottle for sample.
- Remove the container cap, invert the bottle, and slowly submerge the container with the mouth of the bottle entering the water first.
- Rinse the container with site water three times and discard contents behind where you will be collecting the sample.
- When ready to collect the sample, submerge bottle as before, then invert the bottle so the mouth is upright under the water and pointing upstream into the oncoming direction of water flow (if applicable). Allow water to run slowly into the container until filled.
- Put the cap on the filled container while still underwater, before returning the bottle to the surface. Headspace is not allowed in the sample container for this parameter.

Orthophosphate (OP) and aluminum sample collection:

The water sample used to analyze orthophosphate and aluminum will be filtered in the field. Orthophosphate is collected at every site. Aluminum is only collected on Lake Seminole and occasionally additional sites. Make sure filter and syringe are set up properly before collecting the sample.

Prior to taking the sample:

- Flush the syringe and filter paper frame with deionized water, without a filter paper.
- Place a new filter membrane (0.45um pore) in the filter paper frame. Make sure that the ridged/rough sides of the filter frame discs are facing each other and that the O-ring has not come out of the groove. Make sure that the filter paper is centered on the frame, not askew.
- Then, screw the filter paper frame onto the end of the syringe, as shown in Figure 1 below.

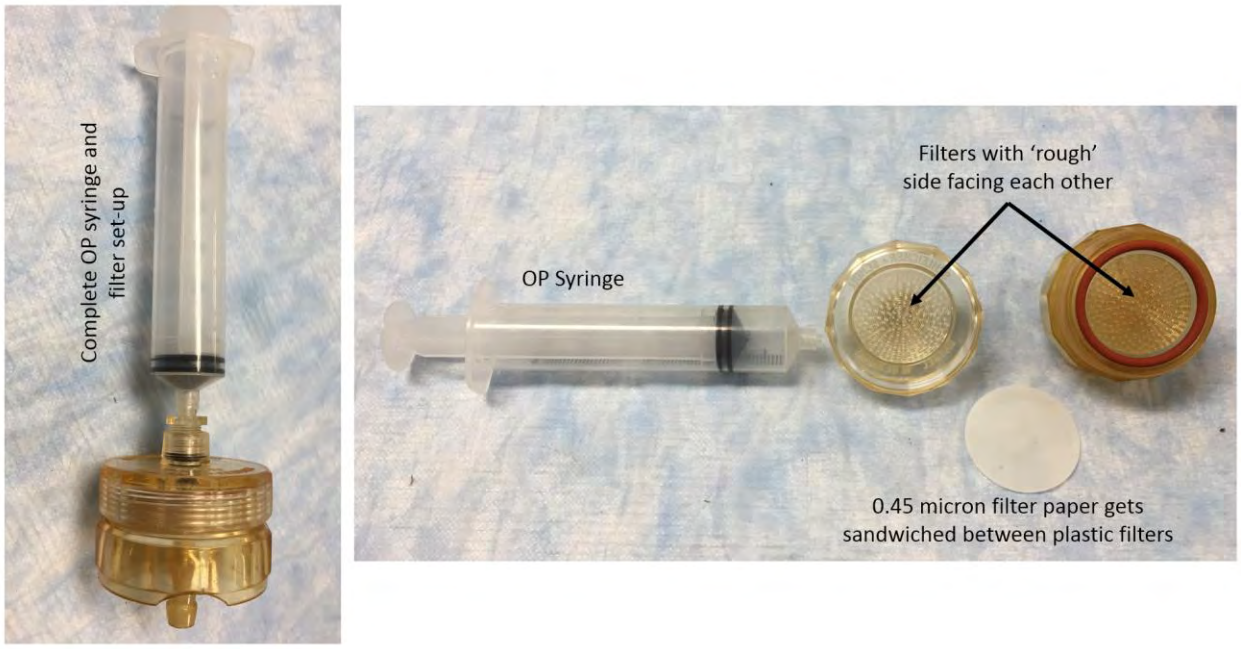


Figure 1: Orthophosphate and aluminum syringe and filter set-up

When ready to collect the sample:

- Unscrew the syringe from the filter apparatus.
- Submerge the syringe tip to about 0.2 m in the water and fill the syringe.
- Screw the filter apparatus onto the syringe and push water into orthophosphate bottle (small round clear bottle) or aluminum bottle (small square clear bottle). Firm pressure is applied to the plunger to force water through the filter paper membrane. Caution must be exercised to avoid pushing too hard. Excessive pressure can force water through the seal or possibly tear the filter paper.
- Repeat the previous three steps, and then put the lid on the bottle and place on ice.
- Remove the filter paper from the apparatus and examine the filter paper. Make a note in the comments on the field sheet if there is a film or particles on the filter paper. Discard the filter paper.
- Pull DI water into the syringe, replace the apparatus without a filter paper, and push the DI water through the apparatus. Repeat. Then, put a new filter paper in the apparatus, being careful not to touch the white filter paper with your hands (the blue paper is OK to touch).

Bacteria sample collection:

- Put on disposable gloves.
- Put a small amount of hand sanitizer in your hand to disinfect. Allow time for the gel to evaporate.
- If you can get down to the sample site, fill the whirl-pak one of the following ways:
  - Direct grab from the water body:
    - Hold the open whirl-pak by the yellow tabs, and in a single motion, submerge the whirl-pak and sweep it below the surface of the water into the direction of flow.
    - Fill the bag at least to the fill line marked on the top of the white label area. If you do not fill to this level, discard the whirl-pak and use another one. You want the level just a little over the fill line (a few mm above is good). If you overfill, carefully squeeze out the extra.

        - Close the whirl-pak by swinging around 3 times, then twist the yellow tabs together.
    - Use the tongs:
        - The gloved staff holds the open whirl-pak while the ungloved staff attaches the alligator clips on the yellow tabs.
        - The ungloved staff then submerges the whirl-pak and sweeps it below the surface of the water into the direction of flow in a single motion.
        - Fill the bag at least to the fill line marked on the top of the white label area. If you do not fill to this level, discard the whirl-pak and use another one. You want the level just a little over the fill line (a few mm above is good).
        - The gloved staff then takes the whirl-pak and, if overfilled, carefully squeezes out the extra. Then, close the whirl-pak by swinging around 3 times, then twist the yellow tabs together.
- If you cannot physically get down to the site, you will fill the whirl-pak from an intermediary device (alpha sampler and bucket):
    - Obtain water sample using the technique described in the "Depth Grab Samples" section below.
    - The ungloved staff either opens the spigot or starts pouring water from non-spigot buckets.
    - Once the flow starts, the gloved staff places the opened whirl-pak in the flow and fills it. Same fill requirements and closing method apply.
- Place the whirl-paks in the tray in the ice-water slurry in the red bacteria cooler. Make sure the level of the water does not get above the top of the whirl-paks.
- **The hold time for bacteria is eight hours, starting when the first sample is collected, so the samples must be delivered to the lab within approximately six hours of first site collection to allow lab set-up of tests.** Certain runs can be completed early enough that the sample crew can deliver samples to the lab within this hold time. Other runs will require samples collected in the morning to be delivered to the lab either by sampling staff or by a runner. If a runner is required, then about mid-way through the run field staff will need to contact PCDEM office staff to pick-up the first half day of samples to deliver to the lab.

Occasionally, samples will be collected using a sample container with premeasured preservative:
This is not the usual PCDEM method for sample collection.

- Submerge the sample container **unopened** to the appropriate level.
- Turn the container so that the opening is upright and pointing upstream into the oncoming direction of water flow.
- Open the container and allow the water to run into the container until almost full (leave an air space).
- Cap the container and return to the surface.
- Invert the container several times to ensure sufficient mixing of sample and preservatives.
- Check preservation of the sample and adjust pH with additional preservative, if necessary.
- Place samples into appropriate cooler with ice for transport to lab.

1.9.2 Depth Grab Samples

On land runs, some sites may be too deep and/or wide to obtain a grab sample in flowing water. In these cases, an "alpha" sampler will be used (Kemmerer, Niskin, and Van Dorn type devices).

- Submerge the sampler under the surface of the water and rinse it three times with site water.

- Prop the ends of the sampler open with the wires and hold onto the messenger so that the sampler ends remains open.
- Lower the sampler slowly to the appropriate sampling depth (0.2 m line), taking care not to disturb the sediments.
- At the desired depth, send the messenger weight down the line to trip the closure mechanism.
- Bring the sampler to the surface.
- Seed the bucket with sample water by pouring a little bit into the bucket and placing the lid on and rinsing around and pouring out the water.
- Place the collected sample into a sample bucket.
- Fill the sampler again and pour into the bucket to make a composite sample. You may need more than two if you have extra bottles to fill.
- Fill sample bottles with water from sample bucket. Always rinse the sample bottle three times except for the orthophosphate bottle which is filtered with a syringe as described above.
- **For the nutrients sample only**: Add preservative (2 ml of sulfuric acid for 1 liter) into the nutrients squat quart bottle, cap the bottle, and shake thoroughly. Check preservation of the sample by pouring a small amount from the sample bottle onto a strip of pH paper, and adjust pH with additional preservative if pH is greater than 2. ***Do not over or under acidify as this can lead to laboratory errors in the sample**.
- Place all samples into appropriate cooler with ice for transport to lab.
- Transmissivity samples do not need to be iced. They should be placed in a separate, smaller cooler with no ice.

1.9.3 Quality Assurance/Quality Control (QAQC) Samples

Field blanks will be collected on runs LR4, LR6, LR7, E1, W1, and Lake Tarpon, and an equipment blank will be collected on LR4. This will result in 10% of samples being quality controlled/quality assured, as required by the FDEP. One field duplicate is collected in the W1 strata site each period for a total of eight duplicate samples collected each year.

Blanks (LR4, LR6, LR7, E1, W1, Lake Tarpon):

- Field blanks are collected on LR4, LR6, LR7, E1, W1, and Lake Tarpon. This is to confirm the cleanliness of the bottles used for assessing nutrients and orthophosphate. Fill the appropriate container for nutrients with DI water. For the orthophosphate blank, run DI through the syringe and filter to fill the OP bottle. Make sure to use the labels with the designation “FB” to denote field blank. Place both containers on ice.
- An equipment blank is collected on LR4. This is to confirm the cleanliness of the alpha sampler and bucket, so it should be collected before the equipment is used to collect ambient water samples. Fill the sampler with DI water and empty into the bucket. Fill the appropriate container for nutrients with DI water from the bucket. For the OP blank, run DI water from the bucket through the syringe and filter to fill the OP bottle. Make sure to use the labels with the designation “EB” to denote equipment blank. Place both containers on ice.

Duplicate samples (W1):

- Duplicate samples are collected only on W1. They can be collected at any of the four W1 sites. After collecting the chosen site’s samples, collect a full suite of samples again to achieve the duplicate samples. Make sure to fill in all site information on the data sheet. All values (lat-long, secchi, pH, salinity, etc.) should be the same as the chosen ambient site except for the time.

1.9.4 Dropping Samples Off at the Laboratory

- Samples should be at the lab before 4:00pm. If you are going to be late, let someone at the office know and they can call the lab and let them know.
- Fill out all of the Chain of Custody form (see Data Sheets, Chain of Custody, and Sample Labelling SOP).
- Make sure all of the times are on all of the samples.
- All samplers must sign the form.
- One person must relinquish the sample to the lab by signing and putting the date and time (time that arrives at the lab).

1.10 Data Management & Records Management

- See the Field Sheet, COC, and Sample Labelling SOP document
- The Water Quality Data Sheet (WQDS) is the primary document tracking field sample collection activities. Collected samples and/or non-sampled sites are recorded on the WQDS. Collected samples must be accurately labeled and accompanied by a Chain of Custody (COC) form or be recorded in the "Extra Samples" column on the Water Quality Data Sheet. It is necessary to label and trace the possession and handling of each sample and/or container to maintain integrity for legal and practical applications.

2.0 QA/QC SECTION

2.1 Training

Training of field personnel will be done through dry run exercises in the laboratory to familiarize them with instrument operation, calibration, and maintenance. All operators are required to become familiar with the SOP document and equipment manual. Prior to solo sample collection, field personnel are evaluated in a field setting for proper use of equipment and sample collection protocol. Annual field audits are performed on sample collectors following procedures outlined in the Quality Management Plan.

2.2 Maintenance

Not applicable

2.3 QC Procedures

Follow SOP guidelines and instructions.

3.0 REFERENCES

Consult the Pinellas County SOP's for the following

Hydrolab
Flow Meter
Bacteria Sampling
Sample Preparation, Bottle Preparation, and Acid Washing
Field Sheet, COC, and Sample Labelling

Consult the FDEP SOP's FS 1000, FS 2000, FS 2100, FT 1800.

Ambient Field Sampling Checklist

ALL TRIPS

- H2SO4 Acid 2-ml dispenser squeeze bottle, cooler, ice pak, and
- Nitrile gloves for handling acid dispenser(one pair per sample, sizes to match crew)
- Site bottle kits (See *Bottle Volume and Kit Counts* guide)
- One bucket and one sampler if necessary
- Coolers and ice
- DI water , one to two carboys depending on blanks/dups per run
- Field Book (field sheet(2), DEI Lab COC(2), flow sheet, waterproof labels, strata maps, lat/long sheets, road maps)
- Hydrolab (Sonde, cable, Surveyor, back-up Surveyor if needed) with tap water in PVC tube
- Toolbox (with extra Litmus paper, filter papers, filter set up, syringe, batteries, tools, pens, permanent markers, Ziploc bag for waste)
- Personal gear – hip waders, tall boots, insulated waders, boots, booties, raingear, hats, sunscreen
- Radio

ALL LAND RUNS

- Site book (site descriptions, site photos, 0464 key, Tarpon bypass combination 7211)
- Check tide information for low/high tides at all sample sites
- Flow data sheet (confirm it's in Field Book)
- Safety vests
- Flow Meter with extra batteries (D-cell)
- Short and Long adjustable rods for flow meter
- Measuring Tape, Stakes, Meter Stick, Machete
- BOD collection bottle (for periods 2,4,6, and 8)
- Whirl-pak containers (write lot # on field sheet)
- Bacteria coolers with ice slurry using DI water and trays (2)
- Nitrile gloves for handling bacteria Whirlpaks (one pair per sample, sizes to match crew)
- Alcohol disinfectant gel

Land Run 3 (Lake Sites 14-02 and 14-07 require additional data collected)

- Secchi disk
- Long phytoplankton sampler tube
- Bucket
- Phytoplankton collection containers (2)
- Land Run COC (to distinguish lakes sites needing color analysis)

ALL BOAT RUNS

- Secchi Disk
- Transmissometer bottles transport cooler (no ice)
- Boat backpack, GPS, and boat keys
- Plug in Boat
- Fire extinguisher, PFD's & Throwable PFD
- Fill out pre-trip portion of boat maintenance log sheet

LAKE TARPON BOAT RUN

- BOD collection bottles (for periods 2,4,6, and 8)
- Phytoplankton collection containers (4)
- Phytoplankton sampler tube and extra bucket
- Whirl-pak containers (write lot # on field sheet)
- Nitrile gloves (one pair per sample, sizes to match crew)
- Bacteria cooler with ice slurry using DI water and tray (1)
- Fixed phytoplankton location map (confirm it's in field book)

Lake Seminole Boat Run

- Bring same equipment listed for *Lake Tarpon Boat Run*
- Aluminum collection bottle (nitric acid preservation done at laboratory when relinquished) (4)
- Pre-filter tower and glass fiber filter paper tube
- Inverter and peristaltic vacuum pump with tubing (to connect to boat battery)

End of Field Day Checklist

- Unload vehicle
- Post calibrate Hydrolab
- Fill in calibration sheets and pass/fail box on field sheet.
- Rinse the Sonde and protective stir cap with fresh water to remove any dirt or salt.
- Place the Hydrolab Surveyor units on shelf in lab and plug in to charger.
- Put away Hydrolab Sonde, Cable, stirrer protective cap, and calibration log.
- Fill up any empty or low calibration standards.
- Fill up DI and Tap water jugs
- Wash all dirty/ salty gear (alpha sampler, bucket, coolers, etc) according to SOPs, and place in clean area to dry
- Place acid dispenser container in the hood, rinse the cooler and ice pack before storing in designated area
- Place unused bottles and containers back in their storage place in the garage, check lot numbers on chlorophyll bottles and place back with same lot numbers; hang the empty bag up to dry
- Empty orange field boxes, rinse and dry before re-loading for next trip
- Rinse off boat and trailer with plenty of fresh water if on a saltwater run
- Run the motor with fresh water for approximately five minutes, followed by salt away.
- Turn off boat battery.
- Fill out the boat log with hours used, field personnel on run, date of run, the run you were on, and if gas added to the boat or not
- Rinse off any other gear that is dirty/salty and put away in designated area to dry
- Fill out all cleaning and prep logs
- Check all vehicles gas tanks and fill if less than half a tank remains
- Park vehicle, fill out vehicle log sheet, return keys to station behind Admin desk on second floor
- If there were problems with any of the vehicles or gear, notify the responsible person so the problem can be fixed

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Wind Meter
(WeatherHawk SkyMate-18)

Effective Date 06/01/2017

1.0 PROCEDURAL SECTION

1.1 Scope and Application

The WeatherHawk Skymate-18 anemometer is used to determine the wind speed and air temperature at our sample sites while out collecting water quality samples. The Environmental Monitoring and Assessment Section (EMAS) records weather conditions at the beginning of the day, the middle part of the day, and at the end of the sampling day.

1.2 Summary of Method

The anemometer is turned on and held at arm's length into the direction of the blowing wind. A wind speed measurement and an air temperature are collected after a few minutes when the readings have somewhat stabilized.

1.3 Definitions

- Anemometer-- an instrument for measuring and indicating the force or speed and sometimes direction of the wind

1.4 Health and Safety Warnings

- Not applicable

1.5 Cautions

- Consistent use at very high speeds, for example from the window of a fast-moving car, will damage the impeller's bearing and reduce accuracy.

1.6 Interferences

- Keep meter (or the box it is in) out of the sun before taking temperature reading to avoid inaccurately high temperatures.

1.7 Personnel Qualification

Field personal must be trained and evaluated on the use of equipment prior to collecting samples or data. Use of the equipment is subject to approval by the QA Officer and/or the Environmental Monitoring Coordinator. Training will be done through dry run exercises in the laboratory and field to familiarize field personnel with operation/collection, calibration and maintenance. Users must be familiar with the SOP document and instruction manual.

1.8 Equipment

- WeatherHawk Skymate-18 Anemometer
- WeatherHawk Skymate-18 Instruction Manual
- WeatherHawk Skymate-18 SOP

1.9 Procedure

1.9.1 Measurement / Operation

- Open the case and click into the fully opened position.
- **POWER ON** by pressing the ON/OFF button momentarily.
- **POWER OFF** by pressing and holding the ON/OFF button for approximately 3 seconds.
- **AUTO POWER OFF**: If the meter is inactive for approximately 5 minutes, it will automatically shut down to preserve the battery.
- **OPERATING MODES:** Turn the unit on using the ON/OFF button on the left. Use the MODE button on the right to scroll to the desired function. To turn off the unit, press and hold the ON/OFF button for 3 seconds, until the display is blank, then release.
- **CHANGING UNITS OF MEASURE:** With the Skymate on, change the units of measure by selecting the mode you wish to change (Wind Speed or Temperature). Next, press and hold the ON/OFF button and, while holding, press the MODE button to change the units of measure. When changing the mode for wind speed, you will need to press the MODE key repeatedly to scroll through options (MS, FPM, KNT, KMH, MPH, BF (Beaufort). Release the ON/OFF and MODE buttons when the desired unit is displayed. **NOTE**: When you restart your Skymate, it will default to the last mode and unit used.
- **TAKING MEASUREMENTS**: Hold or place the meter so airflow enters the vane (impeller) from the rear of the unit. When holding the meter, hold it at arm's length, away from your body. **CAUTION**: The Skymate is very accurate at low and mid-range air speeds. Consistent use at very high speeds, such as from the window of a fast-moving car, will damage the impeller's bearing and reduce accuracy. See below for impeller replacement.
- **WINDSPEED AVERAGE MODE:** You may select average readings over 5 (AV5), 10 (AV10) or 13 (AV13) seconds. Press MODE repeatedly to select desired average. **Example**: Select AV5 then press ON/OFF key to start the display. Reading will appear and freeze after 5 secs. Press ON/OFF to restart. Same applies to AV10, AV13. To exit, press the MODE button until the icons at the top disappear.
- **MAXIMUM WINDSPEED HOLD:** Press the MODE button repeatedly until the MAX icon appears. After a measurement session, the LCD will show the highest wind speed measured since selecting the MAX icon. Press the MODE button repeatedly to return to current wind speed or other options.
- **TEMPERATURE:** Make sure to remove the meter from the toolbox and place in the shade for at least five minutes prior to taking a temperature reading to prevent readings that are higher than true air temperature.

1.9.2. Troubleshooting

- **LOW BATTERY:** When you see the battery icon in the upper R corner, the battery is low and should be changed as soon as possible, or accuracy will become an issue. Skymate uses a Lithium CR2032 battery, available almost anywhere. To change the battery, open the slotted cover on the back by turning clockwise. When installed, the battery should have the positive side facing you.
- **WIND IMPELLER REPLACEMENT:** If the impeller is damaged or the unit appears inaccurate, the impeller can be replaced. Loosen the set-screw found on the back. Remove the impeller by twisting the impeller assembly clockwise (if you are facing the

back of the wind meter) to the “O” position marked on the rear of the meter. Install the new impeller by reversing these instructions.

1.10 Data Management & Records Management

Weather Conditions, including wind speed and air temperature, are written on the back of the Water Quality Sampling Field Sheet. They are recorded three times during the sample run: once in the beginning of the trip, once in the middle of the day, and once at the end of the sample trip.

2.0 QA/QC SECTION

2.1 Training

Training of field personnel will be done through dry run exercises in the laboratory to familiarize them with instrument operation, calibration, and maintenance. All operators are required to become familiar with the SOP document and instruction manual. Prior to solo sample collection, field personnel are evaluated in a field setting for proper use of equipment and sample collection protocol. Annual field audits are performed on sample collectors following procedures outlined in the Quality Management Plan.

2.2 Maintenance

- Keep extra batteries in field box.

2.3 QC Procedures

- Not applicable

3.0 REFERENCES

WeatherHawk SM-18 Skymate Manual: Version 4.05

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Data Management

Effective 06/01/2017

1.0 PROCEDURAL SECTION

1.1 Scope and Application

The Pinellas County Surface Water Quality Monitoring program is mandated under the Clean Water Act to support the National Pollution Discharge Elimination System (NPDES) permit and Total Maximum Daily Load (TMDL) assessment programs[35]. Surface water quality data is submitted to the State of Florida's STOrage and RETrieval (STORET) database through December 2017[36] and is available from the Water Information Network (WIN) beginning January 2018.[37] Reported data is used for the Impaired Water Rule (IWR) assessment as a requirement for criteria development by the Florida Department of Environmental Protection (FDEP) and the Environmental Protection Agency (EPA). Data is submitted to FDEP and is reviewed before being submitted to the EPA. Water quality data is used within the County for trend analysis in conjunction with the Pinellas County Comprehensive Management Plan.

The County's water quality database(s) house historic and current baseline information used for numerous County projects including watershed planning, construction, restoration, and enforcement. Calculating tributary pollutant loading to receiving waterbodies and conducting site outlier assessments provides information for pollution reduction, prevention, and management for impaired waters. County water quality data promotes citizen education and participation through submission to online tools like the Pinellas County Water Atlas. Furthermore, available water quality data attracts collaboration with academic and national programs on special grant-funded monitoring projects to further support County goals and reduce cost on mandatory programs.

1.1 Summary of Method

Pinellas County's Environmental Management staff performs water sample collection in conjunction with an inter-local agreement between the County and local municipalities. Chemical components of water quality are analyzed by a contracted laboratory accredited by The National Environmental Laboratory Accreditation Council (NELAC) and Institute (TNI). Physical components of water quality are collected for download using Hach Hydrolab water quality monitoring sondes. Water clarity components are collected to calculate light attenuation coefficients downloaded from Li-Cor equipment, light transmissivity percentage using a transmissometer analyzed by EM staff, and secchi depth obtained *in situ*. Field conditions and site comments are described on hand-written field sheets.
All of this data must be managed through automated uploads or manual data entry, as described in this document.

1.9 Procedure

1.9.1 Physiochemical Data

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[35] In compliance with 62-303.320 (9) The Department shall consider all readily available water quality data collected and analyzed in accordance with Chapter 62-160, F.A.C. If requested, the sampling agency must provide to the Department all of the data quality assessment elements listed in Table 2 of the Department's Guidance Document "Data Quality Assessment Elements for Identification of Impaired Surface Waters" (DEP EAS 01-01, April 2001) (http://www.flrules.org/Gateway/reference.asp?No=Ref-06034), which is incorporated by reference herein. Copies of the document may be obtained by writing to the Florida Department of Environmental Protection, 2600 Blair Stone Road, MS #6511, Tallahassee, FL 32399-2400.

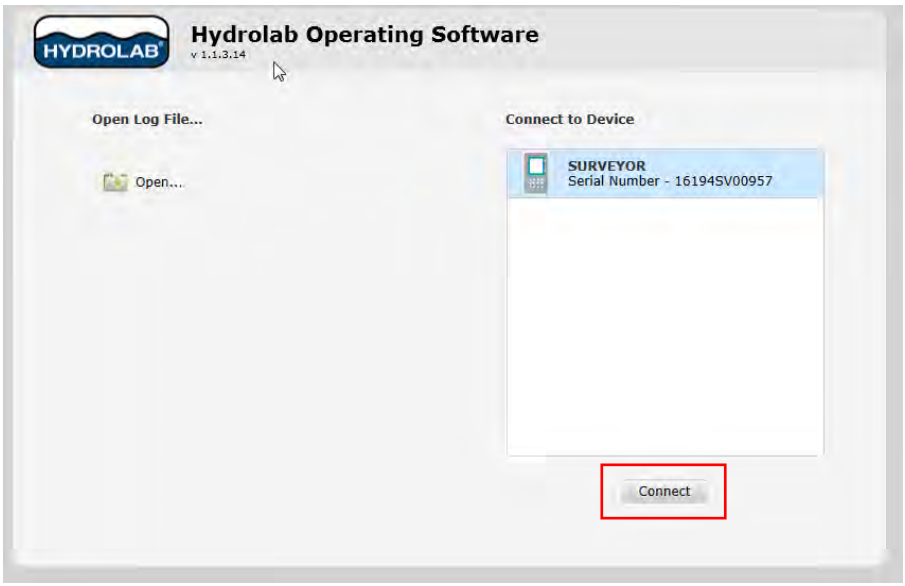
[36] Available online at http://storet.dep.state.fl.us/DearSpa/public/welcome

[37] Available online at http://prodenv.dep.state.fl.us/DearWin/public/welcomeGeneralPublic?calledBy=GENERALPUBLIC

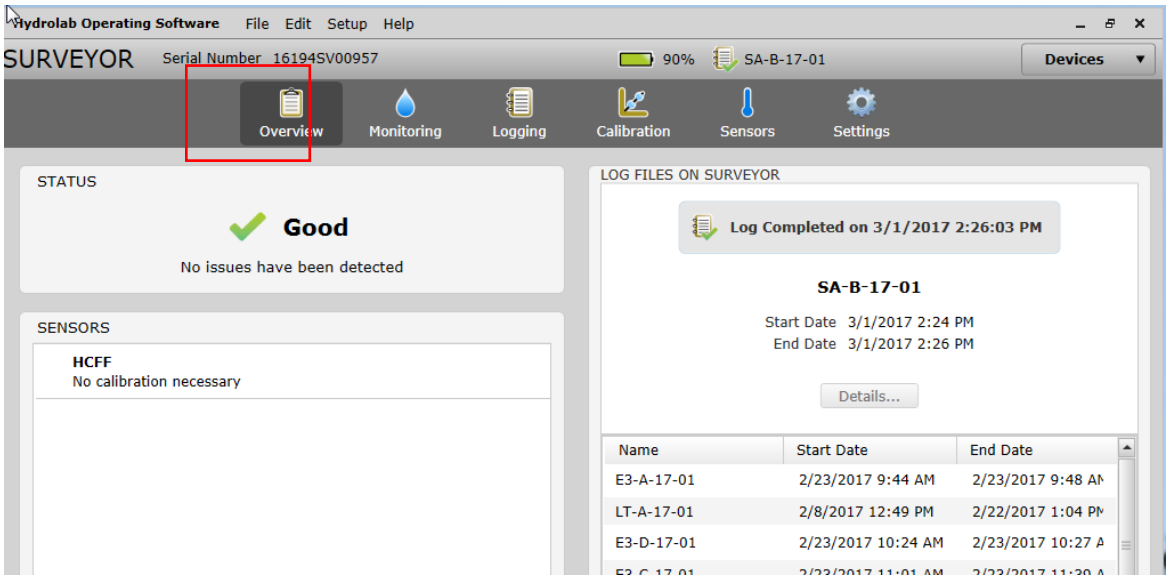
Physical components of water quality are stored from sonde measurements using Hydrolab Surveyors and downloaded to files. Measured components are programmed to produce a consistent download and are selected and retained in the Hydrolab download software:

1.9.1.1 Data download from the Hydrolab HL4[38] surveyors requires a USB cable for connection to the computer and installation of the Hydrolab Operating Software to the computer (file HOS-1.1.3.14_x64.msi found in the Data Formatting folder).

1. Connect the USB cord to the PC tower and click on the desktop icon to launch the connection.
2. Select to highlight the surveyor from the device list and click on the "connect" button:

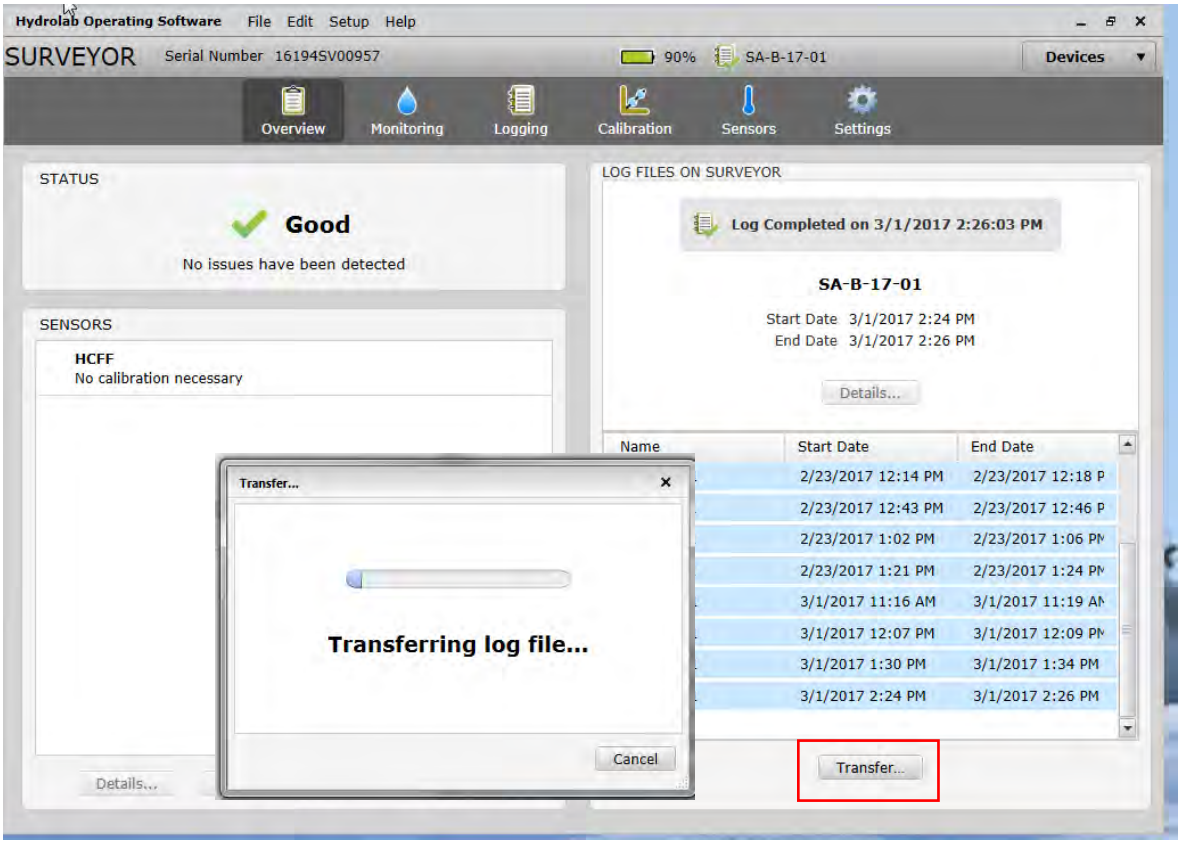


3. Click on overview to bypass any upgrades and to see available data:

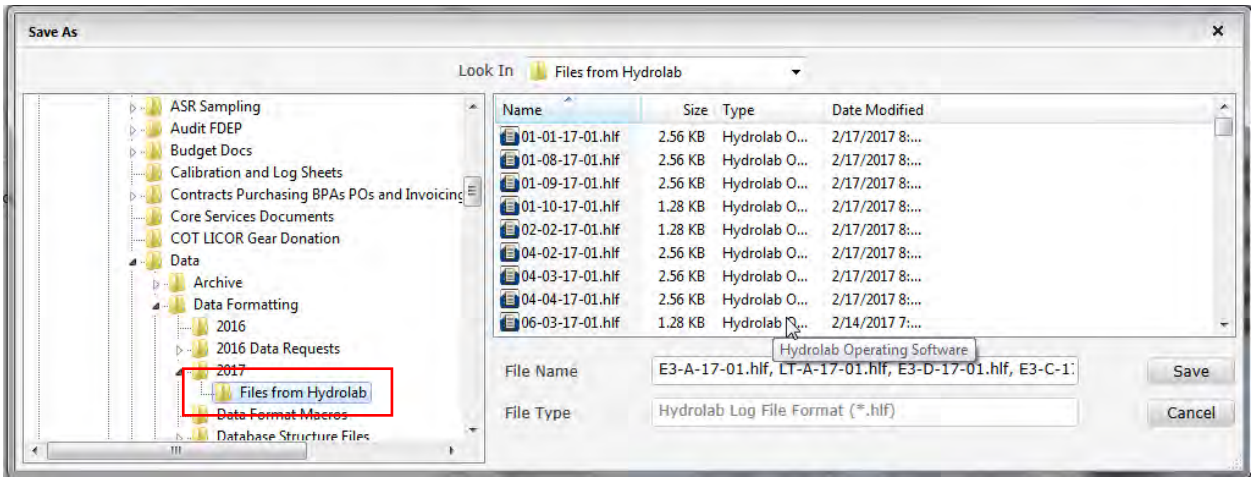


[38] *Sample Collection Equipment Name* for WIN *Field* activities is reported as "Misc Field Device."

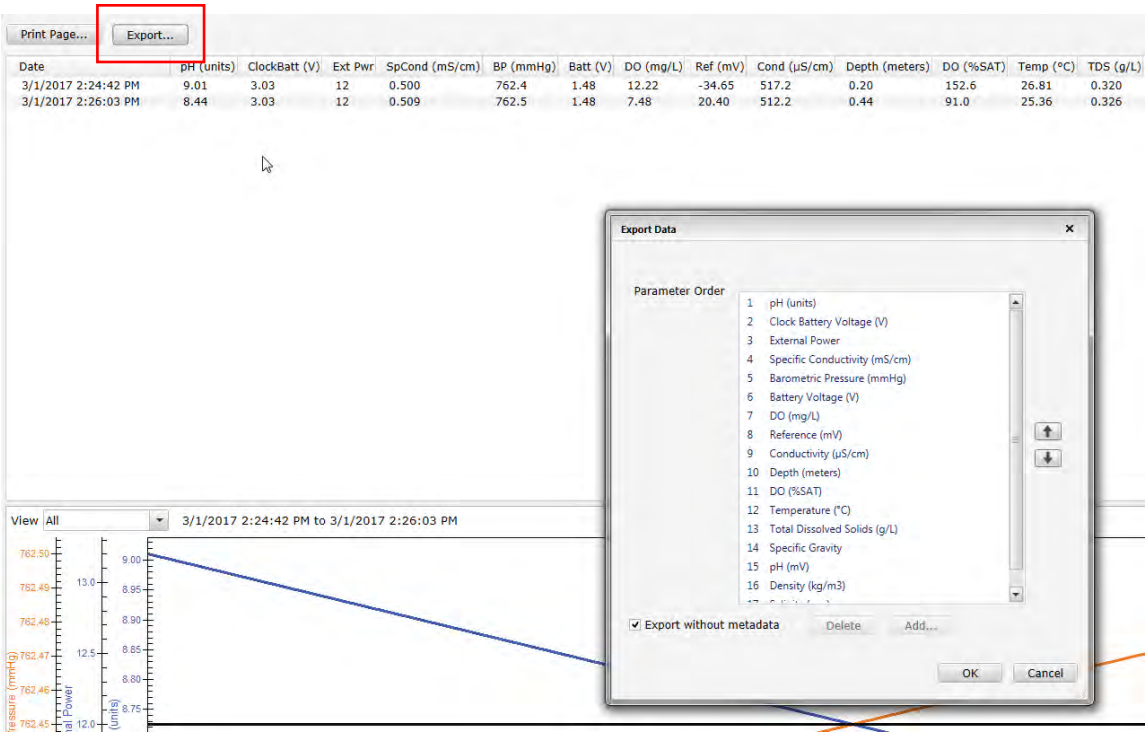
4. Select the files you'd like to download (using Ctrl or Shift to select multiple) and click the "Transfer" button:



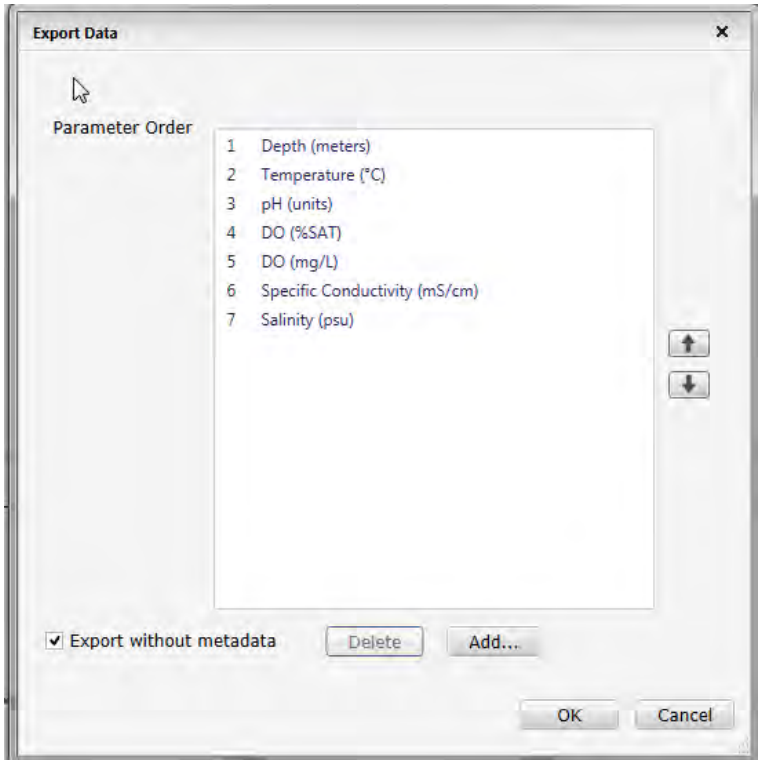
5. Save transferred files to the preliminary "Files from Hydrolab" folder for review and formatting for .csv save:



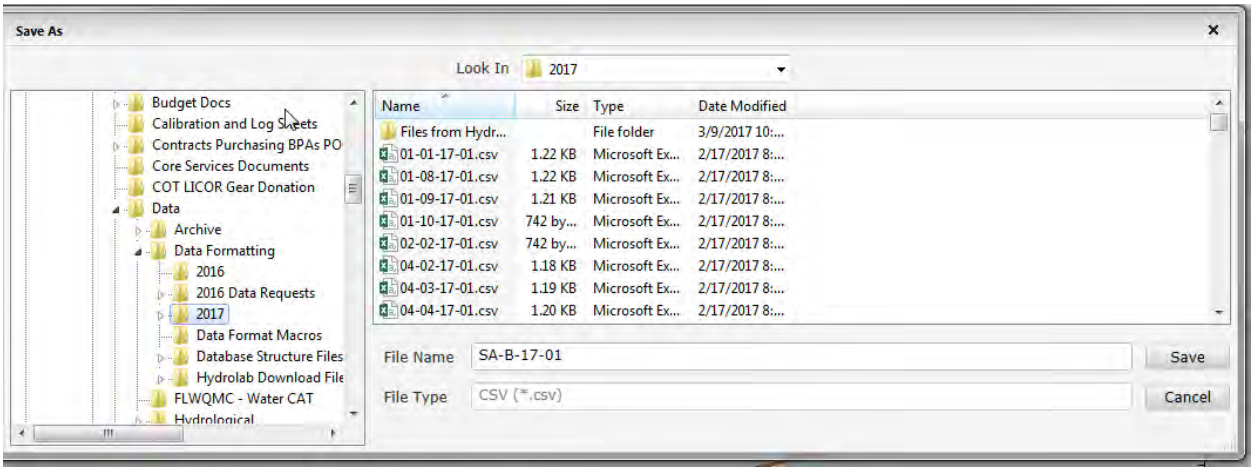
6. Go to the “Hydrolab Download File” on the server and select one of the transferred .hlf files to display in the Hydrolab Operating Software (HOS).
7. Click the “Export” button to choose the export format:



8. The order of parameters is shown below to match the DEM database format. Click “OK.”



9. Map to the file folder on the server, and click “Save.”

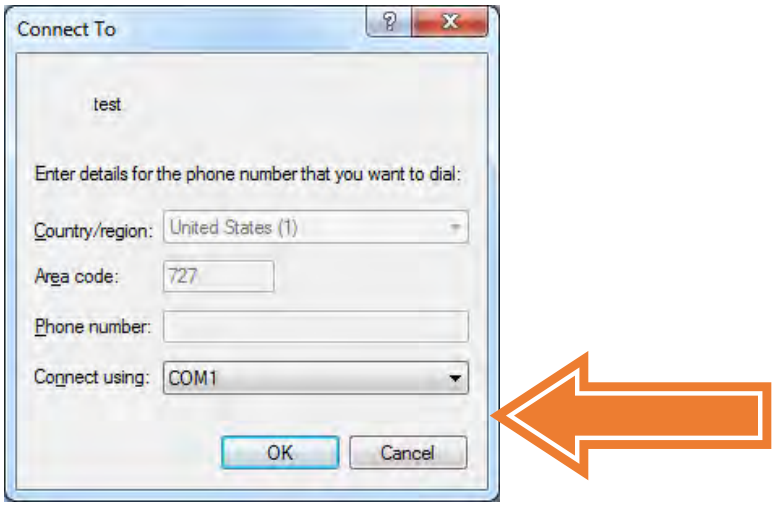


Delete Stored Files from the Hydrolab Surveyor:

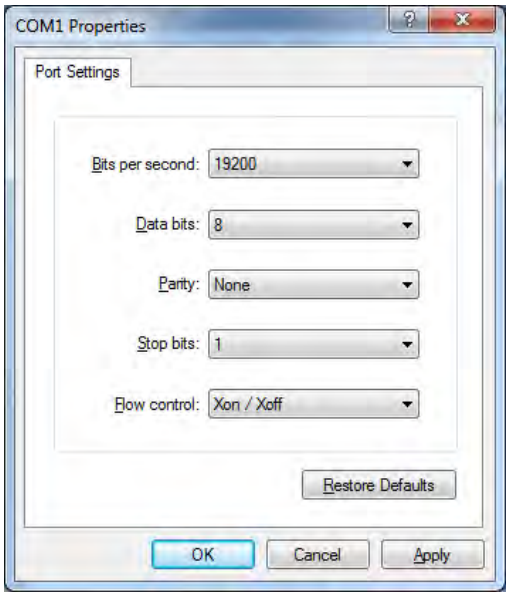
1. Highlight “Log Files” from Hydrolab Menu.
2. Highlight file to delete.
3. Press “Four-lined” Menu button.
4. Scroll down to highlight “Delete Log” and press “OK” button.
5. The Password is hydrolab (the password stays for duration of deletions as long as unit remains powered on).
6. Highlight “OK” and confirm the file is correct from the preview.
7. Press the “OK” button on the keypad to confirm deletion.

1.9.1.2 Data download from the "Old" Hydrolab surveyors to a computer requires available serial ports on the computer tower, connector cable, and software. Contact technical support to determine the best program to work with the current operating system. The manufacturer recommends Hydras software available for download from the Hach website. A Microsoft Hyperterminal program was programmed by BTS to download the data to a .csv form to import into a spreadsheet format (compared to having to connect the sonde directly to the computer to establish download metrics). The Hyperterminal program allows for direct download from the surveyor to the server. A Hyperterminal connection needs to be defined before the data can be downloaded. Please refer to the following images for specific configurations for successful connection and download.

After opening the Hyperterminal software and providing a connection name, select the serial port to use for connecting the surveyor to the computer. The most common is to select "COM1."

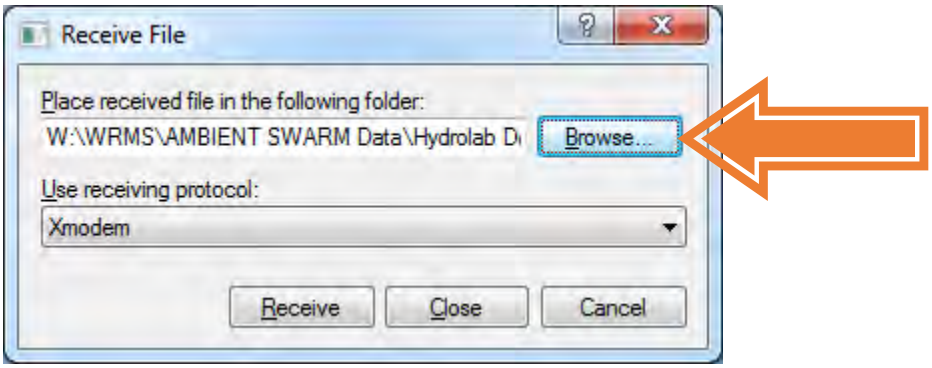


Next you will specify the download characteristics in the "Port Settings" tab. The following screen outlines the specifications for the Hydrolab Surveyors. Click okay and the connection will be active for downloading.

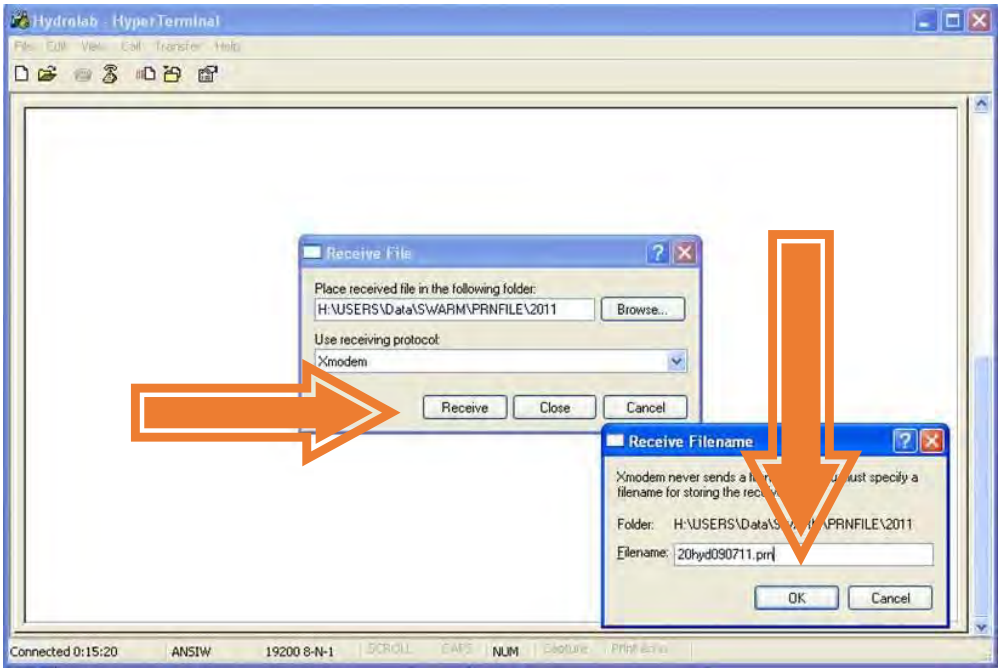


To download, click on ***Transfer*** located on the title menu and ***Receive File*** to open the following prompt.

Browse to select or edit the file path to indicate the location where Hyperterminal will save the file for you to access later.



Click the ***Receive*** button and type in the determined file name format. Click OK and the Hyperterminal is ready to receive the download.



Connect the Hydrolab Surveyor to the designated port in the computer tower. From the main menu on the Hydrolab Surveyor press the button to select ***Files*** and highlight to select ***Transmit***. Choose your project and highlight to select ***SS-Importable*** for importing into an Excel spreadsheet. The .csv file can be imported into an Excel spreadsheet as text for QA/QC review and inclusion into the STORET and WM databases. Confirm the download is intact and saved. From the Files menu, highlight to select ***Wipe*** to clear the event data from the Hydrolab surveyor once downloaded, confirmed, and saved.

1.9.1.3 Li-Cor sensor reading *collections were discontinued as part of the routine monitoring program at the end of 2014.* Light attenuation data was used to calculate a kd coefficient value and involves the use of Li-Cor DataLogger hand-held computers to store readings from an apparatus with two light sensors. EM uses three Li-Cor computers and two apparatuses. The two models available are the LI-1400 series and the LI-1000 series. Each model type has its own Hyperterminal program file based on its output configuration. Measurements stored in the Li-Cor DataLogger are downloaded into a .csv file format using the Hyperterminal software. Downloaded output files are directed to their designated server location and saved as .csv files. Files must be re-named to include the sampling period and LiCor model information since Li-Cor dataloggers are downloaded at the end of each monitoring period.

LI-1000
To download press the OUT key. Confirm baud=48, form=H,len=80, dump all=YES. Press Enter and you will see the values logging on the Hyperterminal screen.

LI-1400
To download press the Fct key. Arrow to screen displaying FCT Print Memory and press enter. On the "Print Memory" screen arrow down to the bottom where it displays !Print Mem! and press enter. You will see the Hyperterminal logging the values stored.

Periodically, .prn files are imported in the *Calculation database* to be QA/QC reviewed and kd values are calculated for use in light attenuation models. Current QA/QC tests that may result in rejection of collected data include <10% difference comparison between top and bottom sensor readings, calculation of a coefficient of variation among collected site values (cv) that exceeds 20%, and review of individual readings that indicate equipment malfunctions or negligent use resulting in switched cables or improper data collection.

1.9.2 Contracted, Consultant, and Calculated Flow Data Compilation
Calculated Discharges (Q) or "flow" are available from three sources and associated with the WQMP's fixed, routine water quality sites (STORET project AMB 001 or WIN projects: TMDL1 and TMDL5). The three sources of flow discharge values are 1) data manually collected and Q-calculated by EM staff, 2) contracted USGS continuous data, and 3) continuous data provided by Hydrologic Data, Inc. (HDI) consultants. Tidally influenced sites are scheduled to coincide with the lowest outgoing tide predictions but flow discharges are not routinely collected or reported.

In 2017, the FDEP adopted DEP SOP FT 1800 *Field Measurement of Stage, Surface, Water Velocity, and Discharge (Flow) and Computation of Streamflow*[39] to outline criteria for reporting flow values.[40] The new guidance is based on the use of USGS criteria, methods, and measures. The continuous flow information provided by USGS and HDI consultants follow FT 1820 *Direct Measurement Methods for Determining Discharge at Gaging Stations and Other Locations* criteria and discharge (Q) data is calculated and provided by these contracts.

1.9.2.1 Hach OTT flow meters were purchased in 2017 to advance EM staff collect measurements and meet FT 1822 *Midsection method for the determination of discharge* criteria, but the sensitivity of the

[39] Available online at https://floridadep.gov/dear/quality-assurance/content/dep-sops
[40] Prior to 2017, environmental monitoring staff collected flow measurements using a Marsh-McBierny flow meter and the modified transect method to collect readings and calculate cubic feet per second (cfs).

equipment, the inconsistency in site characteristics, and the additional time required at each site to collect adequate measurements was deemed unreasonable, therefore, data continues to be collected using a modified, efficiency method. Beginning in 2017, data reported to STORET was be coded with a J-code and comments indicating a "program specific flow collection method" was used. EM staff enters individual Hach OTT flow velocity measurements and depths from flow field sheets into an Excel spreadsheet to calculate the flow discharge value (Q). Entries are reviewed by another staff member to check proper function of the calculation and original entry. Electronic field sheets and calculation spreadsheets are retained on the EM server using the sample date, group, and type filing nomenclature.

EM collected "Instantaneous" or calculated (Q) discharge values are reported based on the time of sample collection.

[Reference to EM Flow SOP]

The data officer enters the discharge (Q) values into the EM and STORET/WIN reporting templates.[41] Sample Collection Equipment Name for WIN Field activities is "Misc Field Device." Sample or total depth is not required for "Flow (Instantaneous)" discharge (Q) values in WIN[42] and reporting the calculated discharge associates the transect cross-section with the "surface" water quality values as a benefit to data retrieval. Entry, proofing, and completion are listed on the flow field sheets with the date and staff initials to document the QA/QC process.

1.9.2.2 USGS contracted flow data is rated and continuously measured at 15-minute intervals to follow USGS SOPs for collection, calculation, and reporting. Data is retrieved and transcribed **into STORET/WIN reporting or** EM databases from the USGS website[43]. See Appendix C for the Fixed Land Station Flow Information document with the USGS station identifications.

1.9.2.3 Hydrologic Data, Inc. consultant flow data is rated and continuously measured at 15-minute intervals to follow USGS SOPs for collection, calculation, and reporting. Data is retrieved and transcribed **into STORET/WIN reporting or** EM databases from an Excel deliverable provided by the HDI consultant. Provisional HDI flow values are provided on a quarterly basis with a final deliverable being available at the end of the fiscal year after review against the annual rating curves.[44] HDI data is not entered into

[41] Nijole Wellendorf. FDEP. RE: WIN Depth "Rules" with Flow et al, email correspondence from 07/27/2018.
[42] Julie Zimmerman. FDEP. RE: WIN Depth "Rules" with Flow et al, email correspondence from 07/30/2018.
[43] USGS Real-time data is available for 120 days before only a daily mean measurement is available. Visit http://waterdata.usgs.gov/fl/nwis/rt to find the Pinellas County designated sites.
[44] Notes from John Coffin (HDI) regarding provisional v. approved flow values: The rating change [that could be observed as provisional data deviations from approved data] is indicated by the plotting of the discharge measurements…we adjust the discharge through shift measurements. If we feel that a January storm was the reason for the rating change we may not have sufficient information (measurements) until August to develop a new rating, if one is justified…if we feel the discharges computed using the shifts are reasonable and [computing] the data with the new rating will not significantly increase the accuracy of the already computed discharge record we will leave the record along and start the new rating in August. [Additionally,] the data are logged in the field, downloaded to a lap top and uploaded to our main computer…The information from the discharge measurement and gage height are entered into the processing programs manually. If either of those are entered in error the shift or datum correction will be computed in error by the processing program. We then manually enter the shift values and datum corrections into the processing sub programs manually [which could result in a deviation between provisional and approved data].

any databases until the final annual report is received.[45] Site 19-02 has real-time data available on the County's Water Atlas site.[46] See Appendix F for the Fixed Land Station Flow Information document with the HDI station identifications.

1.9.4 Field Sheet Data Entry

Manual entry is completed for attributes recorded on the field sheets. Manual entry includes actual latitude and longitude location, total depth, secchi depth, submerged aquatic vegetation (SAV) presence/absence and species codes, bottom type codes, observations, and field weather conditions. Data entry and QA/QC review and completion is documented on Appendix C of the Semi-Annual Water Quality Data QA/QC Report for each period.

Latitude and longitude values are entered into the WMS Excel database. These values are transferred to the STORET upload header file template. The latitude and longitude values are imported into ESRI GIS ArcMap to be QA/QC reviewed with a County developed strata layer for accurate location in relation to the originally selected locations. Locations that do not coincide with originally selected locations are reviewed for entry errors or illegible handwriting interpretation. In cases where original and actual locations do not coincide after review, the original location will be used in the WMS database and for data submissions. Data entry proofing is confirmed with the comparison of the actual values to the original since original values are not manipulated from the SAS program output.

Total depth and secchi depth are manually entered into the WMS Excel database and the WIN upload templates. Sample Collection Equipment Name for WIN Field activities is "Misc Field Device." Data entry is completed by a WMS staff member or volunteer and proofed for accuracy by the EM data officer.

The SAV presence/absence, SAV species codes, and bottom type codes are manually entered into the WMS Excel database. Table 2 shows the current codes and definitions entered into the database.

Bottom Type	
Code	Definition
1	mud
2	sand
3	muddy sand
4	rocks
5	shell/sand
6	mud/shell
7	oyster

SAV	
Code	Definition

SAV Species	
Code	Definition
T	Thallasia sp.
H	Halodule sp.
S	Syringodium sp.
R	Ruppia sp.
C	Caulerpa sp.
Hp	Hygrophila sp.
Ct	Certophyllum sp.
RA	Rooted Algae
FA	Filamentous Algae
DA	Drift Algae

[45] STORET data was submitted quarterly with a value of "0.00" as a placeholder in lieu of the final results to increase efficiencies in the data entry processes.

[46] Allens Creek real time is available and updating every 15 minutes on the Pinellas Water Atlas: http://www.pinellas.wateratlas.usf.edu/datamapper/station.aspx?ds=PINELLAS_DATA_LOGGERS&s=19-02

Y	Present
N	Absent

AA	Attached Algae
Pw	Pondweed
V	Valesnaria sp.
Hx	Hydrilla sp.

Observation or site comments are the crew's visual description of the water and site conditions in relation to water quality. Observations are manually entered into the WMS Excel database and the STORET upload template. Information summarized in relative data fields will be omitted from observational entry and reported under relevant fields. The data manager will interpret comments and transcribe to provide consistent and concise phrasing within the dataset. Common translations are outlined in Table 3 below:

Translated Phrase(s)	Examples from Field Sheets	Reasoning
Not turbid	Clear	Avoid implicit phrasing
Sufficient Flow	Good flow,	Avoid ambiguous phrasing
Particle film	References to "filter" or "filter paper"	OP filter paper comments

The WMS database documents all field, laboratory, and coding definitions in the Result_Comments field. The STORET upload templates house observations in the Result Comments field based on the *Activity Type* or *Characteristic* fields. Field observations will be entered with the *Field Msr/Obs* activity type, laboratory comments will be entered with the *Sample* activity type and field observations specific to the *Characteristic* will be entered accordingly. Observations specific to a characteristic can include light attenuation coefficient (Li-Cor), flow, secchi, and transmissivity.

Field weather conditions are recorded at the start, middle, and end of the water quality sampling day. Attributes recorded are prior rain events within 48 hours, air temperature, percent cloud cover, wind speed, wind direction, wave height, time, and notes. Air temperature is obtained from the Hydrolab temperature sonde while the remaining conditions are estimated based on the crew's observations. The data manager will interpret data and provide results in ranges for consistent and concise phrasing within the dataset. Ranges provide an averaging since scientific equipment is not used to obtain results and bias between crew members is alleviated.

Wind Speed		
	Historical	*Database Entry*
Retain spaces for database entry.	Calm	0 - 5
	Breezy	5 - 10
	Windy	10 - 15
		15 - 20
		20 - 25

Wave Height	
	Database Entry
Retain spaces for database entry.	0.0 - 0.5 ft
	0.5 - 1.0 ft
	1.0 - 1.5 ft
	1.5 - 2.0 ft
	2.0 - 2.5 ft
	2.5 - 3.0 ft

These values will be translated to descriptive wind and wave text in the Natural Resources Excel Database using the Beaufort Scales developed by Russ Rowlett at the University of North Carolina at Chapel Hill.[47] Please see Appendix for

Cloud cover is interpreted from the percent recorded on the field sheet to a description in the WMS Excel dataset based on the METRA weather condition categories.

Cloud Cover		
	METRAS Code	
% coverage	*Oktas*	*Database Entry*
0 - 10%	0	Clear
10 - 25%	1 - 2	Few Clouds
25 - 50%	3 - 4	Scattered Clouds
50 - 90%	5 - 7	Broken Clouds
90 - 100%	8	Overcast
		Fog
		Haze

Rainfall data is referenced to provide coding[48] information for water quality conditions linked to stormwater runoff from precipitation events. The TMDL Coordinator expressed the requirements under the NPDES permit and inter-local agreements and recommends identifying the closest upstream rainfall site to the target stations in the basin. Currently, Pinellas County pump station SCADA data, USGS station, and NOAA data are used to "R" code water quality data when hourly rainfall measurements exceed 0.5 inches. ..\..\Data\Rainfall Summary Data\2013 Rainfall Stations.xlsx

Reporting Data Affected by Storm Events

Hurricanes may have a significant impact on water quality monitoring in the State of Florida. As a result of the conditions these storms leave in their path, much of the water quality data collected in Florida could be affected. FDEP is requesting that our data providers use the words "HURRICANE " or "TROPICAL STORM" (all CAPS, no abbr. or quotations) in the Result_Comment field where results may have been affected by storm conditions. ***The result value should be qualified by entering an R in the value qualifier field when samples are collected during or within 48 hours of the storm event.*** When an R is entered in the value qualifier field you should also enter **R** in the result comment field in addition to any other value qualifiers that may be reported (2 examples: **RI**, **RTJ**). The Result_Comment might look like this: **RTJ** HURRICANE It may also be informative to include specific information such as the name of the storm.

[47] Russ Rowlett. (2001, May 31). Beaufort Scales (Wind Speed), University of North Carolina Chapel Hill, https://www.unc.edu/~rowlett/units/scales/beaufort.html

[48] FDEP Guidance for **Data affected by Significant Rainfall – But *NOT* Considered a Hurricane or Tropical Storm** When samples are collected during or within 48 hours of a significant rainfall event, the result value should be qualified by entering an R in the value qualifier field. When an R is entered in the value qualifier field you should also enter **R** in the result comment field. It is optional, but may be informative, to also include specific information about the storm event in the result comment field.

For data collected for hurricane-specific projects, FDEP is requesting that "HURR "be provided as the first 4 characters of the Project_ID (8-character field).
It is up to the agency's discretion as to which data should be considered hurricane-affected. We recommend notating any samples for which you believe the results are significantly different due to the hurricanes. ***For example, data taken from an area that was within the track of a hurricane for the month following would be reasonable.***

1.9.5 Hydrolab Data Formatting

Raw hydrolab data in Excel from the download is manipulated in Excel using Microsoft Visual Basic (VBA) coded and recorded macros with manual editing.

- Review of site nomenclature, collection time, and sample depth is completed.
- Collection times must be one minute apart and sample depth must be ordered with surface readings first preceded by mid water and bottom depth readings.
- Dissolved oxygen and salinity values are reviewed.
- Biological guidelines say that dissolved oxygen values should not fall below 5 mg/L in freshwater and should not fall below 4 mg/L in saltwater.
- Salinity values are reviewed to determine if sites were collected in optimal ambient conditions based on tidal influence.
- Freshwater sites for the Pinellas County Water Quality Monitoring Program (WQMP) must have a salinity of 2.70 ppt or less.[49]
- Notes to omitted, edited, updated, or conditional data will be recorded in the *Period [#] Combined* file after Hydrolab download[50]

Current sites that are collected in saline conditions at the lowest possible outgoing tide are the Anclote River sites (01-01 and 01-08), Allen's Creek (19-02), Cross Bayou (24-01, 24-02, 24-07), Bear Creek (39-01 & 39-05). Data is considered non-representative of ambient conditions or criteria because of these types of conditions, illicit discharges, or extreme flow conditions are reported as "Not Representative" in the Water Information Network (WIN) regulatory database.

When review and correction is complete the data is retained in the *Period [#] Combined* file and provided to the Data Manager for reporting formatting procedures.

Hydrolab Database Format Types

Hydrolab data is formatted to be merged with laboratory, consultant, and data entry reporting attribute data. Microsoft's Visual Basic (VBA) is used to run programmed macros to format data into the two reporting types – the FDEP STORET/WIN reporting dataset and the DEM dataset.

Using VBA Macros

The order of macro operations is as follows:
Time_Format_Field/SiteAssign/WM_Column_Format

STORET data VBA macro order:

[49] A salinity value of ≥3.5 ppt is considered a saline sample for the Enterolert bacteria analysis method per laboratory correspondence. PC WQMP requests ≥2.70 ppt be analyzed as a freshwater sample.
[50] Completed by the Hydrolab swami – one must be flexible with Hydrolab maintenance and handling.

STORET_Step1_Site_Row_Format/STORET_Step2_Transpose_Parameters/Field_Transpose_Step3Continued/Store t_Characters

STORET[51] Reporting & Upload

(Attach Description appendices)

Data QA/QC Coding

In the WMS Excel dataset the analyte fields precede a qualifier field for documenting QA/QC codes associated with the results. Code definitions are described in the Result_Comments field.

The STORET upload template requires QA/QC code entry into the Value Qualifer field and notated in the Result Comment field with two asterisks preceding and following the relevant codes. For example, an estimated value code for matrix interference (J) will be a "J" in the Value Qualifier field and a "**J**matrix interference" in the Result Comment field.

All reported flow data collected by Pinellas County staff using the Hach OTT equipment for use in the 5-year Comprehensive Report is based on a program specific flow collection method, therefore, these data will always be coded with a **J** code and a "program specific flow collection method" explanation in STORET templates and the database.[52]

STORET Upload using SIM201

The Florida Department of Environmental Protection's (FDEP) STORET Oracle database is housed on the County's Virtual Machine (VM) server. The computer name associated with the database is df34fmf1.

The VM allows for cost efficient management of the continual additional of data to meet reporting requirements.

Connection to the VM and the Data Entry Module is password protected:
ID: storuser
Password: storuser
Server: STORET

The database needs to be "started." From the start menu, under Programs, locate the STORET Data Entry Module v2.0 and click to open the options to "Start Database" or "Stop Database." If you are getting errors when trying to open the Data Entry Module or the SIM applications try stopping and then restarting the database. Remember to stop the database before you log off of the VM.

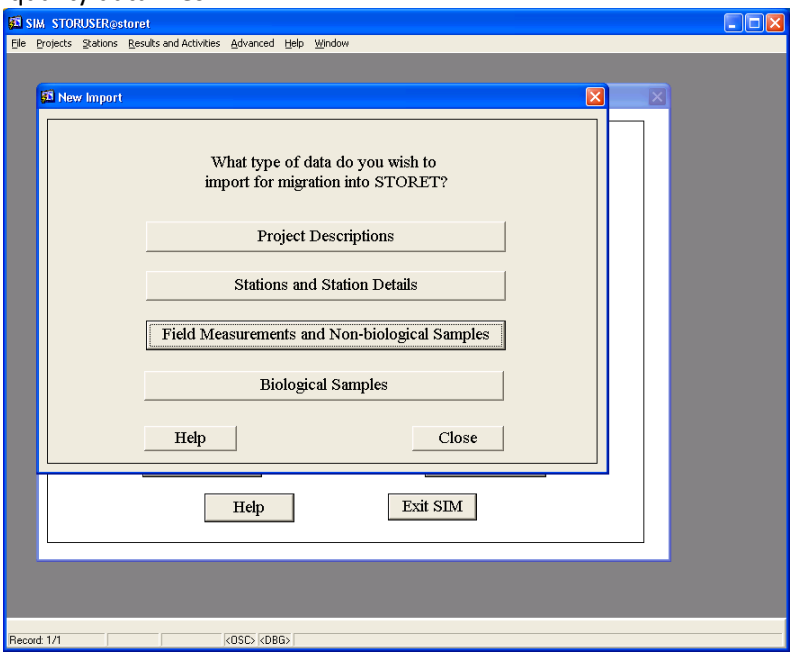
Double click EPA SIM201 Icon.

Click "New Import"

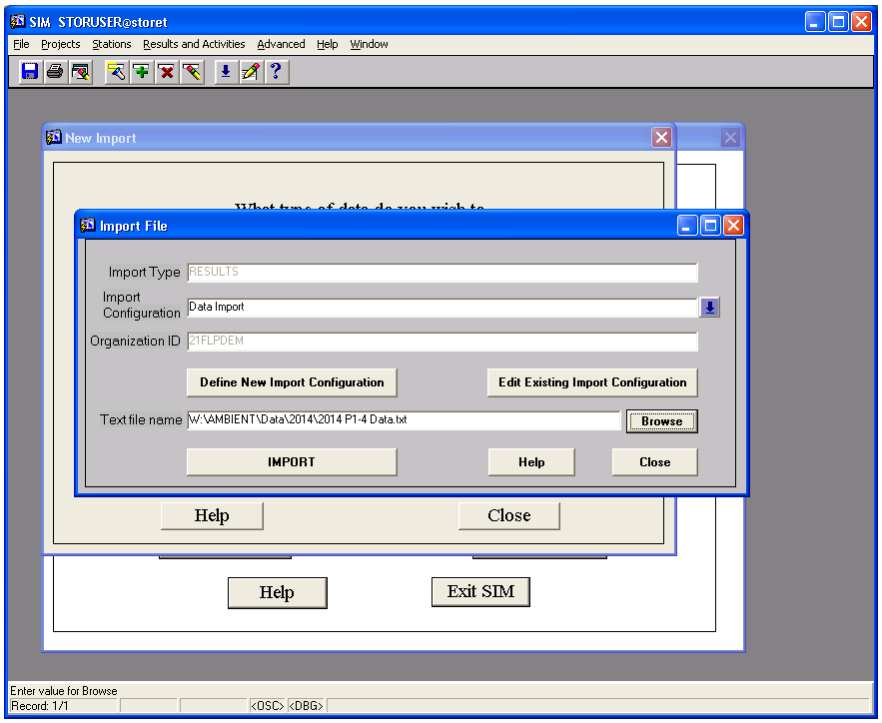
[51] The STOrage and RETreival (STORET) reporting software was replaced by the FDEP Water Information Network (WIN) reporting software beginning June 2017. Pinellas County surface water quality data is available in STORET through December 2017 and then in WIN beginning January 2018.

[52] Estimate coding is required because the County's specific program method does not meet FDEP SOP and USGS requirements outlined in DEP SOP 001/01 FT 1800: Field Measurement of Stage, Surface Water Velocity, and Discharge (Flow) and Computation of Streamflow.

Click “Stations and Station Details” to import HEADER files or “Field Measurements and Non-biological Samples” for water quality data files.



Select “Data Import” from the drop down menu for Import Configuration and browse for the prepared file for the Text file name field.



Click Import.

Excerpt from November 15, 2012 FDEP STORET Newsletter: *In STORET, there are three ways to report the depth at which a sample is taken. The Depth_to_Activity is the exact depth at which the sample was taken, measured in feet or meters. The Relative_Depth is the depth the sample was taken relative to the entire water column, measured as Surface, Midwater, or Bottom. The Total_Depth as an actual STORET characteristic (like pH or DO) and describes the total depth at the monitoring location, measures in feet or meters. Total_Depth is added to the suite of charateristics taken at a particular monitoring location.*

Reporting the Depth_to_Activity is most common and provides the most complete information about the sampling event. A separate Depth_to_Activity is measured for each sample taken.
If Relative_Depth is reported, then the Depth_to_Activity (actual depth of the sample) must also be reported to give reference to "Surface", "Midwater", "Bottom".

If Total_Depth is reported as a separate STORET characteristic for a given monitoring location, the Depth_to_Activity should also be recorded to identify the depth at which the sample was taken.

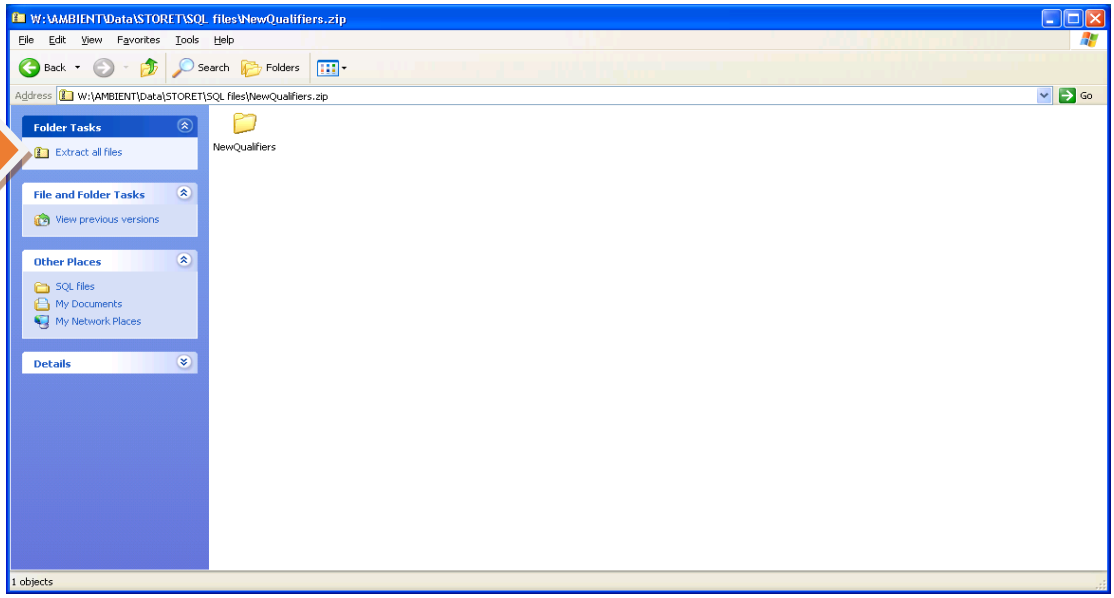
In summary, reporting the Depth_to_Activity is required for all samples. The Relative_Depth and Total_Depth are additional information that are helpful and important in data assessments. If you agency is currently reporting Relative_Depth and Total_Depth, please continue to do so along with the Depth_to_Activity.

STORET Database Updates with SQL scripts

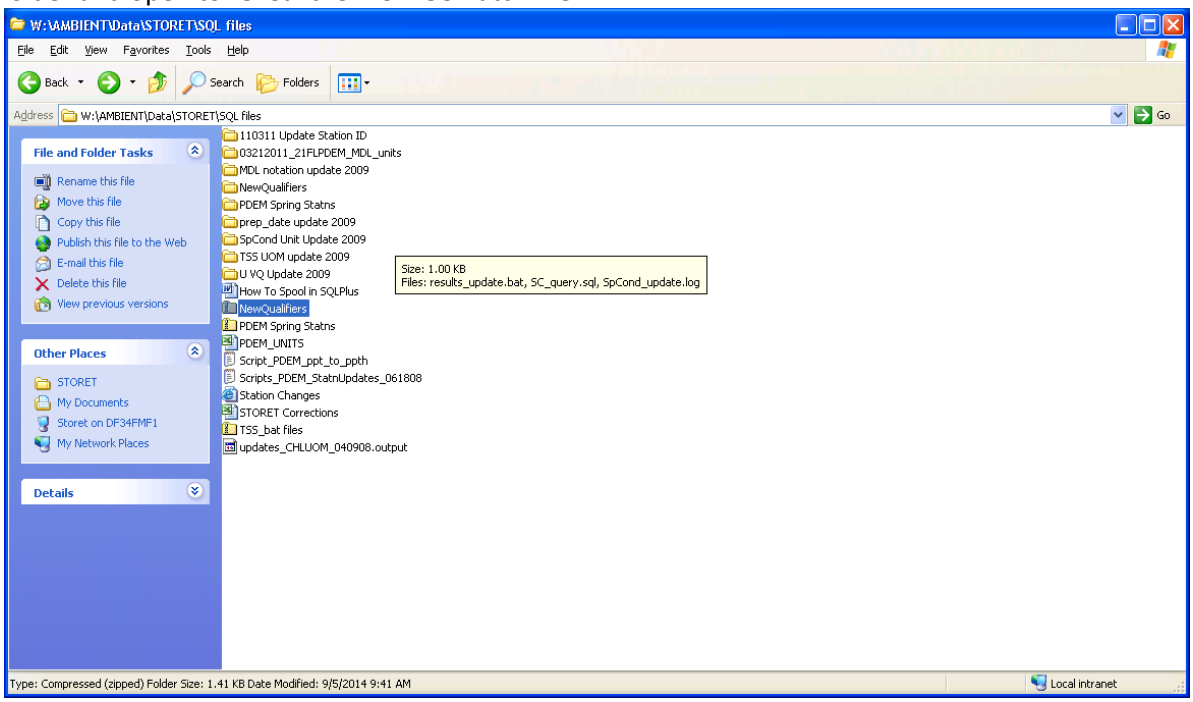
The Florida Department of Environmental Protection's (FDEP) STORET Oracle database is programmed with pre-determined attributes to encourage consistency in reporting and provide standards for quality control and quality assurance testing. A few common occurrences that lead to errors are translation errors, data entry errors, or new mandated reporting requirements in coding, method adoption, and/or nomenclature. The FDEP provides representatives to assist or provide data managers with SQL programming scripts to run on in-house databases to remedy identified errors.

1. Start the STORET Data Entry Module v2.0 database
2. Files are sent in a .zip folder. Save to the server to be able to access them via the Virtual Machine.

3. The files must first be extracted from this format to make an MS-DOS Batch File (.bat) and a text SQL file available.



4. The files will be extracted to a named file folder in the original .zip file location. Locate that new folder and open to reveal the MS-DOS Batch file.



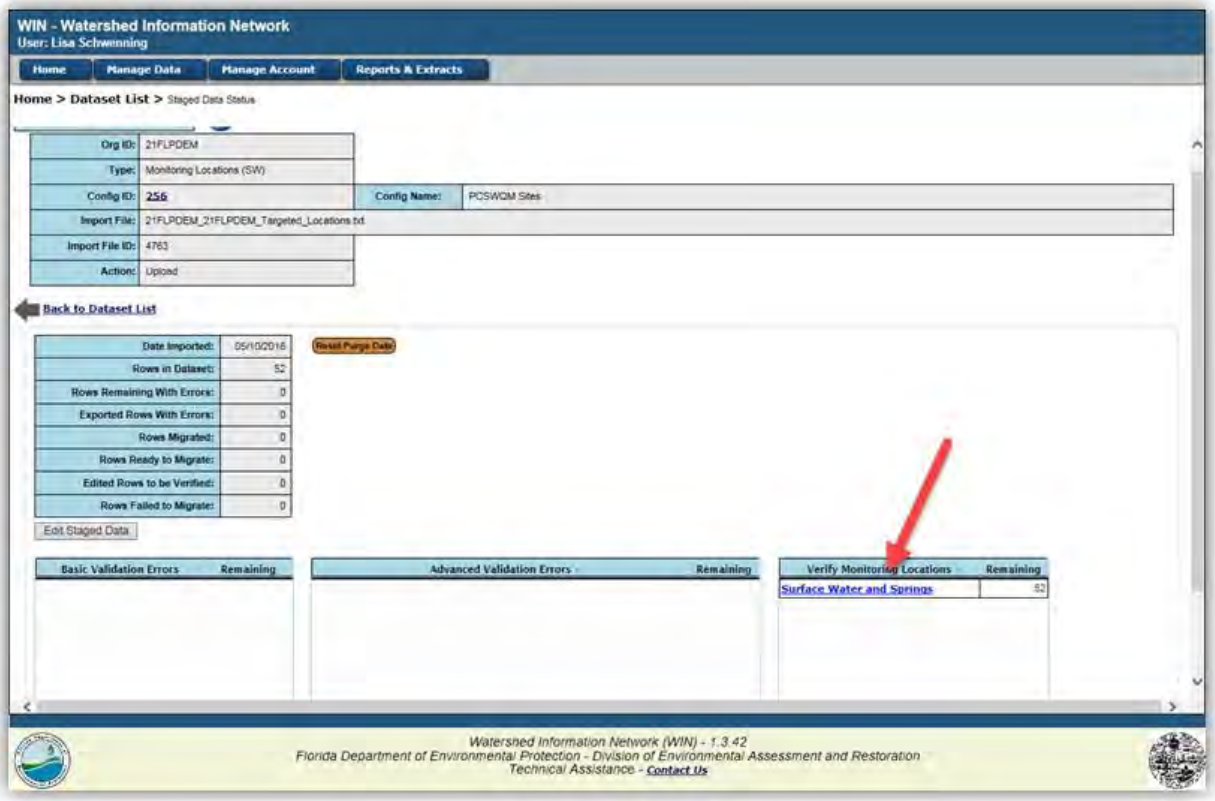
5. Open the newly extracted folders to find the .bat and .txt files
6. Double click on the .bat file icon to run the update.
7. A screen will appear to show the progress and output a text document (.log) to the file folder containing the extracted file.

In most cases, the FDEP representative will request a copy of the log to ensure the updates are complete.

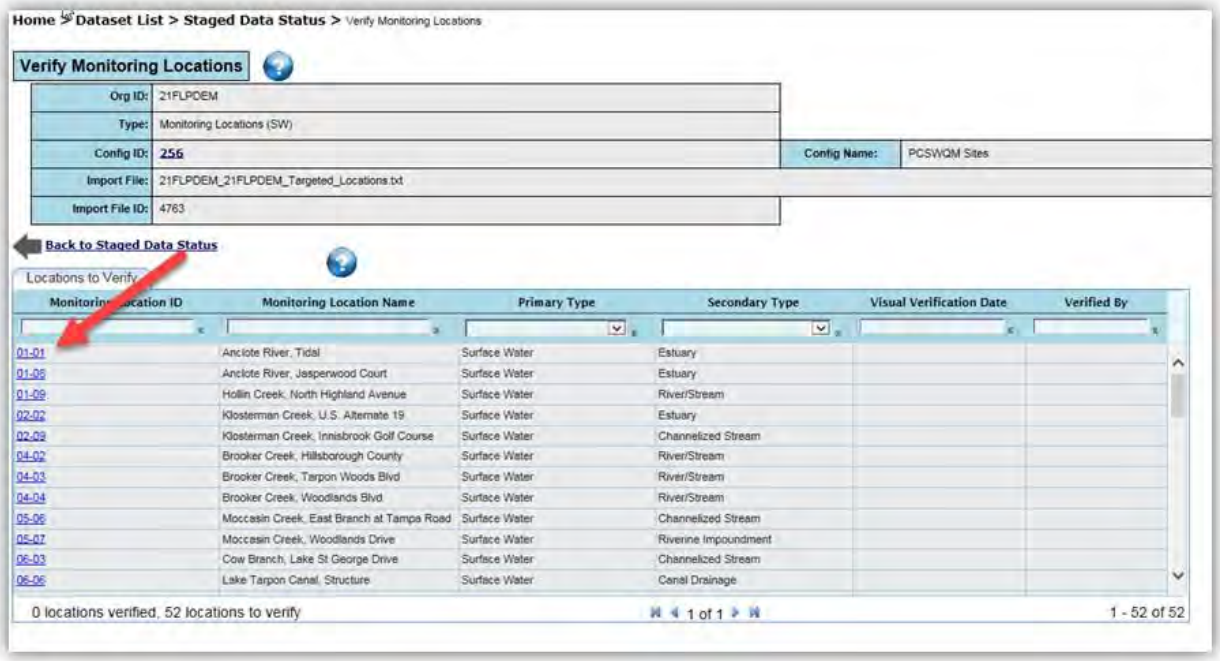
Water Information Network (WIN) Upload
[Add Data Format Process]

WIN Project IDs
Pinellas County defines three project IDs for routine program regulatory reporting:
"TMDL" is associated with the fixed tributary monitoring program (e.g. sites with numerical basin and site numbers).
"WQMP" is associated with the coastal and lake probabilistic (random) monitoring program (e.g. sites with letter and numerical site numbers).
"SPECIALS" are associated with specific study, contract, or litigation requests and/or projects. Currently, these include the Anclote River Spring Bayou Complex and Bear Creek sites.
FDEP will request and/or advise on the nomenclature of project IDs associated with large scale climate, biological, or chemical impacts within our region that are not considered routine or ambient conditions (e.g. HURR[yyyy] is to be used for data collected post hurricane conditions.

WIN Monitoring Location IDs Upload & Verification
Monitoring locations metadata needs to be uploaded without errors and each site must be verified before being fully migrated to WIN. Monitoring locations must be verified within the 45 day period by clicking the link under Staged Data from the main menu (otherwise the data will be removed from the staging queue and will need to be uploaded again):



Each "new" monitoring location must be verified in WIN before monitoring results can be uploaded and associated with these pre-determined locations. Click on each site to verify:



"Fixed" or targeted stream, ditch, or inland tributary sites will only be verified once since the sites are revisited each sampling period. Coastal "strata" sites will be "new" with each upload and therefore undergo verification with each sampling period.

WIN Laboratory Reporting Guidelines & Definitions

When determining the Preparation Date and Time associated with a biological sample's Preparation Method the following definitions are important to relay to the laboratory staff preparing reports (mainly because FDEP's Water Information Network defines additional reporting elements compared to the standard or national method requirements):

- For Microbiological Data, Preparation Date/Time must be the time incubation began.
- For Chlorophyll Data, Preparation Date/Time must be the time the sample was filtered.
- For BOD data, Preparation Date/Time should remain blank.

All hold times are calculated to the second and not the day when a Q-code value qualifier is being applied (e.g. if the method hold time is 48 hours then a Q code would be required at 48 hours and one second).

If laboratory processes result in the Analytical batch IDs being the same as the Method Batch ID then that will not cause error with upload to the WIN.

Activity Representative Indicator field is either "Not Representative" when site conditions during the sampling event or within 24 hours does not reflect typical conditions for the site or "Representative" when site conditions are typical. The "Not Representative" indicator is intended to be used when water levels are extremely low or high or there is evidence of discrete release of pollutant (e.g. chemical or waste spill, herbicide and/or pesticide application)[53]. Review of analytical results using normal

[53] FDEP. Available online at http://publicfiles.dep.state.fl.us/DEAR/WIN/MDQS/

distribution outlier calculations and visuals and/or field comments is used to assign these indicators for each period's site results for WIN upload.

Electronic and Hardcopy Records Management

Electronic records of all water quality documents and information are kept on the server. Nomenclature codes are assigned to aid in search functions and characterizing files. The general format consists of a code followed by the timeframe of the data in years and the unique file name (i.e. XXX_YEAR(S)_ Name).

Code	Relation
WQF_	Field collection information; scanned field sheets and equipment downloads
WQD_	Compiled data summaries; formatted to be analyzed
WQL_	Laboratory information; COCs, deliverables, QA/QC
WQS_	Monitoring Station/Site information; Maps, Directions, Locations, Photographs
WQA_	Analysis files; calculations, graphs, methods, summaries
WQR_	Report files

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Transmissometer

Effective Date 06/01/2017

1.0 PROCEDURAL SECTION

1.1 Scope and Application
Transmissivity is the measurement of the percent transmittance of a 660 nanometer (red light) over a 10 centimeter flow-through cell and is useful in determining total concentrations of matter in the water and as a measure of water clarity.

1.2 Summary of Method
A water sample is introduced into the flow through cell and light from the transmissometer light source passes through the sample. Some is absorbed or scattered, with the remainder striking the light receiver. The light that falls on the receiver is converted into an electric signal and the amount of light is proportional to the voltage that is generated. This voltage is read on one of the older LI 1000 LI-COR data loggers.

1.3 Definitions
- Transmissivity-- the degree to which a medium allows something, in this case light, to pass through it

1.4 Health and Safety Warnings
None applicable.

1.5 Cautions
- Make sure that the glass plates are cleaned with lens paper or Kimwipe.
- Check the battery voltage on channel 7A and make sure it is above 7.000 volts based on the C-Star manual.
- Machine powers off after 15 minutes if a button is not pressed.

1.6 Interferences
Air bubbles will bias the sample. Give thirty seconds after pouring sample into syringe before reading and recording to let air bubbles settle out.

1.7 Personnel Qualification
Field personal must be trained and evaluated on the use of equipment prior to collecting samples or data. Use of the equipment is subject to approval by the QA Officer and/or the Environmental Monitoring Coordinator. Training will be done through dry run exercises in the laboratory and field to familiarize field personnel with operation/collection, calibration and maintenance. Investigators must be familiar with the SOP document and owner's manual, when applicable.

1.8 Equipment
- Data book with data sheets
- Wet Labs C-Star Transmissometer
- Flow-through cell
- Short 6 pin to 4 pin pigtail connector/37 pin wire-block assembly
- LI-1000 LICOR data logger labeled 'use for transmissometer' on the top front
- 1-gallon of fresh DI water
- 60-ml syringe-funnel

1.9 Procedure

1.9.1 Equipment Set Up

- Clean the circular glass plates at the light source light sensor using a Kimwipe and condensed breath (per Roger Johannson of COTBSG). Note the 4 pin pigtail/37 pin wire-block assembly is usually left connected to the transmissometer (see Figure 1A). The wires from the pigtail connector are connected to the terminal block as shown in Figure 1B. If you need to reconnect a loose wire, use a small flat head screwdriver to open and close the connectors on the terminal block.

Figure 1A: Transmissometer with pig-tail/wire-block assembly already attached and 10-cm flow-through cell not in place.

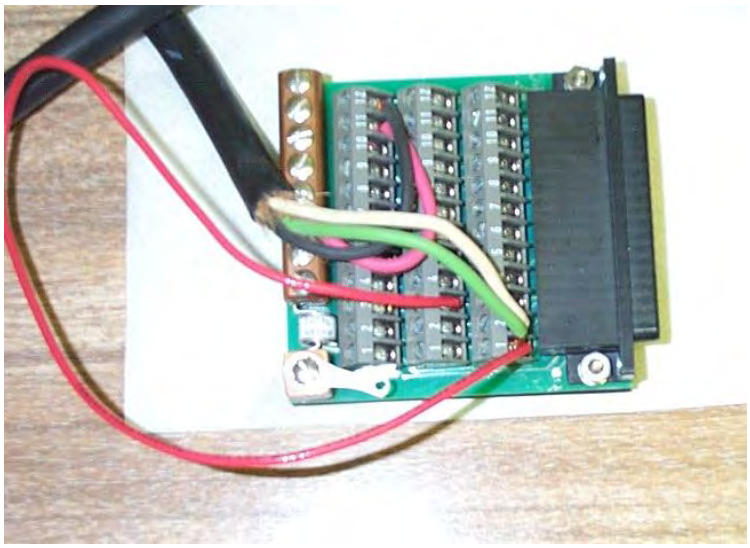


Figure 1B: Wire connection from the pigtail on the terminal block. See Appendix 1 for connections.

- The 10-cm flow through cell elongates and shortens. Shorten the cell and place it in the space between the two glass plates. The glass plates sit on slightly raised pedestals with O-rings. When you elongate the flow-through cell, the cell fits over the O-ring and pedestal and makes a water-tight seal. Fit the ends of the cell one at a time over each pedestal. Once in place it will look like the set-up in Figure 2.

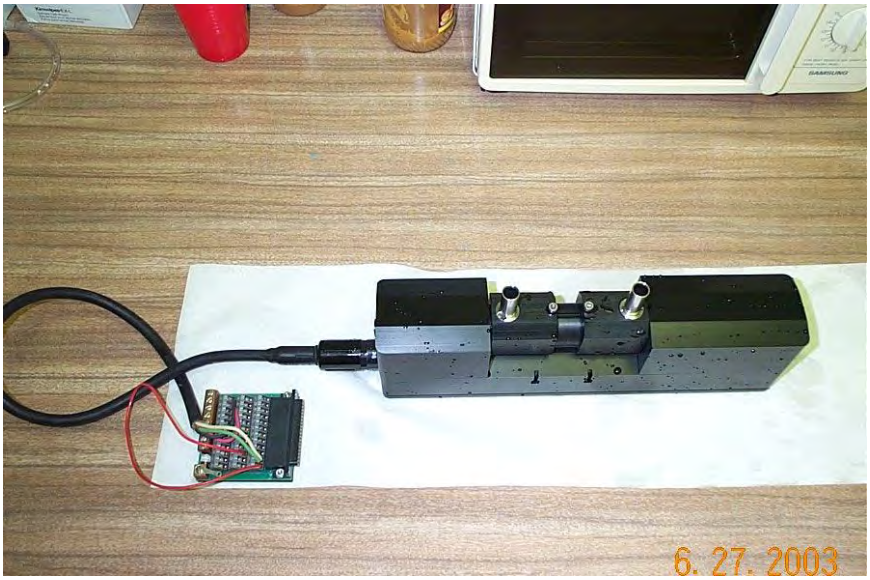


Figure 2: Transmissometer with pig-tail and wire-block assembly attached and 10-cm flow-through cell in place.

- Attach the syringe-funnel to the stainless steel tube of the flow-through cell that is furthest from the pigtail connector. See Figure 3.
- Now attach the 37-pin wire-block to the 37-pin connector on the top of the LI-1000 data logger. The LI 1000 data logger is now supplying power (6 D cell batteries) to the transmissometer and a red beam of light is passing from the light source to the light receiver. Set the transmissometer in the deeper cooler tray and both of these in the shallow fish-sorting tray (see Figure 3).

Figure 3: Complete set-up for taking transmissometer readings (05-22-17).

- Turn on the LI-1000 data logger. Channel 1A and channel 2A are used for measuring PAR sensor output and are not used for transmissometer readings. Channel 6A is used to take the transmissometer readings. Channel 7A is used to check the battery level of the internal batteries. See Appendix 2 for configuration settings for Channel 6A and 7A.

1.9.2 Measurement / Operation

The LI-COR datalogger is configured to display readings needed for measuring transmissivity on channel 6A (transmissivity voltage) and channel 7A (battery voltage). Use the 'Channel' button to scroll through the channels.

1) Check the internal battery level on channel 7A. It has to be 7.0 volts or greater. If it is not, then the internal D cell batteries have to be replaced before proceeding. Write down the battery voltage in the comment section of the data sheet.
2) Take the first DI blank reading:
    - Fill the 60-ml syringe-funnel with DI water twice. Allow the water to fill the flow-through each time. Fill the 60-ml syringe-funnel a third time with DI water.
    - Now you can take the transmissivity reading of the DI blank. Make sure the LI-1000 is set on channel 6A. As you fill the syringe-funnel, the transmissometer voltage reading will be below 4.990 and then start increasing once you stop filling. This is probably due to small bubbles clearing out of the path (personal communication with Roger Johansson, COT). After filling with the syringe the third time with DI water it typically takes about 15-30 seconds for the readings to rise and stabilize. Stabilizing for blanks means the reading will vary 5 – 10 thousandths of a volt. Recorded voltage readings typically range from 7.895 to 4.990 volts for DI blanks. Record the reading in the blank column of the first row of the data sheet. The DI water can stay in the chamber.
3) Ambient water sample/ Feather Sound water sample readings:
    - Gently shake the first sample for about 30 seconds. It is important that the sample is shaken so it is well mixed. Fill the syringe-funnel with sample water twice.
    - Fill the syringe a third time. Wait 15 – 30 seconds and look for a stable reading which will last for a short period of time (then start rising again). For water samples a stable reading will vary 5 – 10 hundredths of a volt. Remember that as the voltage reading increases it means more light is passing through the sample. In the samples there are both small bubbles clearing and sample particles. You want to allow 15 – 30 seconds to let bubbles clear as with the DI blank but not much longer because suspended particles are also dropping out of the path of the light.
    - Once you get a reading, record it in the sample column along with the Sample ID, date, time, and depth.
    - Repeat the previous three steps for four more samples, then run a DI blank as in step 2. For the rest of the samples you want to run five samples then a DI blank. Once all samples are run, finish with a final DI blank.
4) Once you have run all the samples, check the battery reading and record on the last line of the data sheet. Turn off the LI 1000 data logger and disconnect the 37 pin block from the top of the data logger. Rinse the outside of the transmissometer with tap and then DI. Carefully remove the flow through-cell and dry the glass plates with a KIMWIPE. Rinse the trays. Use lens paper to dry lens.

1.9.3 Troubleshooting

If voltage is low, replace batteries. If DI reading is less than 4.800 volts, clean glass plates with DI and Lens paper or Kimwipe. **Note that the machine turns off after 10 minutes if a button is not pressed.**

1.10 Data Management & Records Management

After each sample is read, record each table column in the Log Book:

	PERIOD_____			**YEAR_____**		
Sample ID	**Sample_Date**	**Sample_Time**	**Reading**	**Reading**	**Comments**	**Analyst**
	Analysis Date (for Blanks)	Analysis Time (for Blanks)	(volts)	Blank (volts) After 5 samples	Note battery level > 7.00 V	

2.0 QA/QC SECTION

2.1 Training

Training of field personnel will be done through dry run exercises in the laboratory to familiarize them with instrument operation, calibration, and maintenance. All operators are required to become familiar with the SOP document and owner's manual. Prior to solo sample collection, field personnel are evaluated in a field setting for proper use of equipment and sample collection protocol. Annual field audits are performed on sample collectors following procedures outlined in the Quality Management Plan.

2.2 Maintenance

1. Wiring 4-pin Pigtail wires to the 37-pin Terminal Block
   - Red wire to connector A11
   - Black wire to connector A12
   - Green wire to connector C1
   - White wire to connector C2
   - Red jumper C1 and B3

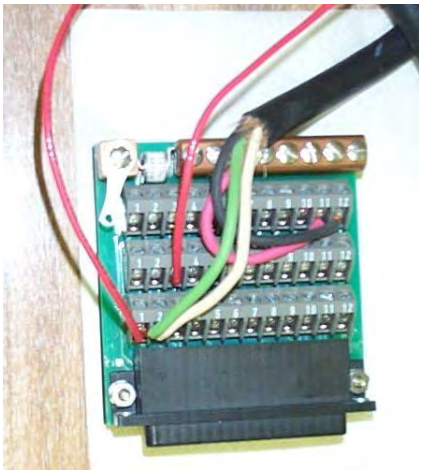


Figure 4: Wiring 4-pin Pigtail wires to the 37-pin Terminal Block

2. Configuration Settings for Channel 6 and Channel 7 in the LICOR LI- 1000 Datalogger

   - Channel 6 gives the voltage output readings from the transmissometer. The configuration setting is:

     CH6=GEN
     RANGE = A
     a0=0.1000
     a1=0.1000
     a2=0.0
     a3=0.0
     a4=0.0
     a5=0.0
     MATH=OFF
     LABEL=TR (for **TR**ansmissometer)
     AVE=5

   - Channel 7 gives the voltage output readings from the batteries in the LI 1000 used to power the transmissometer. The voltage of these batteries must be greater than 7.500 volts. The configuration setting is:

     CH7=GEN
     RANGE = A
     a0=0.1000
     a1=0.1000
     a2=0.0
     a3=0.0
     a4=0.0
     a5=0.0
     MATH=OFF
     LABEL=BA (for **BA**ttery)
     AVE=5

2.3 QC Procedures

C-Star (manufacturer) recommended maintenance and calibration on a two year cycle. Maintenance and calibration was done in 2005 and again in 2011. Maintenance is expected again in 2017. Each time the unit was gone for 2-3 months and the cost was about $700 including shipping to and from Wet Labs. Around 2007, a series of email were exchanged among COT staff, DISTRICT staff, and Chris Anastaciou (FDEP) concerning frequency of C-Star maintenance and calibration. The opinion of the group was collect air and DI blank voltage data. A gradual, persistent drop in these voltage readings is a reasonable criterion for deciding to send in the C-Star for maintenance/calibration. To check for performance of the C-Star voltage output, air blank data and DI blank data are plotted in the Excel file:

W:\Watershed\AMBIENT\Data\Water Quality Data\Transmissometer\Blank Data\Air and DI Blank Data.xlsx

Plots are tracked for decline in air blank or DI blank voltages.

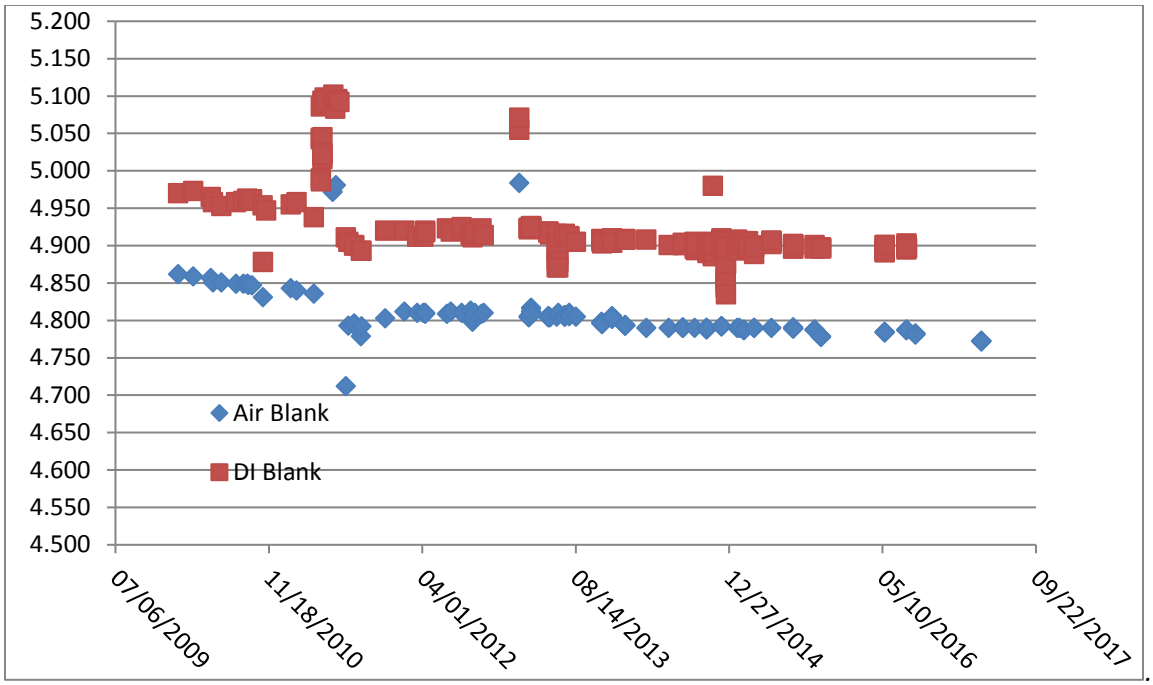


Figure 5: Transmissometer Air Blank and DI Blank Voltages.

3.0 REFERENCES

Sea-Bird Scientific Transmissometers BAM, C-Star, C-Rover User Manual: http://wetlabs.com/sites/default/files/documents/Manual-transmissometers170511-Rev-B.pdf

WET Labs C-Star homepage: http://wetlabs.com/cstar

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Automated Sampler
(ISCO 6712)

Effective Date 06/01/2017

1.0 PROCEDURAL SECTION

1.2 Scope and Application
ISCO 6712 automated samplers ("autosamplers") are used to collect composite water samples at the inflow and outflow of certain waterbodies with alum treatment during the "first flush" of rain events. The water samples are analyzed to determine pollutant concentrations in stormwater runoff at the inflow (before treatment) of alum system waterbodies, and the pollutant concentrations near the outflow of alum-treated water. Collection of water samples using this method allows determination of the effectiveness of alum injection into waters as a means of reducing nutrient loads in stormwater.

1.2 Summary of Method
Alum treatment systems are engineered and designed with an inflow ditch, or canal that conveys stormwater runoff to a deep settling pond with an outflow structure on the perimeter of the pond opposite from the inflow ditch. An alum system is located at the pond site. The alum system has a flow meter in the inflow ditch that measures volume discharge, and a pump system that injects alum and air into the inflow ditch just upstream of the connection of the inflow ditch to the settling pond. When a rain event causes flow into the pond to increase, the alum system pumps alum into the ditch at a volume proportional to stormwater volume flowing into the pond. The injected alum reacts with pollutant chemicals in the incoming stormwater, binds with the pollutants, and settles to the bottom of the deep settling pond as a heavy floc material. To measure the efficiency of pollutant removal, DEM attempts to collect a composite sample of stormwater in the inflow ditch just upstream of alum treatment, and a composite sample of treated water leaving the settling pond at the outflow structure. An ISCO 6712 sampler, set up just upstream of the alum injection point, periodically collects small samples of stormwater into a 10 liter container for the duration of time alum is injected to treat increased stormwater flow caused by a rain event. This is the inflow composite sample. During the same time period, a second ISCO 6712 sampler collects a composite sample of treated pond water at the outflow structure. The difference of pollutant concentrations of inflow and outflow waters measures efficiency of pollutant removal by the alum system for each rain event.

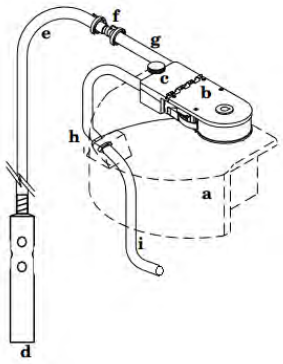
1.3 Definitions
Not applicable.

1.4 Health and Safety Warnings
The ISCO 6712 samplers are carried to sample sites by hand. The sampler is heavy enough that it should be carried by two people.

Sulfuric acid is used as a preservative for orthophosphate, and hydrochloric acid is used to clean the equipment. Eye protection should be worn, and care should be taken when using these acids.

1.5 Cautions
- Make sure all Tygon tubing and the 10 liter composite Nalgene sample carboy were cleaned following the procedure in the QA section below.
- Insert collared pump tube in the peristaltic pump so the correct end is connected to the stainless steel bulkhead fitting on the ISCO CPU shell that conveys water to the 10 liter Nalgene carboy. The other end of the pump tube is connected with a short, stainless steel coupling then to Tygon tubing that runs to the ditch. See the diagram below that shows the correct connections for the ends of the pump tube.

a. Controller.
b. Peristaltic pump.
c. Liquid Detector.
d. Strainer
e. Suction line
f. Stainless Steel Coupling
g. A pump tube routed from the liquid detector's intake port through the pump, out the detector's discharge port, and over the side of the controller to a bulkhead fitting at the top of the center section.
h. Bulkhead fitting.
i. Discharge tube running from the bulkhead fitting on the inside of the center section through the spring and distributor arm.



- Make sure to connect the short length of tubing to the inside bulkhead fitting of the ISCO as shown below, and thread through the side slot of the white, plastic cylinder.

- Know the length of Tygon tubing needed to run from the ISCO to the ditch. Tubes are already labelled. This length is needed for programming the ISCO so the tube length has to match the length in the programming.
- Need to know the approximate length of time the alum system injects alum for level of rainfall (low, moderate, and heavy rain events). This is the hydrograph. This length of time is needed for programming the ISCO. Estimates of the hydrograph can be estimated by looking at alum injection and volume discharge data collected by the alum system and stored on the system SD card. Data from the SD card is periodically transferred off the card and stored on the W drive.
- Use the sampling checklist to ensure all items are brought for the sample event.
- Contact Logan Lab staff via email to alert them that samples may come in on the day of the rain event. Update the Logan Lab Sharepoint calendar.
- If no sample is collected, email Logan staff to let them know no sample is coming in.

1.6 Interferences
Not applicable.

1.7 Personnel Qualification
Field personal must be trained on the use of equipment prior to collecting samples or data. Use of the equipment is at this time is not subject to approval by the QA Officer and/or the Environmental Monitoring Coordinator. Training will be done through dry run exercises in the laboratory and field to

familiarize field personnel with operation/collection, calibration, and maintenance. Investigators must be familiar with the SOP document and owner's manual, when applicable.

1.8 Equipment needed per alum system sampled

- Two ISCO 6712 samplers
- Two Tygon sample tubes with strainers. Tygon tube length will be specific to each ISCO 6712
- Two 10 liter Nalgene carboys
- Two charged ISCO Ni-cad batteries with one power strip
- Three bagged sample bottle kits
- Field book with alum field sheets and alum system specific COC's
- Two pre-programmed HACH sondes, programmed to run 2-3 days, and two sensor guards
- Two PVC sonde deploy pipes, chains, and/or rope and cable ties needed to deploy the sondes
- 1-gallon of fresh DI water
- Orthophosphate filter set up
- H2SO4 Nalgene 2-ml squeeze bottle, cooler, and ice pack
- Personal gear – rain gear, tall boots, hats, sunglasses
- Three cooler iced to the top for icing ISCO's and preserving samples
- Chains and locks to secure ISCO. Needed at sub-basin 6 outflow, sub-basin 1 both inflow and outflow

1.9 Procedure

1.9.1 Equipment Set Up

The DEM section has four ISCO 6712 samplers. As of 05-26-17 one pair of samplers are programmed to sample Lake Seminole sub-basin 3, one at the inflow with a 20' tube and one at the outflow with an 18' tube. The other pair are programmed to sample Lake Seminole sub-basin 6, one at the inflow with a 59' tube and one at the outflow with a 50' tube.

Well before the rain event:

1. For each sub-basin, the approximate length of time the alum system injects alum for rainfall levels (low, moderate, and heavy rain events) needs to be determined. This length of time is needed for programming the ISCO. Estimates of the time is made using alum injection and volume discharge data collected by the alum system and stored on the system SD card. Data from the SD card is periodically transferred off the card and stored on the W drive.

2. Acid wash 10 liter Nalgene carboy, ISCO pump tubes, short tubes to carboys, and Tygon tubing with strainer (see QA section). When these items are dry:

   a) cap carboys and seal with masking tape. Initial the tape and put the date of cleaning (this is the carboy lot number);
   b) Insert the ISCO pump tubing around the peristaltic pump and connect the correct end to the bulkhead fittings. Attach the short Tygon tubing to the inside of the bulkhead fitting. Re-assemble each ISCO;
   c) coil the tubing with strainer and put in a garbage bag and label the bag with the tube length and date of cleaning (this is the tubing lot number).

3. Drop off ISCO's at the buildings at sub-basin 3 alum system and sub-basin 6 alum system.

4. When dropping off ISCO's also bring two ISCO Ni-cad batteries and put two in the sub-basin 3 building on charge, and two in the sub-basin 6 building on charge.

5. Bottle kits with lot numbers were made previously, bagged in garbage bags, and stored in each alum system building. Sets of field sheets and COC's were printed and stored in each alum system's building.

A couple of days before (or on the day of) the anticipated rain event:

6. Calibrate and program HACH sondes for 15 minute interval data collection when deployed during the rain event (See the SOP for sonde calibration and programming). Bring the programmed sondes to the alum system along with protective PVC tubes, chains, and/or rope for deploying. These can be deployed a day or more before the anticipated rain event as long as the program is set up so the sondes are collecting data through the rain event. Deploy one sonde in the inflow ditch upstream of alum injection and one sonde at the outflow from the settling pond.

On the day of anticipate rain:

7. Assemble coolers with ice, personal gear, sulfuric acid and cooler, and orthophosphate filter set, and load in truck.

1.9.2 Measurement / Operation

1. Check weather radar to try to assess when rain will start at sub-basins. Staff need to be at the sub-basin at least two hours before rain starts. Alternatively, staff can complete the set-up at the beginning of the day, return to the office to watch weather radar, and then get to the alum system just before the rain starts to turn on and start the ISCO program.

2. Deploying sondes – Sondes have already been calibrated and programmed. Put the sondes in the PVC pipe, attach chain/rope to top bolts, and suspend one PVC with sonde in inflow ditch just upstream of alum injection and the other PVC with sonde at the pond outflow structure. How to secure the sonde varies with each sub-basin. Record on the field sheet sonde serial numbers and location (inflow or outflow).

   ISCO samplers – unhinge the lower barrel from the CPU housing. Put in the 10 liter carboy and fill with ice. Assemble the lower barrel and CPU housing. Carry the ISCO to the inflow or outflow location. Depending on the location it may be necessary to chain and lock the ISCO. Attach Tygon tubing to the ISCO, make sure tube length matches the ISCO programming. It may work best if the strainer or Tygon tube near the strainer is cable tied to the PVC cylinder that holds the sonde. Need to note the carboy and tube lot numbers.

   Staff have to wait at the alum system building for the rain to start. Once the rain starts, staff have to wait for the alum system to start alum injection. There is a lag time from when rain starts and alum injection begins. The lag time is due to the amount of time it takes rainfall in

the sub-basin to make it through the MS4 pipes to the alum pond. Lag times can only be determined by staff being present for rain events.

3. Once alum injection starts, staff need to run to the inflow ISCO first, turn on the ISCO, and start the program. Then go to the outflow ISCO, turn on the ISCO, and start the program.

   On the field sheet, fill in information about which ISCO is at the inflow or outflow, carboy lot number, tube length and lot number. Open the bottle kits and fill in on the field sheet bottle lot numbers.

4. Once the ISCO program is complete, note on the field sheet the end time on alum system clock and ISCO clock, and if storm flow is entering the pond. Remove the 10 liter carboys for each ISCO and fill sample bottles with composite sample water. Swirl composite water before filling each bottle. Follow COC preservation notes to properly preserve each bottle. Dump unused composite water. You may need to use the ISCO ice to put in the coolers used to transport samples to Logan Lab.

5. Remove PVC cylinder with sonde from inflow and outflow locations. Replace sensor guard with calibration cup and with tap water.

6. Deliver samples to Logan Lab, then return to the office.

7. Turn off the sonde program and complete the post-trip sonde verification.

1.9.3 Troubleshooting

Not applicable.

1.10 Data Management & Records Management NEED UPDATE

Transfer recorded sonde data to the correct subdirectory on W drive.

Once lab results are sent by the Logan Lab, transfer lab data to the correct subdirectory on W drive.

2.0 QA/QC SECTION

2.1 Training NEED UPDATE

Training of field personnel – DEM does not have an audit process for use of ISCO sample collectors.

2.2 Maintenance

1. After each sample event bring the ISCO's back to the lab:
   - Remove all tubing and acid wash (see acid washing procedure below)
   - Acid wash carboys (see acid washing procedure below)
   - Disassemble the ISCO by removing the cover and separating the ice barrel from the CPU part
   - Wash cover and ice barrel inside and out with soap and water
   - Wash the underside of the CPU with soap and water
   - Wipe down the CPU with a damp Wipe-All

2. Turn on the ISCO and check the pump count. If approaching 1,000,000 then replace the pump tubing and reset the pump counter. If less than 800,000 then note the pump count on the masking tape on top of the peristaltic pump housing.

2.3 QC Procedures

Acid washing procedure:

2. 10 liter carboys:
    - Wash with phosphate-free liquid soap, triple rinse with tap water, and triple rinse with DI water
    - Pour about 250-500 ml of hydrochloric acid (HCl) into the first carboy, cap and swirl the acid in the carboy for about 30 seconds, then pour the HCl into the next carboy;
    - Repeat the step above for remaining carboys until the last one is treated with HCl then pour the HCl into a beaker, neutralize and pour down the sink
    - Triple rinse each carboy with DI water and set aside to air dry

3. Pump hose and short inner 10 liter carboys:
    - Wash with phosphate-free liquid soap, triple rinse with tap water, and triple rinse with DI water
    - Pour about 250-500 ml of HCl into a beaker and immerse each tube in the acid for about 30 seconds, then remove the tube and put in a second dry beaker;
    - Repeat the step above for remaining tubes until the last one is treated with HCl then pour the HCl into a beaker, neutralize and pour down the sink
    - Triple rinse each tube with DI water and set aside to air dry

4. Tygon tube with strainer carboys NEED TO UPDATE:
    - Wash with phosphate-free liquid soap, triple rinse with tap water, and triple rinse with DI water
    - Pour about 250-500 ml of HCl into the first carboy, cap and swirl the acid in the carboy for about 30 seconds, then pour the HCl into the next carboy;
    - Repeat the step above for remaining carboys until the last one is treated with HCl then pour the HCl into a beaker, neutralize and pour down the sink
    - Triple rinse each carboy with DI water and set aside to air dry

3.0 REFERENCES

Teledyneisco ISCO Manual webpage:
http://www.teledyneisco.com/waterandwastewater/Sampler%20Documents/Manuals/6712%20Portable%20Sampler%20User%20Manual.pdf

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Benthic Sampling for EMAP

Effective Date 06/01/2017

1.0 PROCEDURAL SECTION

1.1 Scope and Application

Pinellas County participates in the annual Environmental Assessment and Monitoring Program (EMAP) as part of its natural resource management strategy under the Strategic Plan's "Practice Superior Environmental Stewardship". The EMAP sampling of the Tampa Bay region fulfills the Action Plan, BH-8 of "Charting the Course, the Comprehensive Conservation and Management Plan for Tampa Bay" to "Expand Habitat Mapping and Monitoring Programs" put forth by the Tampa Bay Estuary Program. Hillsborough County's Environmental Protection Commission (HCEPC) heads up the sampling effort which encompasses Tampa Bay including tributaries and Boca Ciega Bay.

1.2 Summary of Method

Pinellas County follows all Environmental Protection Agency (EPA) sampling protocols. The EMAP requires sampling at randomly selected points, coordinated by HCEPC, in the Tampa Bay area once a year. Samples are submitted to HCEPC for analysis. The species of invertebrates living in these sediments are collected, sorted, identified, and counted. The sediment grain size is determined, and the chemistry (metals, hydrocarbons, PCB's and pesticides) of the sediment is determined. Water quality data is also collected for dissolved oxygen, pH, conductivity, salinity, and temperature. HCEPC's most recent QAPP document can be found here: EPC Laboratory Quality Manual.pdf

Pinellas County employs a modified Van Veen benthic grab sampler deployed by an electric winch (when possible). Special sampling sometimes requires different equipment.

1.3 Definitions

NA

1.4 Health and Safety Warnings

The electric winch and dredge require proper training. Improper use of winch and dredge can result in injury. Field crews will exercise caution while operating this equipment.

EMAP sampling is done primarily by boat in August and September. Proper care will be taken to ensure safety of crew with regards to weather and dehydration.

Biological samples are preserved by NOTOX HISTO^{tm}. This preservative is alcohol based and not as toxic as previous preservatives used. Gloves and eye protection will be worn by staff preserving samples, and NOTOX HISTO preservative must be used only in an area with good ventilation. The MSD for NOTOX HISTO^{tm} can be found here:
..\..\..\EMAP\2017\MSDS NOTOXhisto.pdf

1.5 Cautions

Weather, currents, and wildlife should all be considered when sampling for EMAP. This sampling is done concurrently with other groups and coincides with hurricane season. A crew will make the determination the morning of the sampling event whether to perform the monitoring. Small craft warnings and thunderstorms preclude sampling for the day. Close communication between individuals on shore and the field crew ensures that should any weather or other safety events occur, field crews will be notified and sampling will be concluded for the day.

1.6 Interferences
EMAP sampling is done primarily by boat. The sites are randomly selected, and some sites may be too dangerous to sample. Depth, current, and boat traffic will all be taken into consideration. The field crew will make that determination in the field, and if a site is deemed unsafe, an alternate site will be chosen.

1.7 Personnel Qualification
Field personal must be trained and evaluated on the use of equipment prior to collecting samples or data. Use of the equipment is subject to approval by the QA Officer and/or the Environmental Monitoring Coordinator. Training will be done through dry run exercises in the laboratory and field to familiarize field personnel with operation/collection, calibration, and maintenance. Investigators must be familiar with the SOP document and owner's manual, when applicable.

1.8 Equipment
- Electric winch installed on Privateer
- Bell with modified Van Veen grab installed, spare cotter pin
- 30m rope, bucket
- Site locations and map, data sheets, field SOP
- Jars for samples
- Gloves
- Plastic tubs (3 or 4)
- Metals spoons and bowls (2)
- Squirt bottles (6)
- Brush for cleaning dredge, bowl, and spoon between sites
- Contrad soap mixture for cleaning dredge, bowl, and spoon
- 2-propanol alcohol for sterilizing dredge, bowl, and spoon
- Kitchen sized garbage bags for biological samples
- Epsom salts
- Carboy for Epsom salt/seawater mixture
- Sieves for biological samples
- Duct tape and spare waterproof paper for labelling biological samples
- Trowels for sieving
- Sharpies for labelling biological samples
- NOTOX HISTO^{tm} for preserving samples
- Eye protection
- Absorbent for NOTOX HISTO^{tm} spills

1.9 Procedure

1.9.1 Calibration
Hydrolab^{tm} multiprobe water quality sampler will be calibrated according to the Standard Operating Procedures for Hydrolab Calibration.

1.9.2 Measurement / Operation
- Pinellas County GIS specialist generates random sites for all participants.
- Hydrolab data is taken prior to grab sample: pH, conductivity, depth, salinity, temperature, dissolved oxygen

- Grab, metal spoon, and bowl are cleaned by gloved technician with Contrad soap.
- Grab, bowl, and spoon are rinsed with ambient water and sprayed with 2-propanol alcohol.
- Grab is lowered to approximately .5m off of the bottom and dropped to activate grab mechanism.
- Gloved technician takes top 2cm of sediment from grab using clean metal spoon, removing large shell, seagrass, and any live organisms.
- Sample is homogenized and divided between sample jars.
- Dredge is deployed two more times to collect samples for biological analysis.
- Biology samples are collected whole, triple bagged in garbage bags, and dosed with Epsom salts/seawater mixture to relax invertebrates.
- Upon returning to boat ramp (when logistically feasible), biological samples are sieved and placed in appropriate sized, labelled containers.
- Biological samples are preserved back at lab. To preserve samples, add enough NOTOX HISTO to cover samples.

Field SOP can be found here:
2017 EMAP SOP.docx

1.10 Data Management & Records Management
HCEPC provides field data sheets and waterproof labels for biological samples. Copies of field data sheets are scanned and kept on Pinellas County server. HCEPC takes possession of original field data sheets when samples are relinquished.

Hydrolab data is downloaded from Surveyors and digitally sent to HCEPC. A copy of data is retained on Pinellas County servers.

A copy of the Chain of Custody can be found here:
2017 EMAP COC.docx

2.0 QA/QC SECTION

2.1 Training
Training of field personnel will be done through dry run exercises in the laboratory to familiarize them with instrument operation, calibration, and maintenance. All operators are required to become familiar with the SOP document and owner's manual. Prior to solo sample collection, field personnel are evaluated in a field setting for proper use of equipment and sample collection protocol. Annual field audits are performed on sample collectors following procedures outlined in the Quality Management Plan.

2.2 QC Procedures
All applicable SOPs from EPA and HCEPC will be followed. Hydrolab^{tm} procedures in the field and in the download procedure will follow established SOPs.

3.0 REFERENCES

Courtney, C.M., R. Brown & D. Heimbuch. 1994. *Environmental Monitoring and Assessment Program. Estuaries- West Indian Province: 1993 Sampling. Volume I. Introduction, Methods and Materials, and Quality Assurance Field and Laboratory Operations Manual for a Synoptic Survey of Benthic Macroinvertebrates of the Tampa Bay Estuaries*.

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Heitmuller, Thomas P. & **Preacher, C.** *Environmental Monitoring and Assessment Program-EMAP-Estuaries West Indian Province, 1995 Quality Assurance Project Plan.*

Hillsborough County Environmental Protection Commission. 2008 *Laboratory Quality Manual;* revision 6.4.

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USEPA. 1995. *Environmental Monitoring and Assessment Program (EMAP): Laboratory Methods Manual-Estuaries, Volume 1: Biological and Physical Analyses*. USEPA. EPA/620/R-95/008.

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Bioassessment:
Streams and Lakes

Effective Date 11/01/2018

1.0 PROCEDURAL SECTION

1.1 Scope and Application

The Pinellas County Watershed Monitoring Biology Laboratory performs biological assessments of surface waters and taxonomic analysis of benthic macroinvertebrates, aquatic macrophytes and periphyton using methodology developed by the Florida Department of Environmental Protection (FDEP). The biological data is submitted to the FDEP for use in the Impaired Waters Rule (IWR) and Total Maximum Daily Load (TMDL) Programs. **All following SOP references are found in the FDEP QA Rule, 62 – 160, F.A.C. Field collections follow DEP-SOP-001/01. Laboratory activities comply with DEP-SOP-002/01. FDEP SOP Listings**

Table 1. Biological Indices and Surveys

Method (Index)	Source	Procedure (Section of DEP-SOP-001/01 and 002/01), respectively
Stream Condition Index (SCI)	Aquatic Macroinvertebrates	LT7200, FS 7420, SCI 1000
Biorecon	Aquatic Macroinvertebrates	FS 7410, BRN 1000
Lake Vegetation Index (LVI)	Aquatic Macrophytes	FS 7310 , LT 7500, LVI 1000
Habitat Assessment (HA)	Physical Habitat	FT3000
Linear Vegetative Survey (LVS)	Aquatic Macrophytes	FS 7320
Rapid Periphyton Survey (RPS)	Aquatic Periphyton	FS 7230
Petite Ponars	Marine	FS 7450

1.2 Summary of Methods

The Stream Condition Index (SCI) is a biological assessment procedure that measures the degree to which flowing fresh waters support a healthy, well-balanced biological community, as indicated by benthic macroinvertebrates. The BioRecon is a companion tool to the SCI, which provides screening level information. For both the SCI and BioRecon, the principles in Sampling and Use of the Stream Condition Index (SCI) for Assessing Flowing Waters: A Primer must be followed for successful application of the methods. The Lake Vegetative Index assesses lake health based on the plant community structure. Sampling and Use of the Lake Vegetation Index (LVI) for Assessing Lake Plant Communities in Florida: A Primer contains the principles governing the method.

1.3 Definitions

- Periphyton -- algae that are attached to a substrate
- Petite ponars -- grab samplers used to collect lake and estuary sediment and benthos
- Benthos -- invertebrates that live in lake and estuary bottoms
- Biorecon -- short for Biological Reconnaissance
- Frotus – a rake deployable from a boat that collects submerged vegetation

1.4 Health and Safety Warnings

Formalin

1.5 Cautions

- Many of these biological sampling procedures require specific training and a demonstration of competency due to the expert judgment exercised during field sampling.
- Study objectives are extremely important in determining the appropriate environmental conditions (e.g., hydrology), site selection, and other factors associated with conducting biological sampling. Because biota respond to natural and human stressors alike, it is imperative that samplers fully understand the study objectives associated with any biological sampling and take efforts to control for confounding factors that may interfere with the appropriate interpretation of the biological data.

1.6 Interferences

For both the SCI and BioRecon, the principles in Sampling and Use of the Stream Condition Index (SCI) for Assessing Flowing Waters: A Primer must be followed for successful application of the methods. The Primer provides guidance in decision making based on habitat and hydrological conditions which would render the sampling inappropriate and result in a false fail. In addition to the concepts presented in this document, samplers, data analysts, and resource managers who use the SCI (or BioRecon) must also read DEP SOP SCI 1000 and BRN 1000, for the training, quality assurance, sampling, laboratory, and index calculation Standard Operating Procedures. Furthermore, those wishing to implement and interpret the SCI must also read and understand "Development of Aquatic Life Use Support Attainment Thresholds for Florida's Stream Condition Index and Lake Vegetation Index". (DEP-SAS-003/11)

Because multiple natural and anthropogenic factors affect biological results it is critical that SCI users fully understand the method to ensure any conclusion regarding potential human environmental effects are scientifically defensible.

1.7 Personnel Qualification

Field personal must be certified by FDEP on the correct application of the biological assessment methods prior to collecting samples or data. New staff will be trained by a FDEP certified biologist before completing FDEP audits. Training requirements are established by FDEP and outlined on their website FDEP BIOASSESSMENT TRAINING AND TESTING GUIDELINES: RIVERS AND STREAMS and Lake Vegetation Index Audits

Use of County equipment is subject to approval by the QA Officer and/or the Environmental Monitoring Coordinator.

1.8 Stream Condition Index

1.8.1 Equipment and Supplies

- Physical/Chemical Characterization Field Sheet (FD 9000-3)
- Stream/River Habitat Sketch Sheet (FD 9000-4)
- Stream/River Habitat Assessment Field Sheet (FD 9000-5)
- D-frame Dip net with No. 30 mesh (approximately 600 µm) and handle marked in 0.1-m increments
- Two 4-liter wide-mouth plastic jugs (Take extra in case more are needed.)
- Buffered formalin (See FS 7001, section 1)
- Brush

1.8.2 Methods

(For specific field methods, refer to FDEP SCI 1000 and Sampling and Use of the Stream Condition Index (SCI) for Assessing Flowing Waters: A Primer)

Sampling consists of 20 dipnet sweeps of the most productive habitats found in a 100-meter stretch of a stream. Organisms collected in these sweeps are preserved and brought back to the laboratory for processing in accordance with the DEP SOP LT 7200. Data generated from the species identification and relative abundance of these organisms is used to calculate ten biological metrics, each of which has been shown to respond predictably to human disturbance. The metrics are:

- Number of total taxa,
- Number of long lived taxa (require more than one year to complete their life cycle)
- Number of Ephemeroptera (mayfly) taxa,
- Number of Tricoptera (caddisfly) taxa,
- Number of Florida sensitive taxa,
- Number of clinger taxa,
- Percent dominant taxon,
- Percent Tanytarsini (tribe of midges),
- Percent very tolerant taxa,
- Percent filterers.

Most of these metrics decrease in response to adverse human influences, while two of the metrics (% dominant taxon and % very tolerant taxa) increase in response to human disturbance. Once the metrics are calculated, scores are assigned for each metric based on criteria which have been regionally calibrated and are contained in DEP SOP LT7200. These scores are then summed to determine an overall score of biological health.

A balanced macroinvertebrate community is attained if the average score of at least two temporally independent SCIs, performed at representative locations and times, is 40 or higher, with neither of the two most recent SCI scores less than 35.

1.9 Habitat Assessment.

1.9.1 Equipment and Supplies

- Physical/Chemical Characterization Field Sheet (FD 9000-3)
- Stream/River Habitat Sketch Sheet (FD 9000-4)
- Stream/River Habitat Assessment Field Sheet (FD 9000-5)
- Pencil and pen
- Watch or stopwatch
- Flow Meter (optional)
- D-frame dip net with U.S. No. 30 mesh and handle marked in 0.1-m increments
- Secchi disk with at least three meters of 0.2 m sections marked on its rope
- Tape measure (100 m)
- Flagging tape
- Camera (optional)
- GPS tool (optional)
- Multi-probe meter or separate pH, dissolved oxygen, temperature and conductivity meters

1.9.2 Methods

(For specific field methods, refer to FDEP FT 3000)

A habitat assessment is performed concurrent with each SCI collection. Eight attributes known to have potential effects on the stream biota are rated to produce a score between 8 and 160; the higher the score indicating less human disturbance. This is important when determining potential causes of any biological imbalances because the stressors may be due to the inadequacy of physical habitat and proximity to human activities. Total scores range from 8 – 160.

- Substrate Diversity – the number of productive habitats present (snags, logs, tree roots, aquatic vegetation, leaves, rock, or other stable habitat).
- Substrate Availability –the percentage of productive habitats present (as listed above)
- Water Velocity - higher velocities typically receive higher scores
- Habitat Smothering – the percentage of area of the stream bed which is covered or "smothered" by sand or silt accumulation
- Artificial Channelization - anthropogenic channelization of a stream based on its variance from natural stream patterns (sinuosity) and the presence of artificial bank structures
- Bank Stability - the stability of a stream's banks based on evidence of erosion or bank failure
- Riparian Buffer Zone Width
- Riparian Zone Vegetation Quality

1.10 Floral Assessment – Rapid Periphyton Survey (RPS) for Numeric Nutrient Assessment

1.10.1 Equipment and Supplies

- Ruler to measure a 6 cm distance
- Rapid Periphyton Data Sheet (FD 9000-8)
- Physical/Chemical Characterization Field Sheet (FD 9000-3)
- Stream/River Habitat Sketch Sheet (FD 9000-4)
- Stream/River Habitat Assessment Field Sheet (FD 9000-5)

1.10.2 Methods

(Refer to Rapid Periphyton Survey DEP SOP **FS 7230**)

The RPS measures the relative abundance of algae growing on stream substrate in a 100 m stream segment. Nine observations are made every 10 m for a total of 99 observations (11 transects, including 0 and 100 m marks). A canopy measurement is made at the mid-point of each transect using a spherical densiometer. A small amount of substrate is randomly collected at each transect point and is visually examined for the presence/absence of algae. If present, the average length of the filament is measured and entered on the Rapid Periphyton Survey field sheet (FD 9000-25).

1.11 Linear Stream Index (LVS) for Numeric Nutrient Assessment

1.11.1 Equipment And Supplies

- Aquatic & wetland plant identification manuals
- Hand lens
- Boat (if non-wadeable site)
- Frotus (if non-wadeable site)
- Plastic bags
- Permanent marker
- Cooler and ice
- Linear Vegetation Survey Field Sheet (FD 9000-32)
- Physical/Chemical Characterization Field Sheet (FD 9000-3)
- Stream/River Habitat Sketch Sheet (FD 9000-4)
- Stream/River Habitat Assessment Field Sheet (FD 9000-5)

1.11.2 Methods

(Refer to the Stream and River Linear Vegetation Survey DEP SOP **FS 7320**)

The LVS is a rapid tool to document the plant community in a 100m stream reach. Aquatic plants growing in the stream are recorded for each of ten 10 meter sections, and any domination of taxa is noted on the field form. The average sensitivity of the plant community is calculated using coefficients of conservatism that are based on each species ecological tolerance to environmental changes. These values are obtained from Appendix LVI 1000-1 in DEP SOP **LVI 1000**. The percentage of invasive exotics is calculated as the number of occurrences of FLEPPC Category 1 or 2 present.

Table 2. Interpretation of floral assessments in regards to Nutrient Numeric Criteria: Implementation of Florida's Numeric Nutrient Standards, March, 2013

Floral Metric	No Imbalances of flora
LVS C of C	> 2.5 calculated COC
LVS FLEPPC	< 25% invasive exotics
RPS	< 25% longer than 6 mm

Two separate floral evaluations at least 3 months apart are required for assessment. Impairment thresholds are summarized in Table 2. A macrophyte community is determined as unimpaired if the metrics comply with the values summarized in Table 2 for two sampling events in a row. When two sequential sampling events do not meet the unimpaired thresholds, it is deemed impaired. If one event is unimpaired and the next is impaired, the final assessment is considered unresolved.

1.12 Biorecon

1.12.1 Equipment And Supplies

- Physical/Chemical Characterization Field Sheet (FD 9000-3)
- Stream/River Habitat Sketch Sheet (FD 9000-4)
- Stream/River Habitat Assessment Field Sheet (FD 9000-5)
- Biorecon Field Sheet (FD 9000-1)
- Forceps
- Transfer pipettes
- White picking pans
- 10X hand lens
- Jars filled with alcohol (80% ethanol)
- D-frame dip net with No. 30 mesh and handle marked in 0.1-m increments
- Meters (DO, pH, Conductivity)
- Wide-mouth jug
- Cooler with ice

1.12.2 Methods

(For specific field methods, refer to FDEP **FS 7410**)

The BioRecon is the initial screening tool for streams, intended to rapidly assess a site to prioritize it for more intensive sampling. The SOP for Performing BioRecons (*DEP SOP FS 7410*) differs from that for an SCI sample in that only four dipnet sweeps of the most productive habitats are performed. A Biorecon also differs from SCI sampling in that the organisms are sorted in the field using the BioRecon Field Sheet (*FD 9000-01*) to target specific numbers of individuals for subsequent laboratory identification. Regionally based thresholds specific to this method have been established for each of 6 calculated metrics (a subset of the 10 metrics used in the SCI). The metrics in the BioRecon assessment, all of which decrease in response to human disturbance, include:

- Number of total taxa,
- Number of long lived taxa, those that require more than one year to complete their life cycle,
- Number of sensitive taxa,
- Number of clinger taxa,
- Number of Ephemeroptera (mayfly) taxa,
- Number of Tricoptera (caddisfly) taxa.

The final Biorecon score is regionally adjusted and normalized to a range from 0 to 10 points. Scores of 6 to 10 are "exceptional," scores from 4 to 6 are considered "healthy," while scores below 3 indicate impairment.

1.13 Lake Vegetation Index

1.13.1 Equipment and Supplies

- Aquatic and wetland plant identification manuals
- GPS unit
- Hand lens
- Binoculars
- Map of lake separated into 12 sections
- Boat
- Frotus
- Plastic bags
- Permanent marker
- Cooler
- Ice
- Lake Vegetation Index Field Sheet (FD 9000-27)
- Lake Observation Field Sheet (FD 9000-31)

1.13.2 Methods

(For specific methodology refer to **LVI 1000** and Sampling and Use of the Lake Vegetation Index (LVI) for Assessing Lake Plant Communities in Florida: A Primer)

Lake Vegetation Index (LVI), a multi-metric tool which assesses lake health based on the plant community structure. Four LVI metrics were chosen based on an HDG evaluation, and the LVI was subsequently calibrated via the BCG process. DEP currently uses the LVI as the primary method to assess biological health in Florida lakes. The LVI is sampled per DEP SOP FS 7320 and calculated per DEP SOP LT 7500. The LVI method involves dividing a lake into 12 units and identifying plants to the lowest possible taxonomic level in 4 of the 12 units. Plants are identified in each unit by a visual boat "drive by" and also via a transect approach. A frotus is deployed a minimum of five times during the transect to assess the presence of submersed aquatic plants. All plants for a unit are recorded in a single column on the Lake Vegetation Index Data Sheet (FD 9000-27) and a dominant or co-dominant is assigned based on areal extent. Unknown plants are brought back for expert identification and verification. The sampling season for the LVI is May through October. Data generated on the presence of species is used to calculate four biological metrics - each of which has been shown to respond to human disturbance. The metrics are:

- Number of Native Taxa
- Number of Invasive Taxa
- Number of Sensitive Taxa
- Dominant Coefficient of Conservatism (C of C)

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1.14 Macroinvertebrate Laboratory Analysis Methods

Refer to FDEP SOP LT7000 for specific methods.

- Macroinvertebrate Sample Homogenation and sorting
- Macroinvertebrate Sample Slide Preparation
- Macroinvertebrate Organism Identification
- Procedures for Counting and Collapsing of Taxonomic Data

1.15 Biotic Index Calculation

- Biorecon. Refer to FDEP SOP BRN 2100
- Stream Condition Index. Refer to FDEP SOP SCI 2100
- Lake Vegetation Index. Refer to FDEP SOP LVI 2200

1.16 Chemical and Sample Waste Disposal

Waste disposal is consistent with Chapter 62-625 FAC and FS 1011 of the DEP SOPs.

The FDEP and Section 23-121(l) of Largo Code of Ordinances require that discharges greater than 15 kg (approximately 30 gallons) per month be reported to the City (PRETREATMENT REQUIREMENTS FOR EXISTING AND OTHER SOURCES OF POLLUTION, CHAPTER 62-625 F.A.C.). The projected amount that PCNR would need to dispose of is 1–2 gallons per month of 10% formalin). In an agreement with City of Largo, Decon Hyde-Away Formalin Neutralizer will be applied at the recommended ratio of 1:15 prior to disposal to the City of Largo WWTP sewer system. PCDEM staff will coordinate visits to Logan Lab with Kathleen Roach, and only use the hood when convenient for lab staff. A log will also be kept with date, time and volume disposed (both formalin and neutralizer), which will be available at all times.

1.17 Data Management & Records Management

1.17.1 FDEP Field Forms

Form	Description
FD 9000-01	Biorecon Field Sheet, Form FD 9000-01
FD 9000-03	Physical/Chemical Characterization Field Sheet, Form FD 9000-03
FD 9000-04	Stream/River Habitat Sketch Sheet, Form FD 9000-04
FD 9000-05	Stream/River Habitat Assessment Field Sheet, Form FD 9000-05
FD 9000-06	Lake Habitat Assessment Field Sheet, Form FD 9000-06
FD 9000-24	Groundwater Sampling Log, Form FD 9000-24
FD 9000-25	Rapid Periphyton Survey, Form FD 9000-25
FD 9000-27	Lake Vegetation Index Field Sheet, Form FD 9000-27
FD 9000-31	Lake Observation Field Sheet
FD 9000-32	Linear Stream Vegetation Survey Form
FD 9000-33	Wetland Condition Index Vegetation Field Form
FD 9000-34	Stream Habitat Assessment Training Checklist and Event Log
FD 9000-35	Stream Condition Index Training Checklist and Event Log

1.17.2 Pinellas County Field and Laboratory Forms
Forms are supplied in Appendix 1 of the Pinellas County Biology SOP.

1.17.3 Chain of Custody
Sample custody is consistent with and follows FD 1000 and LD 7000 of the DEP SOPs. The Pinellas County Biological Monitoring Sample Custody Form will be the Chain of Custody for macroinvertebrate samples. Upon returning to the laboratory with samples the sampling group will date and sign the Chain of Custody entries on the field sheet releasing the samples to the laboratory.

The laboratory personnel will fill out the Chain of Custody entries on the field sheets relating to the condition of the samples. Laboratory personnel must review field data sheets to ensure all necessary data has been recorded. Corrections are to be made by striking through the error with a single line, which is initialed by employee making correction. Corrections should be made on the same day of the sampling event and, therefore, do not need to indicate date of each correction. Changes to the field data sheet made after sample date must show date of correction. Any deviations will be documented with appropriate codes or comments. Samples will be stored in a flame cabinet outside the laboratory building.

1.17.4 PCDEM Freshwater Sample Processing and QC Log
Pinellas County DEM Biological Sample Log provides tracking information required in SCI 1000 Laboratory Quality Control, including date sampled, date sorted, sorting efficiency, date identified, and who performed these tasks.
1.17.5 SCI and Biorecon Benthic Invertebrate Identification Data Sheet
Used for the identification and enumeration of macroinvertebrate species

2.0 QA/QC SECTION

2.1 Training

2.1.1. SCI, HA and BioRecon
All PCDEM biological staff are to be follow the FDEP SOPs for Biorecon (BRN 1000), HA (**FT 3000**) and Sampling and Use of the Stream Condition Index for Assessing Flowing Waters: A Primer.

Training of field personnel on will be conducted at regular monitoring sites by DEP certified staff only. All field staff are required to maintain certification in SCI and HA, as described in .Training and Testing Guidelines: Rivers and Streams.

2.1.2. LVI
All PCDEM staff are to be follow the FDEP **LVI 1000** and Sampling and Use of the Lake Vegetation Index (LVI) for Assessing Lake Plant Communities in Florida: A Primer.

Training of field personnel on will be conducted at regular monitoring sites by DEP certified staff only. All field staff are required to maintain certification in LVI as outlined by FDEP every 2 years and pass an online plant test on the LVI website.

2.1.3. Stream Floral Tools, LVS and RPS
Follow FDEP SOP **FS 7320** for the LVS and FDEP SOP **FS 7230** for the RPS.

Training of field personnel on will be conducted at regular monitoring sites by DEP certified staff only. Training presentations can be found at RPS and LVS Training Presentations.

2.2 Proficiency Criteria

FDEP Audits: All staff wishing to submit data to FDEP generated through SCI and Biorecon procedures shall be audited by FDEP according to the protocol described in DEP SOP SCI 1300 and SCI 2210.

1. Habitat assessment: FDEP requires that analysts wishing to submit data to DEP pass three out of five benchmark tests every two years. Instructions are posted on the DEP Bioassessment Website, HA Training.
2. First-time SCI and Biorecon collectors must pass a test of SCI concepts as outlined in SCI 1300 and the SCI Primer (Sampling and Use of the Stream Condition Index [SCI] for Assessing Flowing Waters: A Primer [DEP-SAS-001/11]). A score of 90% correct answers must be attained. A refresher test is completed every 5 years.
3. SCI Field Audit: Biomonitoring staff must provide a copy of completed training form FD 9000-35 before undergoing the field audit to demonstrate the ability to perform SCI field collection.
4. Macroinvertebrate sorting: All staff performing SCI sample sorting shall follow the quality control checks outlined in SCI 2210 for 10% of all aliquots processed for each SCI replicate**.** The target control limit for *cumulative* sorting efficiency including all SCI lab replicates over a 12-month period is 95%.
5. Macroinvertebrate taxonomic identification: All staff performing macroinvertebrate taxonomic identifications shall follow the quality control procedures outlined in SCI 2220 for 5 % of all SCI replicates processed and enumerated. Because PCDEM does not have a second taxonomist, the second taxonomist will be a contracted expert with expertise in macroinvertebrate taxonomy. The target cumulative correct identification rate is 95% of the total number of individual organisms including all replicates over a 12-month period and 95% of taxa identified in all replicates enumerated by the analyst (5% cumulative error rate) over a 12-month period.
6. The PCDEM taxonomist shall maintain a reference collection with specimens that have been verified by the contracted expert. The reference collection shall contain at least one specimen of all taxa identified.

Corrective Actions

In the event that proficiency criteria are not met, the audit procedure must be repeated until passing status in achieved before data can be considered valid.

Appendix 1. Pinellas County Data Forms

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

LI-COR Data Logger

Effective Date 06/01/2017

1.0 PROCEDURAL SECTION

1.1 Scope and Application

The LI-COR data logger along with two photovoltaic light sensors are used to measure water clarity at our water quality monitoring stations. The Environmental Monitoring and Assessment Section (EMAS) used two LI-COR data loggers interchangeably (the LI-1000 and the LI-1400) to display and store light measurements.

1.2 Summary of Method

Two LI-192SA underwater quantum sensors are set up in a PVC pole frame. The two sensors are separated by 0.5 meters. Each sensor has a unique calibration value provided by the manufacturer. These calibration values are retained and used for result calculation and quality assurance. The LI-COR pole frame is lowered into the water at the sample site, and the data is logged in the data logger.

1.3 Definitions

- Not applicable

1.4 Health and Safety Warnings

- Not applicable

1.5 Cautions

- Not applicable

1.6 Interferences

- Not applicable

1.7 Personnel Qualification

Field personal must be trained and evaluated on the use of equipment prior to collecting samples or data. Use of the equipment is subject to approval by the QA Officer and/or the Environmental Monitoring Coordinator. Training will be done through dry run exercises in the laboratory and field to familiarize field personnel with operation/collection, calibration and maintenance. Investigators must be familiar with the SOP document and instruction manual, when applicable.

1.8 Equipment

- LI-COR data logger
- LI-COR PVC pole frame containing cables and photovoltaic sensors
- Instruction Manual and LI-COR SOP
- Deionized water

1.9 Procedure

1.9.1 Calibration

Connect the two cables to the LI-COR data logger. Turn on the data logger and check the battery level. Low battery voltage is 4.0V. The logger will not work if battery level reaches 3.8V. Air readings are performed to check cable connections. Readings near zero can be the result of a bad BNC connector or a faulty cable near the B. The calibration constant (and multiplier) are +/- 5% NIST. Air readings are compared between the top and bottom sensors and confirmed be roughly +/- 5% apart before proceeding with collecting LI-COR data. If the readings outside the 5% range we assume something is amiss and do not collect. **We do not store/download the air reading**.

1.9.2 Measurement / Operation

The LI-COR pole frame is lowered into the water until the top photovoltaic sensor is at a depth of 0.2 meters. Three measurements are logged, separated by 5 seconds. The average of the three measurements will be entered into the calculation. The pole frame is then lowered until the top photovoltaic sensor is at a depth of 1.0 meters. Three measurements are logged at this depth too. If the water depth is deeper than 3.0 meters, then measurements will be logged at 2.0 and 3.0 meters. The pole frame is then removed from the water and the photovoltaic sensors are rinsed off with deionized water.

Data is downloaded, average Kd calculated, and QA/QC performed. A coefficient of variation is calculated for each set of three readings. If the CV exceeds 20% the Kd is not used. The 20% variation range is based on the relative percent difference precedent which states that any results within 20% of each other are considered similar for a duplicate sample. Comparison of readings collected between the sensors is calculated. If the difference between the top sensor reading and bottom sensor reading shows less than a 10% difference then the data is rejected. The logged data is entered into an Excel database where light coefficient calculations are done. The data in the Excel datasheet are Quality Control (QC) checked. The final LI-COR measurement is entered into the Ambient Surface Monitoring Database, and a final Quality Control check is done.

Follow the instruction manual directions for proper logging techniques.

1.9.3 Troubleshooting

See instruction manual.

1.10 Data Management & Records Management

The LI-COR data is written on the back side of the Field Data Sheet. Information that is collected include Site, Time, and Depth. Measurements are collected at 1.0, 2.0, and 3.0 meters depth as applicable, or if the water is less than 1.0 meter depth, write down that singular depth and time. If no LI-COR measurement was logged, write down the Site, Time, and reason why the LI-COR measurement could not be logged.

2.0 QA/QC SECTION

2.1 Training

Training of field personnel will be done through dry run exercises in the laboratory to familiarize them with instrument operation, calibration, and maintenance. All operators are required to become familiar with the SOP document and instruction manual. Prior to solo sample collection, field personnel are evaluated in a field setting for proper use of equipment and sample collection protocol. Annual field audits are performed on sample collectors following procedures outlined in the Quality Management Plan.

2.2 Maintenance

Rinse the PVC pole frame and sensors with tap water at the end of the day to remove any salt water.

2.3 QC Procedures

Data that is entered on the field sheets, in the Excel spreadsheet, and in the Ambient Water Quality Database will be quality controlled (QC) by a different person than the one who entered the data. This will ensure that two people have looked at the data.

3.0 REFERENCES

LI-COR Data Logger Instruction Manual – Model LI-1000
LI-COR Data Logger Instruction Manual – Model LI-1400

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Phytoplankton Collection and Preservation

Effective Date 06/01/2017

1.0 PROCEDURAL SECTION

1.1 Scope and Application

Phytoplankton identification and enumeration was started in Pinellas County Department of Environmental Management (DEM) to provide biological water quality information for freshwater lakes within the Ambient Monitoring and Assessment Program. Lake Tarpon and Lake Seminole waters were first monitored in 2000, and Alligator Lake and Lake Chautauqua began in 2003. Since 2017, the coastal portion of the Ambient Monitoring Program has had samples collected to determine the presence of algae blooms occurring during the wet season from June through October.

1.2 Summary of Method

Methods for sample collection conform to FDEP SOP FS 7000 for General Biological Community Sampling. Quantitative sampling for phytoplankton in the lakes and coastal waters is done using an integrated water sampler. As algae in the water are dispersed through the water column, composite samples for varying depths are used. The water column depth for each sample is specific to the sample site at the time of collection. The target depth for water column sampling is determined as twice the secchi disk depth reading to capture photosynthesis activity at the specific sample site. The sampler used is a "Sludge Judge," which consists of a length of clear plastic tubing with a stopper inside that allows water into the tube as it's lowered into the water column, and then holds the water in the tube as it is raised. The water is then emptied into a bucket, the process is repeated two more times for a total of three composite grabs. Then a small sample is collected into a glass scintillation vial and perserved on ice. Upon return to the lab, Lugol's solution is added to the sample, and it is stored in a refrigerator.

1.3 Definitions

- **Phytoplankton**: Phytoplankton are single-celled organisms of lakes, streams and oceans that make their own food from sunlight through photosynthesis. Phytoplankton occur almost anywhere there is water and sunlight. While there are thousands of different types of phytoplankton, there are several main categories that make up the most commonly-occurring: cyanobacteria (blue-green algae or blue-green bacteria), dinoflagellates, and diatoms. The terms algae and phytoplankton are often confused. While not all algae are phytoplankton (e.g., seaweeds are algae, but are not phytoplankton), all phytoplankton are considered algae.
- **Lugol's iodine**: also known as aqueous iodine and strong iodine solution, is a medication and disinfectant used for a number of purposes.
- **Secchi disc**: An instrument used for measuring the clarity of water. It consists of a circular plate divided into alternating black and white quadrants and attached to a long measuring tape. The plate is lowered into the water, and the depth at which it is no longer visible from the surface is recorded.

1.4 Health and Safety Warnings

Lugol's solution:

- **Inhalation** Irritation of nose, throat and airway.
- **Ingestion** May cause discomfort if swallowed.
- **Skin contact** Prolonged skin contact may cause redness and irritation.
- **Eye contact** May cause temporary eye irritation.

1.5 Cautions from Lugol's Solution

- Use in a ventilated area
- Wash skin with soap and water.
- Store Lugol's solution in a dark bottle.

1.6 Interferences

Not applicable

1.7 Personnel Qualification

Field personal must be trained and evaluated on the use of equipment prior to collecting samples or data. Use of the equipment is subject to approval by the QA Officer and/or the Environmental Monitoring Coordinator. Training will be done through dry run exercises in the field to familiarize field personnel with collection and maintenance. Investigators must be familiar with the SOP document and owner's manual, when applicable.

1.8 Equipment

- Secchi disc
- Sludge Judge sampler
- Bucket
- Deionized water
- 125 mL sample container, pre-labeled
- Cooler with ice
- Lugol's solution
- Glass scintillation vial and cap
- Inverted microscope
- Microscope chamber slides
- Volumetric pipette

1.9 Procedure

1.9.1 Sample Collection

- Rinse the Sludge Judge sampler and bucket three times with water at the site that is about to be sampled.
- Determine the secchi depth of the water column.

- Slowly lower the Sludge Judge sampler into the water column until a depth of twice the secchi reading is reached. If the site is too shallow to attain this depth, lower the sampler until it is near the bottom, but avoid stirring up bottom sediments.
- Pull the sampler up and release the contents by pressing the tube onto the bottom of the bucket. Repeat 2 more times.
- Place the lid on the bucket and gently swirl and invert the composite sample several times to ensure mixing. Rinse the glass sample bottle 3 times. Fill the glass sample bottle to 3/4 full and firmly secure cap.
- Label the bottle with site, date, and time sampled. Place sample in cooler.

1.9.2 Sample Preservation

Upon receiving phytoplankton samples after field collection, samples will be preserved with Lugol's solution (20g KI +10g Iodine crystals dissolved into 200ml DI containing 20ml glacial acetic acid). Lugol's must be stored in the dark.

Add approximately 0.5 ml, approximately four drops, to each 125 ml sample bottle and store in the refrigerator.

1.9.3 Identification and Counting Procedures

This process is to be done by somebody who has been trained to identify phytoplankton.

1. Gently shake each sample thoroughly for at least 30 seconds so that it is well mixed before sub-sampling.
2. Using a pipette transfer 1ml of deionized water for Lake Tarpon, Alligator Lake, Lake Chautauqua, and possible bloom samples and 2mls of deionized water for Lake Seminole samples to the counting chamber.
3. Using a pipette transfer 2mls of sample for Lake Tarpon, Alligator Lake, Lake Chautauqua and possible bloom samples, and 1ml of sample for Lake Seminole to the counting chamber and place coverslip over chamber.
4. Gently agitate the chamber to mix DI water and sample.
5. Allow samples to settle.
6. Phytoplankton identifications will be made to the species level if possible. For some taxa, such as diatoms, identification to the species level is nearly impossible and therefore will be grouped into size classes. For instance, single centric diatoms can be grouped into those <5 um, 5-10 um and >10 um.
7. Counts will be made on a Zeiss inverted microscope using a Whipple grid. Cells will be counted at 400x due to the large number of nanoplankton currently present in our samples.
8. Cells within the Whipple grid boundaries will be counted. Those cells that are at least 50% within the disc boundaries but are off the bottom or left sides of the Whipple grid will be counted. Those cells off the top or right of the grid will not be counted.
9. For counting random fields, 30 grids or up to 100 cells will be counted. To obtain an accurate count for filamentous or colonial algae, the number of cells per filament or colony will be counted for the first 30 encountered and the mean number of cells per filament/colony calculated.

10. An ACCESS® database titled PHYTOCODE contains all observed species with an assigned number. Using these codes, sample volume and counts will be entered into a report and cells/ml will be calculated for each species counted.

Calculations:

The total number of Whipple grids (fields) within the total chamber area is calculated as:

$$\text{Total Number of Fields} = \frac{\text{Total Area of Chamber [mm}^2\text{]}}{\text{Area of Whipple Grid [mm}^2\text{]}}$$

The conversion factor for counting fields of view is calculated as:

$$\frac{1}{\text{Chamber Volume [mL]}} \times \text{Total Number of Fields} = \text{Ff}$$

To calculate the cell concentration expressed in cells per mL:

$$\text{Cells/mL} = \frac{N}{F} \times \text{Ff}$$

Where:

N = Number of cells counted
F= Number of fields counted
Ff = field conversion factor

1.10 Data Management & Records Management

1.10.1 Field Notation

- When samples are collected, the letter "P" is circled on the Water Quality Field Sheet in the "Extra Samples" box. Write the letter "I" if the Sludge Judge sampler was used to collect the sample. Enter the total depth the sample was collected at in the comments box.
- Phytoplankton Taxonomy Data Sheets are filled out during the identification process under the microscope.

1.10.2 Chain of Custody

- Samples are collected and brought back to our laboratory, so no Chain of Custody is needed.

2.0 QA/QC SECTION

2.1 Training

Training of field personnel will be done in the field. All operators are required to become familiar with the SOP document. Prior to field certification by QA officer, field personnel are evaluated in a field setting for proper use of equipment and sample collection protocol. Annual field audits are performed on sample collectors following procedures outlined in the Quality Management Plan.

2.2 Maintenance

- If the depth markings on the sampler become worn off, re-apply with black sharpie pen. These should be marked in tenths of a foot.

2.3 QC Procedures

- QC of data entry into the ACCESS ® Database will be performed by two people to check for accuracy of the data that is entered.

PINELLAS COUNTY PUBLIC WORKS
ENVIRONMENTAL MANAGEMENT DIVISION
STANDARD OPERATING PROCEDURE

Seagrass Monitoring and Assessment

Effective Date 06/01/2017

1.0 PROCEDURAL SECTION

1.1 Scope and Application

Pinellas County performs annual seagrass monitoring as part of its natural resource management strategy under the Strategic Plan's "Practice Superior Environmental Stewardship." The seagrass monitoring of the Tampa Bay region fulfills the Action Plan, BH-8 of "Charting the Course, the Comprehensive Conservation and Management Plan for Tampa Bay" to "Expand Habitat Mapping and Monitoring Programs" put forth by the Tampa Bay Estuary Program. The monitoring of the seagrasses in the St. Joseph Sound and Clearwater Harbor fulfills a portion of the "Bay Habitats Action Plan" for seagrasses from the Comprehensive Conservation and Management Plant for Clearwater Harbor and St. Joseph Sound.

Seagrasses are an important part of the Tampa Bay ecosystem, providing food, shelter, and nursery areas to both recreational and commercially important fish, invertebrates, reptiles, and marine mammals. It is estimated that approximately 70% of Florida's fishery species utilize seagrass habitats at some point in their life cycle. Seagrass meadows also work to filter nutrients and trap fine sediments leading to improved water quality and clarity. An established seagrass bed helps to stabilize sediments, preventing resuspension during wind and storm events.

The seagrass meadows in the study area are a combination of stable/expanding beds and stressed/receding beds. A comprehensive seagrass assessment is necessary to characterize the watershed and pinpoint the areas where restoration and protection efforts will be most effective. Data is used to develop and calibrate models and make future recommendations for the management of seagrass areas.

1.2 Project Description

Pinellas County has three sub-programs for seagrass monitoring and assessment:

1. Fixed Transects in Boca Ciega Bay and Feather Sound: Pinellas County partners with the Tampa Bay Estuary Program and other area environmental management groups to monitor fixed transects throughout Pinellas County. The current fixed transect monitoring program began in 1997, based upon previous programs and recommendations from TBEP's Technical Advisory Committee. Fixed transect monitoring is useful in ascertaining if seagrass species and/or abundance is changing over time at a specific location; however, this method of monitoring does not provide an assessment of the coverage of seagrass meadows in terms of acres.

2. Bi-Annual Aerial Seagrass Imagery and Analysis: Pinellas County partners with the Southwest Florida Water Management District (SWFWMD) to acquire and analyze aerial imagery to develop seagrass coverage and assess whether the bay and intracoastal regions are meeting seagrass acreage targets in Tampa Bay and St. Joseph Sound/Clearwater Harbor. SWFWMD administrates the contract for the flight photography and analysis. The contract spans a two-year period. The first year is for imagery acquisition and approval. The second year is for analysis and final approval. Pinellas County works with SWFWMD to QA/QC analyses before final approval of the product.

   The final product is a total acreage of seagrass coverage that can tell resource managers if Pinellas County and Tampa Bay is meeting or exceeding seagrass acreage targets set by TBEP's

"Charting the Course, the Comprehensive Conservation and Management Plan for Tampa Bay." Pinellas County receives the aerials and analysis on a hard drive.

Results are published by SWFWMD on their website: http://www.sarasota.wateratlas.usf.edu/upload/documents/2016-SWFWMD-Seagrass-Survey-Results.pdf

4. Clearwater Harbor and St. Joseph Sound: Pinellas County conducts synoptic seagrass surveys in Clearwater Harbor and St Joseph Sound to develop a more comprehensive understanding of an area that is not covered under the Tampa Bay Estuary Program Boundaries.

1.3 Summary of Method

1.3.1 Fixed Transects

Fixed transect are monitored using a method set forth by the City of Tampa's Bay Studies Group using the Braun-Blanquet method of assessment for plant communities. Hydrolab, secchi, and transmissometer data are also taken. Figure 1 shows site locations for all fixed monitoring sites in Tampa Bay.

Transect monitoring is conducted during the late summer and fall to coincide with the period of maximum seagrass biomass. Pinellas County monitors 13 fixed transects. The Boca Ciega Bay transects are each monitored every other year, and the Feather Sound transects are monitored yearly.

Transects are generally sited from shore travelling roughly perpendicularly offshore to the terminus of the seagrass bed. Three transects in Boca Ciega Bay run parallel to shore. Transects vary in length from 40 meters to 2700 meters. GPS coordinates are stored on the Pinellas County servers. Figure 1 shows transect sites throughout Tampa Bay and Boca Ciega Bay.

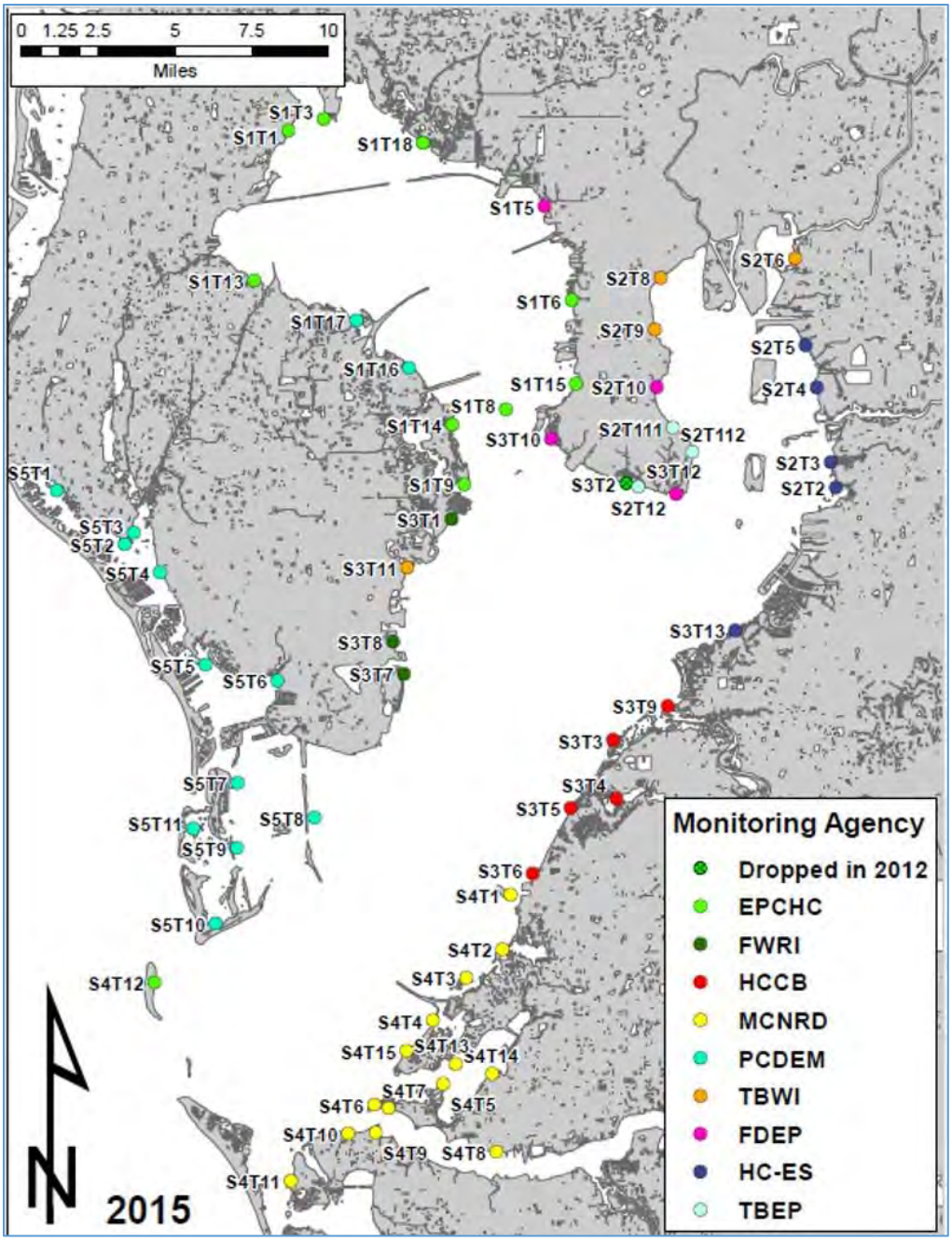

Figure 1. Tampa Bay fixed transect monitoring sites.

The Braun-Blanquet method is used to estimate abundance of seagrass at pre-determined marks along each transect. A one meter square is used for this assessment. In addition to species, abundance, and appearance, epiphytic coverage on seagrass blades and sediment composition is recorded on the field data sheets. Field sampling teams make notes of prop scars and the meter-mark when the seagrass species change.

At the middle and edge of the seagrass bed, a Hydrolab^{tm} water quality sampling unit is used to record *in-situ* temperature, dissolved oxygen, pH, salinity, conductivity, and depth. A transmissivity sample is collected at mid and edge of bed for analysis by Pinellas County Environmental

Management staff. Three density counts for each species and five blade lengths are taken a mid and edge of bed. Figures 3 and 4 are examples of data sheets used by field crews.

The Tampa Bay Estuary Program reports the results in press releases and on their website. A Red/Yellow/Green report card is produced to enable the public to visualize the health and extent of seagrass in Tampa Bay and Boca Ciega Bay.

Additional information can be found in TBEP's Field Manual-Transect Data:
..\Field Manual-Transect Data TBEP.pdf

1.3.2 Biannual Aerial Seagrass Imagery and Analysis

1.3.3 Synoptic Seagrass Surveys for Clearwater Harbor and St. Joseph Sound

Clearwater Harbor and St. Joseph Sound are not within the boundaries of the Tampa Bay Estuary Program. Pinellas County Environmental Management monitors this area independent of other organizations.

This region contains lush seagrass meadows and some hard bottom habitats. In 2016, SWFWMD aerial analysis calculated greater than 17,000 acres of seagrass in this area. From 1998-2005 Pinellas County Environmental Management monitored 14 fixed transects in Clearwater Harbor/St. Joseph Sound area. Due to the extensive coverage of seagrass in this area, Pinellas County implemented a stratified random monitoring program in 2006 to increase the spatial extent of the study area and enhance the knowledge of the seagrass resource in the area. Figure 2 shows the three strata that are surveyed by this method.

Transect monitoring is conducted during the late summer and fall to coincide with the period of maximum seagrass biomass. Sites are generated randomly based upon total acreage of the strata to be sampled. Using a ratio of one transect per 250 acres, W1 (St. Joseph Sound) is allotted 41 sites. W2 (Clearwater Harbor North), is allotted 17 sites, and W3 (Clearwater Harbor South) is allotted 10 sites.

County field crews survey randomly generated sites for seagrass abundance and species assessments and collect *in-situ* data including salinity, pH, conductivity, dissolved oxygen, and depth using at Hydrolab® multiprobe. Transmissivity samples are collected for analysis at the PC DEM lab. Seagrass abundance is assessed by estimating the percent of coverage within a quadrat using a quadrat. At 0m, 15m, and 30m along the 30m transect, 3 density counts and 5 blade length measurements are taken for each seagrass species present using a 10cm X 10cm square subsection of the quadrat.

https://www.pinellascounty.org/environment/watershed/pdf/Pinellas_County_Seagrass_Report_1998-2010.pdf

Random Transects

Random transects are monitored by visually assessing seagrass coverage at randomly generated sites. Hydrolab, secchi and transmissometer data are also taken. Figure 2 shows strata for random sites

Figure 2. Clearwater Harbor and St. Joseph Sound Sampling Strata for random seagrass monitoring.

Aerial Imagery and Analysis

Aerial imagery is acquired on a bi-annual basis and analyzed to produce a total seagrass coverage in acres. SWFWMD administrates and oversees the contract for aerial imagery acquisition and analysis of seagrass beds. Pinellas county QA/QCs imagery and subsequent analysis.

1.4 Health and Safety Warnings

Seagrass monitoring is performed in the water, either from shore or a boat. All caution should be taken to operate boat according to safety standards set forth by safety officer. Individuals counting seagrass will exercise caution and follow safety procedures. When depth makes it necessary, SCUBA equipment will be used. All divers will follow safety procedures set forth in Environmental Management's Dive Safety Plan.

1.5 Cautions

Weather, currents, and wildlife should all be considered when monitoring seagrass. A crew will make the determination the morning of the sampling event whether to perform the monitoring. Small craft warnings and thunderstorms preclude sampling for the day. Close communication between individuals on shore and the field crew ensures that should any weather or other safety events occur, field crews will be notified and sampling will be concluded for the day.

1.6 Interferences

Water clarity is important when making a visual assessment of seagrass species and abundance. Wind, currents and cloud cover can affect the ability to see underwater. To mitigate the effect of impaired water clarity, the technician can:

1. Swim the transect *into* the prevailing current, assuring that any sediment stirred up is carried behind the technician. Individuals assisting the technician and/or the safety diver should also remain down current.
2. Choose to use SCUBA at a particular site to prevent stirring up the sediments on the bottom.

Sampling crew can choose to go to a different site or choose an alternate should conditions prove to be too challenging.

1.7 Personnel Qualification

Field personal must be trained and evaluated on the use of equipment prior to collecting samples or data. Use of the equipment is subject to approval by the QA Officer and/or the Environmental Monitoring Coordinator. Training will be done through dry run exercises in the laboratory and field to familiarize field personnel with operation/collection, calibration and maintenance. Investigators must be familiar with the SOP document and owner's manual, when applicable.

Personnel using SCUBA will possess an open water certification or higher.

A yearly seagrass training is held by the Tampa Bay Estuary Program to ensure that all personnel monitoring seagrass are using equivalent methodology. Monitoring personnel are expected to attend this program every other year at a minimum.

1.8 Equipment

- Boat and all safety gear
- Multiprobe water quality unit
- Maps, site lat/longs, data sheets, ID cards
- GPS for locating sites
- Underwater clipboard and 'Space-Pen' and spares
- Underwater data sheets on iGage Weatherproof Paper (Figures 4 and 6)
- Boat data sheets (Figures 3 and 5)
- Quadrats and ruler
- 30-m marked transect line, dive flags on either end
- Short and long measuring poles
- Regulation diver down flag
- Snorkeling gear, thermal protection
- SCUBA gear for two divers: Buoyancy compensators, regulators, SCUBA tanks
- Spare O-rings, defog, whirl-paks for bringing back samples for ID

- Transmissometer bottles and cooler to store samples
- Coolers and ice for water and lunches
- Sunscreen

1.9 Procedure

May not have the following, but if multiple big categories in procedure, break out as in example:

1.9.1 Calibration

Hydrolab^{tm} multiprobe water quality sampler will be calibrated according to the Standard Operating Procedures for Hydrolab Calibration.

1.9.2 Measurement / Operation

Fixed Transects

Fixed transects are monitored using a procedure set forth by the City of Tampa's Bay Studies Group. Transects are assessed using the Braun-Blanquet method of classifying plant communities. Field Crews locate sites using Trimble WAAS enabled GPS. Each transect is unique in length and points of measurement. Counting technician uses a meter square to make Braun-Blanquet assessment at pre-determined intervals along transect. At the mid and edge of each seagrass bed, extra data and counts are taken:

- Hydrolab: pH, conductivity, depth, salinity, temperature, dissolved oxygen
- Transmissometer sample
- Secchi
- Density Counts (3) and blade length measurements (5) are made for each seagrass species measured using a 10cm x 10cm or 25cm x 25cm square, dependent upon density

Whenever possible, Hydrolab, secchi and transmissometer will be taken at 2m contour.
Figures 3 and 4 show examples of field data sheets used for monitoring fixed seagrass transects.

TBEP field manual for seagrass monitoring can be found here:
W:\Watershed\Seagrass\Field Manual-Transect Data TBEP.pdf

Random Stratified

Pinellas County Environmental Management randomly generates seagrass sites in each of the three strata (Figure 2): Clearwater Harbor North and South and St. Joseph Sound. 30m transects are placed parallel to the shoreline. Transects are assessed visually for percent coverage.
Staff on the boat take the following data:

- Actual beginning and ending lat/longs of the transect
- Hydrolab: pH, conductivity, depth, salinity, temperature, dissolved oxygen
- Transmissometer sample
- Secchi

Technician in the water will make a visual assessment at every 5m beginning at the 0m mark on the transect (Figure 7). At 0m, 15m and 30m, density Counts (3) and blade length measurements (5) are made for each seagrass species measured using a 10cm x 10cm section of quadrat.

Figures 3 and 4 show examples of field data sheets used for monitoring fixed seagrass transects.
The field SOP can be found here:
W:\Watershed\Seagrass\2016\CLW-SJS\2016 CLW-SJS Seagrass SOP.docx

Aerial Imagery and Analysis

Aerial imagery is acquired on a bi-annual basis and analyzed to produce a total seagrass coverage in acres. SWFWMD administrates and oversees the contract for aerial imagery acquisition and analysis of seagrass beds. Pinellas county QA/QCs imagery and subsequent analysis. Final product is total acreage of seagrass in Tampa Bay, Clearwater Harbor and St. Joseph Sound.

SWFWMD produces maps, press releases and reports
https://www.swfwmd.state.fl.us/documents/publications/watermatters/mar-apr2011/4.html

1.10 Data Management & Records Management

Fixed Transects

Fixed transect data is entered into Excel spreadsheets and submitted along with transmissometer and Hydrolab^{tm} data to the Tampa Bay Estuary Program for analysis. Pinellas County stores original field data sheets (Figures 3 and 4) at County office. Data sheets are scanned and stored digitally on County servers.
Janicki Environmental performs analysis. Final results are incorporated into report that can be found on TBEP technical website.

http://www.tbeptech.org/TBEP_TECH_PUBS/2016/TBEP_08_16_2016_Seagrass_Transect_Summary_Report.pdf

Random Transects

Random transects data is entered into Excel spreadsheets for analysis. Original field data sheets (Figures 5 and 5) are stored at Pinellas County offices. Scanned field data sheets are kept on County servers. Analyzed data is incorporated into a status report.

W:\Watershed\Seagrass\2010_Report\Pinellas County Seagrass Report 1998-2010.pdf

Aerial Imagery and Analysis

Aerial imagery is acquired on a bi-annual basis and analyzed to produce a total seagrass coverage in acres. SWFWMD administrates and oversees the contract for aerial imagery acquisition and analysis of seagrass beds. Pinellas county QA/QCs imagery and subsequent analysis.

SWFWMD produces maps, press releases and reports:

https://www.swfwmd.state.fl.us/documents/publications/watermatters/mar-apr2011/4.html

2.0 QA/QC SECTION

2.1 Training

Training of field personnel will be done through dry run exercises in the laboratory to familiarize them with instrument operation, calibration, and maintenance. All operators are required to become familiar

with the SOP document and owner's manual. Prior to solo sample collection, field personnel are evaluated in a field setting for proper use of equipment and sample collection protocol. Annual field audits are performed on sample collectors following procedures outlined in the Quality Management Plan.

Tampa Bay Estuary Program holds an annual seagrass training for participants in the Bay-Wide foxed seagrass monitoring program. Personnel monitoring seagrass for Pinellas County are encouraged to attend this hands-on workshop at least every other year.

Individuals monitoring seagrass in the random transect program receive training and supervision in the field prior to independently counting seagrass. Since the random and fixed transects are very similar, field technicians are encouraged to attend TBEP's yearly training.

2.2 Maintenance

Maintenance of Hydrolab^{tm} multiprobe water quality monitors is done in-house by Pinellas County staff.

Sampling gear maintenance for seagrass monitoring entails ensuring transect and quadrats are in good working order. SCUBA equipment is rented from a reputable SCUBA shop, any maintenance required will be done by the shop.

2.3 QC Procedures

n/a

a. REFERENCES

Johansson, J. O. Roger, Seagrass Transect Monitoring in Tampa Bay A Summary of Findings from 1997 through 2015
http://www.tbeptech.org/TBEP_TECH_PUBS/2016/TBEP_08_16_2016_Seagrass_Transect_Summary_Report.pdf

Pinellas County Seagrass Resource Assessment & Monitoring Program Status Report
W:\Watershed\Seagrass\2010_Report\Pinellas County Seagrass Report 1998-2010.pdf

Tampa Bay Estuary, Charting the Course, The Comprehensive Conservation and Management Plan for Tampa Bay
http://www.tbep.org/about_the_tampa_bay_estuary_program-charting_the_course_management_plan-download_charting_the_course.html

Water Matters Magazine, Seagrass Mapping Reveals Record-Breaking Gains in Tampa Bay, March-April 2011
https://www.swfwmd.state.fl.us/documents/publications/watermatters/mar-apr2011/4.html

2016 Boca Ciega Bay/Feather Sound
Seagrass-Boat Data

Date Crew Counting Tech Sonde/Surveyor Weather

Site	Hydrolab Time	Total Depth	Secchi (cm)	Tide	DO (mg/L)	pH	Salinity (ppt)	Temp (^{0}C)	Tranny ☑	Comments/stakes located? Replaced?

Figure 3. Example of fixed transect boat data sheet

Seagrass Data Date_____ Bay Segment_____ Transect #_____ Crew_____ Counting Tech_____ Page of

Seaward Seagrass Edge (m)_____ Secchi (cm)_____ (@2m Contour) Sonde_____ Weather_____
Species: (AA) Attached Algae (DA) Drift Algae) (H) Halodule (HE) Halophila (R) Ruppia (S) Syringodium (T) Thalassia
Abundance: r=solitary, + few, 1=<5%cover, 2=5-25% cover, 3=26-50% cover, 4=51-75% cover, 5=76-100% cover
Appearance: 1 = excellent, 2 = good, 3 = fair, 4 = poor
Epiphyte Density: 1=clean, 2=light, 3=moderate, 4=heavy Sediment: 1=shelly sand, 2=sand, 3=muddy sand, 4=mud, 5=oyster

Site	Species	Abundance	Appearance	Blade Length (5)	Shoot Density (3)	Count square size	Epiphyte Type/ Density	Sediment	DO	pH	PSU	°C	Depth (cm)	Time	Comments

Figure 4. Example of fixed transect seagrass data sheet

2016 Clearwater Harbor/St/ Joseph Sound Seagrass Boat Data Sheet

2016 Boat Data Sheet

Date_____ **Crew**_____

Sonde/Surveyor **Comments**

Strata / Site	Hyd. Time	Secchi	Total Depth	Tide (From GPS)	GPS (start)	GPS (end)	Trans. ☑	Comments/Weather
					N	N		
					W	W		
					N	N		
					W	W		
					N	N		
					W	W		
					N	N		
					W	W		
					N	N		
					W	W		
					N	N		
					W	W		

Figure 5. Example of random stratified transect boat data sheet

2016 CLW/SJS Seagrass Data

Species:(H)*Halodule (S)Syringodium (T)Thalassia (HE)Halophila (R) Ruppia (DA) Drift Algae*
Epiphytes*: (AA) Attached Algae (CT) Coiled Tubes (B) Barnacles (BR) Bryozoans (E) Encrusting Algae*
%Coverage: use **ACTUAL** % Abundance/Species ***Health***: VG=very good; G=Good; F=fair; P=poor
Epiphyte density*:* 1=clean, 2=light, 3=moderate, 4=heavy ***Sediments****:* 1=shelly sand; 2=sand; 3=muddy sand; 4=mud; 5=oysters

Date _____Start Time_____ Bay Segment _____Transect # _____ Crew _____Counting Tech_____

Site	Species	Coverage %	Health	Blade Length (5)	Shoot Density (3)	Epiphyte Density	Epiphyte Description	Sed.	Depth	Comments See Scallops??
0										
5										
10										
15										
20										
25										
30										

Figure 6. Example of random stratified transect seagrass data sheet.

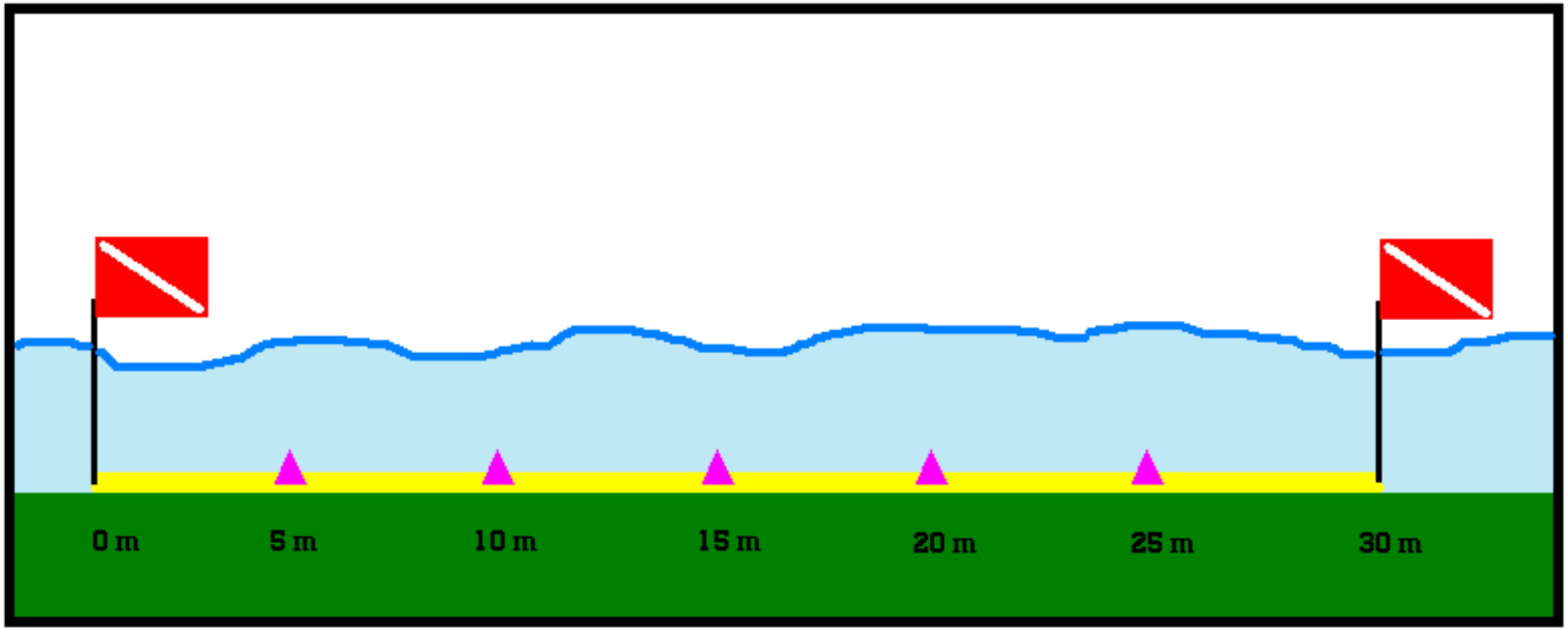

Figure 7. Diagram of 30m random seagrass transect

APPENDIX B

MAP OF MAJOR OUTFALLS IN PINELLAS COUNTY

LEGEND

- COUNTY OUTFALLS
- MAJOR DRAINAGE
- WATERBODIES
- Municipalities
- Unincorporated County

ID	OUTFALL	LAT	LONG
1	SN01_3002	28.16174215	-82.77349354
2	SN01_0230	28.15996455	-82.76375818
3	SN01_0389	28.15636681	-82.76142022
4	SN02_4926	28.15656252	-82.69662556
5	SN01_7412	28.14012477	-82.76486517
6	SN01_7414	28.14012571	-82.76480595
7	SN02_2071	28.13808277	-82.69342812
8	SN02_2072	28.13808252	-82.69347868
9	SN02_2073	28.1380791	-82.69352129
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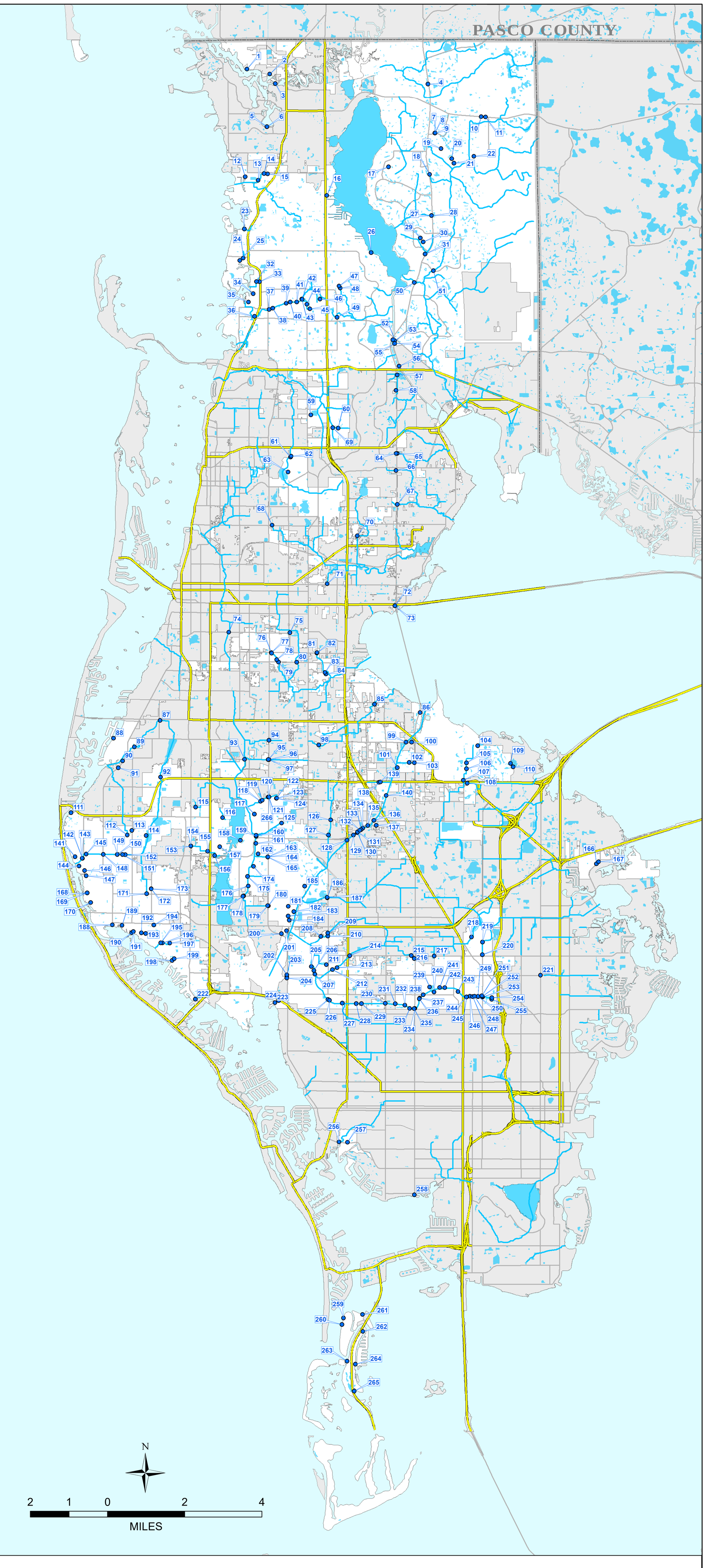


Pinellas County PUBLIC WORKS

Customer & Technical Services Division
22211 US Highway 19 N
Clearwater, FL 33765
(727) 464-8893

PINELLAS COUNTY MAJOR OUTFALLS

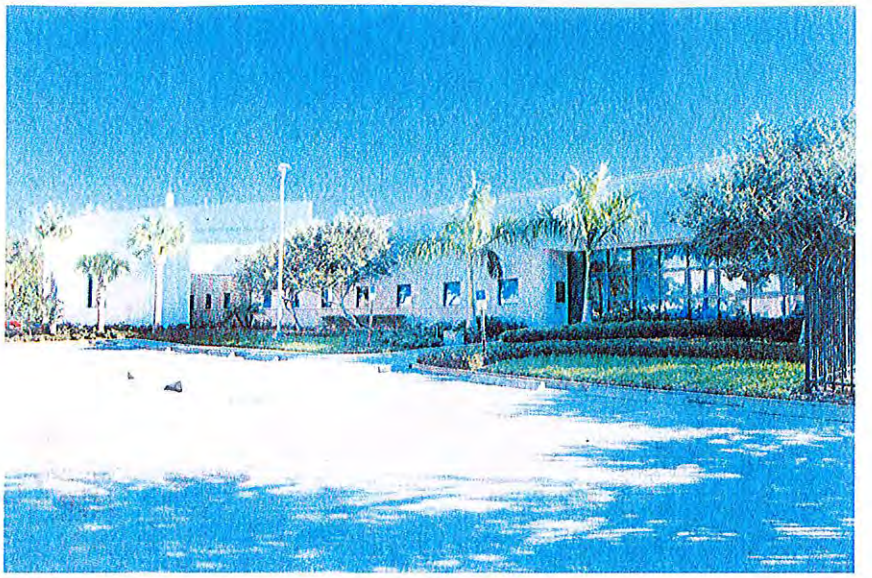
The data contained herein is offered “as is” with no claim or warranty as to its accuracy or completeness. The data is for reference only and should not be considered to be of survey precision. None of the information is official source documentation.

Date: 9/18/2018

APPENDIX C

QUALITY MANUAL FOR

PINELLAS COUNTY UTILITIES LABORATORY



Quality Manual

for

Pinellas County Utilities Laboratory

1620 Ridge Rd., Bldg. B
Largo, FL 33778
727-582-2302
Fax-727-488-4834

Name	Function (Unit)	Signatures	Date
Michelle Milford	Water Quality Division Manager	Michelle Milford	5-25-15
Kathleen Roach*	Laboratory Manager	Kathleen Roach	6-5-15
Terri Grimes*	Quality Manager	Terri Grimes	5-28-15
Michael Putman	Technical Manager	Michael Putman	6/5/15
Jennifer Hunter	Technical Manager	J Hunter	6-1-15
Vionette Mull	Technical Manager	Vionette Mull	6-2-15
Cindy Redmond	Technical Manager/QAO	Cindy Redmond	5-29-15

Note: Those names marked with an asterisk, *, are approved signatories for Pinellas County Utilities Laboratory

Revision Number:	2.0	Effective Date:	06/05/2015

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Section 3

INTRODUCTION AND SCOPE
(TNI V1:M2 – Sections 1,2,3)

The purpose of this *Quality Manual* is to outline the management system for the Pinellas County Utilities Water Quality Laboratory (hereafter referred to as the laboratory). The *Quality Manual* defines or references the policies, procedures, and documentation that assure analytical services continually meet a defined standard of quality that is designed to provide clients with data of known and documented quality and, where applicable, demonstrate regulatory compliance.

The *Quality Manual* sets the standard under which all laboratory operations are performed, including the laboratory's organization, objectives, and operating philosophy. The *Quality Manual* has been prepared to assure compliance with the *2009 TNI Environmental Laboratory Sector Standard – Volume 1 – Management and Technical Requirements for Laboratories Performing Environmental Analysis (EL-V1-M1, M2, M4, M5 - ISO-2009)*. This Standard is consistent with *ISO/IEC 17025:2005* requirements that are relevant to the scope of environmental testing services and thus, the laboratory operates a quality system in conformance with *ISO/IEC 17025:2005(E)*. In addition, the policies and procedures outlined are compliant with the various accreditation and/or certification programs.

3.1 Vision, Mission, and Shared Values Statements

The objectives of the laboratory are embodied within the Vision, Mission, and Shared Values statements.

3.1.1 Vision

To be the best laboratory in the country

3.1.2 Mission

The missions of the laboratory are to:

- Provide the highest quality services and results to customers
- Use laboratory business practices that provide the most value to customers.
- Provide opportunities for the professional growth of staff to maximum potential.
- Promote and encourage all avenues of laboratory communication.
- Provide a work environment that fosters the highest level of personal development of organizational values.

3.1.3 Statement of Shared Values

The laboratory staff developed this *Statement of Shared Values* during Data Integrity training in October 2004.

Our laboratory recognizes the needs of our customers and will continually strive to meet and exceed their expectations by embracing the following values:

- Honesty and integrity in all dealings with customers and employees.
- Maintaining competency and accountability through continued training and education of our staff.
- Provide quality data and services that meet required criteria as well as meeting our customers' expectations.

3.2 Scope of Testing

The laboratory's scope of accredited analytical testing services for various Fields of Accreditation (FOAs) includes those listed in H:\Business Information\Certifications. Click on the desired year (folder) to see the "Certificate of Accreditation" and "Laboratory Scope of Accreditation" files. The nomenclature used follows the format (YY=2-digit year, MM=2-digit month, DD=2-digit day): YYMMDD_cert.pdf for the "Certificate" and YYMMDD_scope.pdf for the "Scope".

Non-accredited analytical test methods include:

Method	Reference
Specific Gravity (All FOAs)	ASTM D1429
Density (All FOAs)	USGS I 1312 85
Free & Total Ammonia (All FOAs)	SM4500NH3F
Odor (Non-Potable Water FOA)	SM2150B
Total Phosphorus (Drinking Water FOA)	EPA 365.1
UV-Transmittance (All FOAs)	----------
UV-254 (Non-Potable Water FOA)	SM5910B
HPC (All FOAs)	SM9215D

3.3 Table of Contents, References, and Appendices

The Table of Contents is in Section 2; there are no Appendices.

This *Quality Manual* uses the references included *in Modules 1, 2, 4, 5 in the 2009 TNI Environmental Laboratory Sector Standard – Volume 1 – Management and Technical Requirements for Laboratories Performing Environmental Analysis*.

3.4 Glossary and Acronyms Used

Quality control or other more specific terms are generally defined within the section that describes the activity.

3.4.1 Glossary

Reference the Terms and Definitions section of Modules 1-7 in the *2009 TNI Environmental Laboratory Sector Standard – Volume 1 – Management and Technical Requirements for Laboratories Performing Environmental Analysis*.

Many of the terms and definitions, if not found in the TNI Standard, are found in individual SOPs throughout the laboratory. Terms and definitions that are not defined elsewhere may include:

3.4.1.1 The TNI Standard: The *2009 TNI Environmental Laboratory Sector Standard – Volume 1 – Management and Technical Requirements for Laboratories Performing Environmental Analysis* (*EL-V1, M1 through M7, ISO-2009*).

3.4.1.2 Acronyms

A list of acronyms used in this document and their definitions are:

AB	–	Accrediting Body
ANSI	–	American National Standards Institute
ASQC	–	American Society for Quality Control
ASTM	–	American Society for Testing and Materials
Blk	–	Blank
°C	–	degrees Celsius
cal	–	calibration
CAS	–	Chemical Abstract Service
CCV	–	Continuing calibration verification
CDOP	–	Continuing Demonstration of Proficiency
COC	–	Chain of custody
DO	–	Dissolved oxygen
DOC	–	Demonstration of Capability
EPA	–	Environmental Protection Agency
g/L	–	grams per liter
GC/MS	–	gas chromatography/mass spectrometry
ICP-MS	–	inductively coupled plasma-mass spectrometry
ICV	–	Initial calibration verification
ISO/IEC	–	International Organization for Standardization / International Electrochemical Commission
lb/in2	–	pound per square inch
LCS	–	Laboratory control sample
LFB	–	Laboratory fortified blank
LIMS	-	Laboratory Information Management System
LOD	-	Limit of Detection
LOQ	-	Limit of Quantitation
MDL	–	method detection limit
mg/Kg	–	milligrams per kilogram
mg/L	–	milligrams per liter
MS	–	matrix spike
MSD	–	matrix spike duplicate
NELAC	–	National Environmental Laboratory Accreditation Conference
NELAP	–	National Environmental Laboratory Accreditation Program
NIST	–	National Institute of Standards and Technology
PT	–	Proficiency Test(ing)
PTP	-	Proficiency Testing Provider
PTPA	–	Proficiency Testing Provider Accreditor
QA	–	Quality Assurance
QC	–	Quality Control
QM	–	Quality Manual
RL	–	Reporting level
RPD	–	Relative percent difference

RSD	–	Relative standard deviation
SOPs	–	Standard operating procedures
Spk	–	Spike
Std	–	Standard
TNI	-	The NELAC Institute
ug/L	–	micrograms per liter
UV	–	Ultraviolet
VOC	–	Volatile organic compound

3.5 Management of the *Quality Manual*

The Quality Manager is responsible for maintaining the currency of the *Quality Manual*.

The *Quality Manual* is reviewed periodically by the Quality Manager and/or laboratory personnel to insure it still reflects current practices and meets the requirements of any applicable regulations or client specifications. Sections of the manual are updated by making a change to the Section and then increasing the revision number by one. The cover sheet of the *Quality Manual* (Section 1) must be re-signed and the Table of Contents (Section 2) will be updated whenever a Section is updated.

The *Quality Manual* is considered confidential within the laboratory and may not be altered in anyway except by approval of the Laboratory Management. If it is distributed to external users, it is for the purpose of reviewing the laboratory's management system and may not be used for any other purpose without written permission.

Section 4

ORGANIZATION
(TNI V1:M2 – Section 4.1)

The laboratory is a legally identifiable organization, and is responsible for carrying out testing activities that meet the requirements of the *TNI Standard* and that meet the needs of the client. Through application of the policies and procedures outlined in this Section and throughout the *Quality Manual*:

- The laboratory assures that it is impartial and that personnel are free from undue commercial, financial, or other undue pressures that might influence their technical judgment.
- Management and technical personnel have the authority and resources to carry out their duties and have procedures to identify and correct departures from the laboratory's management system.
- Personnel understand the relevance and importance of their duties as related to the maintenance of the laboratory's management system.
- Ethics and data integrity procedures insure personnel do not engage in activities that diminish confidence in the laboratory's capabilities (see Section 5 – "Management" and *LP15 Data Integrity, Deviations, and Improper Practices SOP*).
- Confidentiality is maintained.

4.1 Organization

The laboratory is a municipal laboratory and is part of Pinellas County Government.

Pinellas County has a charter, being Laws of Florida ch. 80-590, § 1. The charter was effective upon approval at referendum and was approved at an election held on Oct. 7, 1980.

The laboratory operates in Pinellas County, in the city of Largo, Florida.

The Pinellas County Government organization chart can be found in the Master List of Documents.

The laboratory's organization chart can be found in the Master List of Documents. Additional information regarding responsibilities, authority and interrelationships of personnel who manage, perform or verify testing is included in Section 5 – "Management" and Section 20 – "Personnel". These Sections also include information on supervision, training, technical management, job descriptions, quality personnel, and appointment of deputies for key managerial personnel.

4.2 Conflict of Interest and Undue Pressure

Being a "not-for-profit" municipal laboratory, that is not in competition with other laboratories for business, provides an environment that is free of conflicts-of-interest and undue pressure. Also, being a separate organizational unit within Pinellas County Government minimizes the potential for conflicting or undue interests from other organizational units. The laboratory is within the Pinellas County Government's Utilities Department, Water Quality Division, with its own management team that runs the day-to-day operations.

In addition, there are training, policies, and procedures in place to aid in the prevention of outside pressures or involvement in activities that may affect competence, impartiality, judgment, operational integrity, or the quality of the work performed at the laboratory. Many of these may be found at the County's Human Resources internet website, such as Personnel Rules regarding Non-County Employment, Discipline, Political Activities, etc. The Pinellas County Government *Ethics Essentials* training video, which is required for all county employees upon employment, is available at http://www.pinellascounty.org/hr/videos.htm. *Laboratory Data Integrity and Ethics* Training is required and provided for all laboratory staff annually.

Pinellas County's Human Resources internet is located at http://www.pinellascounty.org/hr/default.htm.

Section 5

MANAGEMENT
(TNI V1:M2 – Section 4.2)

The laboratory maintains a management system that is appropriate to the scope of its activities. The laboratory documents policies, procedures, etc. to assure the quality of its operation.

5.1 Management Requirements

Top management includes the Laboratory Managers, one of which is the Quality Manager. Laboratory Managers are also Technical Managers (TNI definition).

Management's commitment to good professional practices and to the quality of its products is defined in the Quality Policy statement, Section 5.3.

Management has overall responsibility for the technical operations and the authority to generate the required quality of laboratory operations. Management insures communication within the organization to maintain an effective management system and communicates the importance of meeting customer, statutory, and regulatory requirements. Management assures that the system documentation is known and available so that appropriate personnel can implement their part. When changes to the management system occur or are planned, managers insure that the integrity of the system is maintained.

Management is responsible for carrying out testing activities that meet the requirements of the *TNI Standard, the ISO/IEC 17025 Standard*, applicable regulations, permits, and that meet the needs of the client.

Managers implement, maintain, and improve the management system, and identify noncompliance with the management system of procedures. Managers initiate actions to prevent or minimize noncompliance.

Management insures technical competence of personnel operating equipment, performing tests, evaluating results, or signing reports, and limits authority to perform laboratory functions to those appropriately trained and/or supervised. See Section 20 – "Personnel" for requirements related to hiring and retention.

Management is responsible for defining the minimal level of education, qualifications, experience, and skills necessary for all positions in the laboratory and assuring that technical staff have demonstrated capabilities in their tasks.

Training is kept up to date as described in Section 20 – "Personnel" by periodic review of training records and through employee performance reviews.

Management bears specific responsibility for maintenance of the management system. This includes defining roles and responsibilities to personnel, approving documents, providing required training, providing a procedure for confidential

reporting of data integrity issues, and periodically reviewing data, procedures, and documentation. The assignment of responsibilities, authorities, and interrelationships of the personnel who manage, perform, or verify work affecting the quality of environmental tests is documented in Section 20 – "Personnel".

Management insures that audit findings and corrective actions are completed within required time frames.

Designated interim managers are appointed by management during the absence of the Laboratory Manager, the Technical Manager or the Quality Manager, and always if the absence is more than 15 days.

5.2 Management Roles and Responsibilities

5.2.1 Laboratory Manager

The Laboratory Manager is responsible for the overall quality, safety, financial, technical, human resource and service performance of the laboratory. The Laboratory Manager provides the resources necessary to implement and maintain an effective quality and data integrity program.

5.2.1.1 Responsibilities

The Laboratory Managers are responsible for:

a) Insuring that personnel are free from any commercial, financial and other undue pressures that might adversely affect the quality of their work.
b) Ensuring that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and insures that this training has been documented.
c) Ensuring that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the Quality Manual, laboratory SOPs or laboratory policies may be temporarily suspended by the Division Manager.
d) Reviews and approves all SOPs and policies prior to their implementation and insures all approved SOPs and policies are provided to laboratory personnel and are adhered to.

5.2.2 Quality Manager

The Quality Manager (or designee) is responsible for the oversight and review of quality control data, but is independent from laboratory operations. Reference the Organizational Chart to show that the Quality Manager does not report to the Technical Manager. The Quality Manager's training and proof of experience in QA/QC procedures, knowledge of analytical methods, and the laboratory's management system are available in his personnel and/or training file.

5.2.2.1 Responsibilities

The Quality Manager is responsible for:

a. serving as a focal point for QA/QC;
b. arranging or conducting annual internal audits without outside (e.g., managerial) influence;
c. notifying management of deficiencies, and monitoring corrective actions;
d. oversight and review of quality control data;
e. arranging or conducting internal audits annually;
f. monitoring corrective actions;
g. ensuring that the management system related to quality is implemented and followed at all times;
h. monitoring and maintaining laboratory certifications; and
i. keeping this *Quality Manual* current.

5.2.3 Technical Manager

The Technical Manager (or designee) is a full-time laboratory staff member and supervises laboratory operations and data reporting. Technical Managers may be Laboratory Managers and/or Sr. Chemists. Technical Managers must meet the requirements as set forth in the *TNI Standard - EL-V1M2-2009,* Section 5.2.6.1 a) through c) and/or 5.2.6.2 a) through c). The Technical Manager's proof of experience in the fields of accreditation may be found in his/her personnel and/or training file. The Technical Managers are listed in Section 1.

If a Technical Manager is absent for fifteen (15) calendar days or more, an interim Technical Manager with appropriate qualifications will perform the absent Technical Manager's duties. This interim Technical Manager's responsibilities are assigned to other Technical Managers on a rotating basis, taking in consideration workload and availability. Beyond a thirty-five (35) calendar day absence, management will notify the primary accreditation body in writing of the absence of the Technical Manager and the appointment of the deputy.

The Technical Manager is not the Technical Manager of more than one accredited environmental laboratory.

5.2.3.1 Responsibilities

The Technical Manager is responsible for:

a. meeting the general and education requirements and qualifications found in Section 5.2.6.1 of the *TNI Standard - EL-V1M2-2009*;
b. meeting the requirements and performing duties as listed in Section 4.1.7.2 of the *TNI Standard - EL-V1M2-2009*;
c. monitoring performance data and the validity of the analyses for the laboratory;
d. other miscellaneous duties as needed.

5.3 Quality Policy

The Laboratory utilizes a Quality System approach, defined by TNI as "a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products, and services". The Quality System provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance (QA) and quality control (QC) activities." (*TNI Standard - EL-V1M2-2009 Section 3.1*).

Management's commitment to quality and to the execution of a Quality System is stated in the Quality Policy below.

Quality Policy:
The objective of the management system and the commitment of management are to consistently provide our customers with data of known and documented quality that meets their requirements. It is also using best practices to maintain analytical and service quality as well as complying with the TNI Standard. The laboratory insures that personnel are free from any commercial, financial, and other undue pressures, which might adversely affect the quality of work (as stated in section 4.2 Conflict of Interest and Undue Pressure of this manual). This policy is implemented and enforced through the commitment of management, at all levels, to the Quality Assurance (QA) principles and practices outlined in this manual. However, the primary responsibility for quality rests with each individual within the laboratory organization. All lab staff must ensure that the generation and reporting of quality analytical data is a fundamental priority. Every laboratory employee is required to familiarize themselves with the quality documentation and to apply these policies and procedures in their work. All employees are trained annually on ethical principles and procedures as described in Section 19 – "Data Integrity & Data Integrity Investigations". The laboratory maintains client confidentiality, but is subject to the requirements of the *Florida Government-in-the-Sunshine Law* which may be found in Chapter 286 of the Florida Statutes.

5.4 Ethics and Data Integrity System

The laboratory has a data integrity policy, *Data Integrity, Deviations, and Improper Practices SOP (LP15)*. The laboratory's data integrity program, training and investigations are discussed in Section 19 – "Data Integrity & Data Integrity Investigations".

5.5 Documentation of Management / Quality System

The management system is defined through the policies and procedures provided in this *Quality Manual* and written laboratory Standard Operating Procedures (SOPs) and other policies and procedures.

5.5.1 Quality Manual

The *Quality Manual* contains the following required items:

5.5.1.1 document title;

5.5.1.2 laboratory's full name and address;

5.5.1.3 name, address (if different from above), and telephone number of individual(s) responsible for the laboratory;

5.5.1.4 identification of all major organizational units which are to be covered by this quality manual and the effective date of the version;

5.5.1.5 identification of the laboratory's approved signatories;

5.5.1.6 the signed and dated concurrence (with appropriate names and titles), of all responsible parties including the quality manager(s), technical manager(s), and the agent who is in charge of all laboratory activities, such as the laboratory director or laboratory manager;

5.5.1.7 the objectives of the management system and contain or reference the laboratory's policies and procedures;

5.5.1.8 the laboratory's official quality policy statement, which shall include management system objectives and management's commitment to ethical laboratory practices and to upholding the requirements of this Standard; and

5.5.1.9 a table of contents, and applicable lists of references, glossaries and appendices.

This *Quality Manual* contains or references all required elements as defined by the TNI Standard - V1:M2, Section 4.2.8.4.

5.5.2 Standard Operating Procedures (SOPs)

Standard operating procedures (SOPs) are written documents that describe various laboratory processes or operations. They include an effective date, revision number, signature of the approving authorities, signatures of users of the SOP, and are available to all personnel. They contain sufficient detail so that someone with similar qualifications could perform the procedure. SOPs are updated periodically to stay current with changes and/or improvements and may reference other documents, manuals, books, etc. as needed.

There are two types of SOPs used in the laboratory: 1) test method SOPs, which have specific requirements as outlined below, and 2) general use SOPs which document more general procedures. SOPs are written on an as needed basis and are updated as described in *LP3, Updating SOPs*.

Each accredited analyte or method has an SOP. A test method SOP may be a copy of a published, reference method with any additions/changes clearly described; but that is not the general practice at this laboratory. The laboratory's test method SOPs include the following topics, where applicable:

i. identification of the method;
ii. applicable matrix or matrices;
iii. limits of detection and quantitation;
iv. scope and application, including parameters to be analyzed;

v. summary of the method;
vi. definitions;
vii. interferences;
viii. safety;
ix. equipment and supplies;
x. reagents and standards;
xi. sample collection, preservation, shipment and storage;
xii. quality control;
xiii. calibration and standardization;
xiv. procedure;
xv. data analysis and calculations;
xvi. method performance;
xvii. pollution prevention;
xviii. data assessment and acceptance criteria for quality control measures;
xix. corrective actions for out-of-control data;
xx. contingencies for handling out-of-control or unacceptable data;
xxi. waste management;
xxii. references; and
xxiii. any tables, diagrams, flowcharts and validation data.

5.5.3 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows unless otherwise noted:

- Regulations/Permit Requirements
- *Quality Manual*
- Published, Reference Test Method
- SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

Section 6

DOCUMENT CONTROL
(TNI V1:M2 – Section 4.3)

This section describes how the laboratory establishes and maintains a process for document control. Procedures for document management include controlling, distributing, reviewing, and accepting modifications. The purpose of document control is to preclude the use of invalid and/or obsolete documents.

According to *EL-TNI V1:M2 Section 4.3*, documents could be policy statements, procedures, specifications, calibration tables, charts, textbooks, posters, notices, memoranda, software, drawings, plans, etc. The laboratory classifies policies, procedures, SOPs, job descriptions, and final reports as documents. Calibration tables are classified as records (see Section 16 – "Control of Records"). Other items, such as charts, books, posters, notices, memos, software, drawing, plans, etc that are not part of an SOP, procedure, or policy are also not considered as documents. Documents as well as items not considered documents may be on various media, whether hard copy or electronic, and they may be digital, analog, photographic or written.

The laboratory manages two types of documents: 1) controlled and 2) obsolete.

A controlled document is one that is uniquely identified, issued, tracked, and kept current as part of the management system. Controlled documents may be internal documents or external documents.

Obsolete documents are documents that have been superseded by more recent versions or are no longer needed, but are archived in a secure location for historical reference purposes.

6.1 Controlled Documents

Controlled documents are, for the most part, products of Pinellas County Utilities Laboratory as well as Pinellas County Government. Uniquely identifying documents (and revisions thereto) is accomplished by including the title, revision number, effective date, page numbers, total number of pages, and approving authority(ies). Most documents are available as paper copies and electronically through the laboratory computer system. An electronic *Master List of Documents* may be found in the laboratory computer system, which is readable by all staff, but can only be updated by Management and the Quality Assurance Officer. There is no "distribution" of documents since they are viewable electronically by staff, and only one copy is printed for reference. Generally changes to laboratory analytical SOPs follow the procedure outlined in *LP3, Updating SOPs*.

Control of documents include:

- Although some documents may be written or updated by various lab staff; only review and approval are performed by authorized personnel which are generally Sr. Chemists and Management (Technical Managers).
- Documents are made available for use only after approval.

- A meeting, training, or email may be used to describe/release the new or updated document, including information about who needs to read and sign it. This is done by a Technical Manager. Only one hard copy, which contains original signatures, is printed for use.
- Out-dated or old revisions of controlled documents are clearly identified (marked as "Obsolete") and archived in separate files, both physically and electronically.
- Electronic documents that are considered controlled documents also follow the aforementioned controls. Access to original, electronic, controlled documents is restricted by the level of security that is assigned to an individual staff member. They are "read-only" for most staff members, except for Management and the Quality Assurance Officer.
- It is the responsibility of the Laboratory Manager, Quality Manager, or their designee, and the Quality Assurance Officer to maintain obsolete documents in secure files that are made available to personnel only as needed.

Documents are reviewed periodically to insure their contents are suitable, in compliance with the current management system requirements, and accurately describe current operations. Most SOPs and related documents are reviewed annually during the internal audit process, but other SOPs and documents may be reviewed with less frequency depending upon their content, use, and stability of information contained within. Documents not reviewed annually may be reviewed anywhere from every 2-5 years, with management reserving the right to exceed that time frame when deemed appropriate.

6.1.1 Document Changes to Controlled Documents

6.1.1.1 Paper (hard copy) Document Changes

Changes that are not process modifications, that are considered minor or clarifying, may be performed without a change in the revision number. However, such changes/modifications, including handwritten changes, must be approved by one of more Technical Managers. This approval is recorded by stamping the document next to the change with the "Changes Made By:" stamp. This stamp requires the Sr. Chemist, QAO, and a Manager's signature (for approval). Once approved, the modified document is then released. The original signature page (if there's room) or an addendum signature page is used to record required signatures. Whichever signature page is used, a notation must be made to signify why there is another set of signatures (i.e. due to the specific change made). Staff members then read and sign the "modified" procedure. In this case there is no obsolete document.

More significant or procedural changes/modifications to approved documents are incorporated into a new revision. This new revision must be approved by the Sr. Chemist, QAO, and Management (Technical Managers).
Once approved, the revised document is released. Staff members then read and sign the revised procedure. The obsolete document is removed from its location, marked as obsolete, and then filed in an obsolete file. The *Master List of Documents* is updated by Management or the QAO.

The reason(s) for the change/modification is provided as historical information in the revised document as listed in "Summary of Changes

made to this revision, and sections affected" section of the procedure.

6.1.1.2 Electronic Document Changes

Generally, paper copies of documents start as an electronic version. Electronic copies of controlled documents are kept in directories that allow "read-only" access to most staff members. Management and the QAO have a higher security clearance to add documents to these directories or modify such documents using the same process described earlier in this section (6.1). When a procedure is being updated/modified, a separate electronic copy is copied into the "aWork in Progress" folder until completed. Where practical, the altered text or new text in the draft is identified during the revision or review process to provide for easy identification of the modifications. Old revisions (obsolete) electronic documents are archived in an "Obsolete" directory (Archive Information), which allows "read-only" access to most staff members. Moving obsolete documents is a protected function and can only be done by Managers and the QAO.

6.2 Obsolete Documents

As described in 6.1.1.1 and 6.1.1.2, all obsolete documents are removed from general distribution, or otherwise prevented from unintended use. Obsolete documents retained for legal use or historical knowledge preservation are appropriately marked and retained. Periodically, depending on storage space, these documents are subject to archiving to the county's Records Management facility. Refer to Pinellas County Clerk of the Circuit Court, *Records Management Department Procedures* for how this is done.

Section 7

REVIEW OF REQUESTS, TENDERS AND CONTRACTS
(TNI V1:M2 – Section 4.4)

The review of new work assures that oversight is provided so that requirements are clearly defined, the laboratory has adequate resources and capability, and the test method is applicable to the customer's needs. This process assures that all work will be given adequate attention without shortcuts that may compromise data quality.

The laboratory does not utilize tender and/or contracts like commercial laboratories do. New work is usually conveyed less formally through phone calls, emails, or meetings. The client's requirements are discussed which may include items such as analyte lists, methods, project specific reporting limits (if any), project specific quality control requirements (if any), turnaround time, and requirements for data deliverables. This review also covers any work that will be subcontracted by the laboratory.

7.1 Procedure for the Review of Work Requests

Our laboratory is a "captive" lab and does not solicit business from other entities outside Pinellas County Government departments. Therefore, there are no tenders or contracts to review. The vast majority of work is on-going and repetitive since it is related to process control and is performed under a general, long-standing agreement with the other departments/divisions. However, modifications do occur at times. The Laboratory Management works with the client requesting the change or new project to determine if the laboratory has the necessary accreditations, resources, equipment, deliverables, and personnel to meet the work request. This is normally an informal process that may be accomplished by email, phone conversations, or meetings. Most modifications related to process control are minimal and short-term; therefore there are no formal documents other than the newly requested parameter(s) indicated on the COC.

For new projects, the work request is documented on a *Project Summary* form which is filled out by Laboratory Management. Once the laboratory's management determines the laboratory's capabilities and limitations, they will inform the requesting client about the laboratory's ability to perform the work requested. Work may be subcontracted when necessary. After project acceptance, the *Project Summary* form and any supporting documentation (emails, meeting notes, etc.) are placed in a Project folder for reference.

7.2 Documentation of Review

Records are maintained for work requests and any other relevant information when appropriate. However, some work that is on-going, repetitive, and related to process control has been performed under a general, long-standing agreements with the other departments/divisions for many, many years (in some cases preceding the institution of NELAC). Records of project-related information and/or communication with clients (including e-mails, fax, telephone conversations, etc) are kept where practical. Discussion and/or review of any "changes in the volume & type of work" are held during the Annual Management Meeting.

Section 8

SUBCONTRACTING OF ENVIRONMENTAL TESTS
(TNI V1:M2 – Section 4.5)

A subcontract laboratory (subcontractor) is defined as a laboratory external to this laboratory that performs analyses for our laboratory or other county departments.

When subcontracting analytical services, the laboratory management assures work requiring accreditation is placed with an appropriately accredited laboratory or one that meets applicable statutory and regulatory requirements for performing the tests.

8.1 Procedure

Pinellas County Utilities Laboratory maintains a contract with an appropriately accredited, full-service laboratory. Work that cannot be completed by our laboratory is sent to the sub-contracted laboratory. Occasionally, other laboratories are utilized based on the needs of the department collecting the samples and the abilities of the laboratories. The laboratory management maintains a list of subcontractors, with the bulk of the work going to one main contracted laboratory.

A copy of the accreditation certificate and analyte list (a.k.a. “scope”) from subcontractors is maintained by the subcontractor, and is available upon request as needed for evidence of compliance.

During the contract review process, the accreditation certificate and scope are reviewed by a county multi-departmental committee to insure the subcontract laboratory has the appropriate accreditation to do the work. Some work that is subcontracted is not required to be performed by an accredited laboratory because it is not related to permits or regulatory compliance.

Most work that is subcontracted is done so routinely, and the client is fully aware of which work is subcontracted. This results from a long-standing familiarity with on-going, process control work. Also, a listing of tests that are not performed by our laboratory has been provided to clients. However, when work that is routinely performed at our laboratory must be subcontracted, a laboratory manager, or designee, notifies the client of the intent to subcontract the work; which may be done by email, phone call, or meeting.

The laboratory performing the subcontracted work is identified in the final report. Either the final report is the subcontracted laboratory’s final report that is forwarded to the client or the subcontracted data is clearly identified as being from a subcontractor within our laboratory’s final report. The laboratory assumes responsibility to the client for the shipment of samples to the subcontractor, unless a client assumes that responsibility or a regulating authority specifies which subcontractor is to be used. The laboratory also may serve as a liaison with the subcontractor for reports or other needs.

Section 8.2: Approval of Subcontracting Laboratories

Our laboratory follows the very thorough process developed by the Pinellas County Purchasing Department when evaluating and selecting a subcontract laboratory (see Purchasing Department's "*Policy & Procedure Manual*").

Generally, bids/RFPs are solicited and received by the Purchasing Department, who then determines which bidders have met the specifications of the bid. Those laboratories are then evaluated by a multi-departmental committee, which includes a representative from the Purchasing Department. The following items are evaluated by the committee (listing is minimum requirements; other items, not listed here, may also be evaluated):

1. Copy of their Quality Manual. Insure data quality limits for relevant methods are acceptable and that training procedures are adequate.

2. The most recent two sets of proficiency results and any associated corrective actions.

3. Copy of necessary certifications verifying that the required approvals are current. Insure that all needed analytes are included; some may not be accreditable (if so, document). Certificate and scope of State of Florida are required, when applicable.

4. Copy of necessary certifications for subcontracted laboratories (of bidder) verifying that the required approvals are current. Insure that all needed analytes are included; some may not be accreditable (if so, document). Certificate and scope of State of Florida are required, when applicable.

5. Example final report to confirm format is compliant and provides the necessary information (optional).

6. Statement of Qualifications (SOQ) or Summary list of Technical Staff and Qualifications – position, education and years of experience.

7. The most recent two State of Florida Assessments (full lab) with corrective action responses.

Determination of the contract award is made following Purchasing Department's "*Policy & Procedure Manual*".

Section 9

PURCHASING SERVICES AND SUPPLIES
(TNI V1:M2 – Section 4.6)

The laboratory insures that purchased supplies and services that affect the quality of environmental tests are of the required or specified quality by using approved suppliers and products. The laboratory has procedures for purchasing, receiving, and storage of supplies.

9.1 Purchasing Procedure (general)

Products, services, or materials ordered and received are initially checked for correctness and damage. If these conditions are met, the packing slip is signed/initialed and dated by the staff member who received the delivery. The purchasing documents generally contain information that describes the services and supplies ordered. The description may include type, class, grade, identification, specifications, or other technical information.

A more detailed inspection is performed by the initiator of the item(s) ordered, if applicable. Again, the supplies received are inspected for breakage, leaks, or any other damage. Anything that is deemed unacceptable is placed in the "Hold" area until an acceptable resolution can be obtained. Supplies and chemicals are then checked for compliance with specifications related to its use (such as method specifications). The staff member who initiated the order for chemicals records it in the *Chemical Receipt Log*. He/she "checks" the "Inspected for Use / Method" column if specifications have been met or exceeded. The supplies received are stored according to manufacturer's recommendations, laboratory SOPs, or test method specifications.

Any documents received with the supplies and services including specifications, certificates of analyses, warranties, maintenance records, calibration records, etc., are retained in areas throughout the laboratory based on its application or use (i.e. SOP, files, yellow books, etc.).

9.2 Approval of Suppliers

The Pinellas County Purchasing Department along with laboratory management reviews and approves the suppliers of services and supplies (see Purchasing Department's "*Policy & Procedure Manual*" for detailed information). Many suppliers have been evaluated and contracted with Pinellas County for many years due to their successful performance. Laboratory management approves technical content of specific purchasing documents when the total cost is high or the item/vendor is new/unusual. Routine purchases, particularly of typical consumables, from approved/contracted vendors, are not necessarily preapproved by management; although the purchases are reviewed when the invoice is received.

Pinellas County Purchasing Department maintains a list of approved suppliers that have contracts/purchase orders associated with them. Laboratory management also

has a listing of suppliers that may be used, whether there is a contract/purchase order or not. However, other items may be purchased on a case by case basis from other suppliers with management's approval.

On-going evaluation of suppliers is accomplished by checking that the product, service, or material ordered and received is correct and free from damage. If these conditions are met, the packing slip is signed/initialed and dated by the staff member who received the delivery. The purchasing documents contain information that adequately describes the services and supplies ordered. The description may include type, class, grade, identification, specifications or other technical information.

Evaluation of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products, the overall quality of their services, their past history, and competitive pricing. Lack of negative notations on packing slips and purchasing documents generally signifies that the supplier is meeting the expectations of the laboratory. Only when repetitive or serious problems have been documented will a supplier risk being removed as a vendor for the lab.

Section 10

SERVICE TO THE CLIENT
(TNI V1:M2 – Section 4.7)

The laboratory collaborates with clients and/or their representatives in clarifying their requests and in monitoring laboratory performance related to their work. Each request is reviewed to determine the nature of the request and the laboratory's ability to comply with the request within the confines of prevailing statutes and/or regulations without risk to the confidentiality of other clients.

10.1 Client Confidentiality

Our laboratory insures the confidentiality and proprietary rights of client data, samples, and/or information in possession of the laboratory to the extent possible given we are a public entity and subject to the requirements of the *Florida Government-in-the-Sunshine Law* (Chapter 286 of the Florida Statutes). Since the client owns client materials and/or data in possession of the laboratory; release of any information or materials, other than to the client, must have prior approval of the client. This information or material will be returned to the client at their request. Generally, third party requests for data and information are referred to the client.

All electronic data (storage or transmissions) are kept confidential, based on technology and laboratory limitations, as required by client or regulation. Before test results or other information is transmitted electronically (i.e. email, fax, etc.), the information used to send it electronically is verified by the sender before use. When data must be transmitted by fax, a statement of confidentiality is included to help insure that if the data goes to the wrong place, we will be notified and the incorrectly-sent data will be returned or destroyed. Below is an example of a typical statement of confidentiality.

CONFIDENTIALITY NOTICE

This document contains confidential information from Pinellas County Utilities Laboratory, and is solely for the use of the individual/organization named in this document. If you are not the intended recipient, you are notified that disclosing, copying, distributing, or taking any action in reliance on the contents of this information is strictly prohibited.

Please return or destroy this document if you are not the intended recipient and contact immediately:

Pinellas County Utilities Laboratory Contact Person: Terri Grimes
727-582-2322

10.2 Client Support

Laboratory management and technical staff are available to discuss any technical questions or concerns the client may have. The client, or their representative, may be provided reasonable access to laboratory areas for witnessing testing. Delays or major deviations (which are rare) to the testing are communicated to the client by laboratory management by email or by phone. The laboratory will provide the client with all requested information pertaining to the analysis of their samples.

10.3 Client Feedback

The laboratory seeks both negative and positive feedback periodically. Feedback provides acknowledgement, corrective actions where necessary, and opportunities for continuous improvement. This is normally an informal process that may be accomplished by email, phone conversations, or meetings. Periodically customer satisfaction surveys are generated.

Negative customer feedback is documented as a customer complaint (see Section 11 – "Complaints").

Section 11

COMPLAINTS
(TNI V1:M2 – Section 4.8)

The purpose of this section is to assure that customer complaints are addressed and corrected (when applicable). This includes requests to verify results/analytical data, which comprise the bulk of the complaints received by our laboratory. Complaints provide the laboratory an opportunity to improve laboratory operation and client satisfaction.

Laboratory staff is expected to remember our mission and shared values when dealing with our customers, such as:

- Provide the *highest quality services* and results to clients
- Promote and *encourage all avenues of laboratory communication*
- *Recognize the needs* of the client and strive to *meet or exceed their expectations.*
- *Demonstrate honesty and integrity in all dealings* with clients and employees
- *Provide quality data and services* that meet required criteria as well as meeting our clients' expectations

All complaints are investigated. Complaints may be received by email, phone calls, surveys, etc. Information to assist in the investigation of the complaint is received or recorded. Complaints are documented by the person receiving the complaint and addressed to the responsible Manager or Sr. Chemist. Depending upon the nature of the complaint, it may be documented on a Data Check Form (DCF), following *LP7, Data Check Process* SOP, survey results, email, notes, etc. Complaints may also be utilized to assess laboratory performance, such as in Annual Management Reviews. Section 14 – Corrective Action may be also be utilized in the investigation of a complaint.

Generally, once a complaint is received and investigated, management reviews the complaint investigation and determines if any further actions are necessary. When there are actions to be taken, management insures the execution of those actions, including the issuance a "Corrected" report if necessary. Clients are notified of the results of the investigation whether the complaint was determined to have merit or not.

Section 12

CONTROL OF NON-CONFORMING ENVIRONMENTAL TESTING WORK
(TNI V1:M2 – Section 4.9)

Non-conforming work is work that does not meet acceptance criteria or requirements. Non-conformances can include departures from standard operating procedures or test methods or unacceptable quality control results (see Section 27 – "Quality Assurance for Environmental Testing"). Identification of non-conforming work can come through customer complaints, quality control, instrument calibration, evaluating consumable materials, staff observation, final report review, management reviews, and internal and external audits.

12.1 Permitting Departures from Documented Policies and Procedures

Requests for departures from laboratory procedures are approved by Technical Managers, must be documented, and should be infrequent. Depending upon the type or complexity, the departure may be documented within the data packet, Corrective Action Detail Report, Case Narrative, or other forms approved by management. Planned departures from procedures or policies do not require audits or investigations. Client requested departures do not require corrective action, but must be clearly and fully documented after approval from management.

12.2 Non-Conforming Work

The lab policy for control of non-conforming work is to identify the non-conformance, determine if it will be permitted, and take appropriate action. All employees have the authority to stop work on samples when any aspect of the process does not conform to laboratory requirements.

The responsibilities and authorities for the management of non-conforming work are detailed in *LP18 Preventative and Corrective Actions Policy*. The procedure for investigating and taking appropriate corrective actions of non-conforming work are described in Section 14 – "Corrective Actions". Section 14.3 also describes procedures for Technical Corrective Actions. Formal corrective action procedures must be followed for non-conforming work that could reoccur (beyond expected random QC failures) or where there is doubt about the laboratory's compliance to its own policies and procedures.

The investigation and associated corrective actions of non-conforming work involving alleged violations of the Data Integrity & Ethics policies must follow the procedures outlined in Section 19 – "Data Integrity Investigations".

The laboratory evaluates the significance of the non-conforming work and takes corrective action in a timely manner. The customer is notified if their data has been impacted. The laboratory allows the release of non-conforming data only with approval by management on a case-by-case basis. Non-conforming data is clearly identified in the final report (see Section 28 – "Reporting the Results").

The discovery of a non-conformance for results that have already been reported to the customer must be immediately evaluated for significance of the non-conformance, its acceptability to the customer, and determination of the appropriate corrective action. Management of reported, nonconforming data may be found in *LP18, Preventative and Corrective Actions Policy.*

12.3 Stop Work Procedures

LP18, Preventative and Corrective Actions Policy discusses who may stop work if a non-conformance is found. Resumption of work after work has been stopped is authorized by Technical Managers. Any non-conforming work that may involve a violation of the data integrity practices must be reported as soon as possible to management (see *LP 15, Data Integrity, Deviations, Improper Practices SOP*).

Section 13

IMPROVEMENT
(TNI V1:M2 – Section 4.10)

Improvement in the overall effectiveness of the laboratory management system is a result of the implementation of the various aspects of the laboratory's management system: quality policy and objectives (Section 5 – "Management"); internal auditing practices (Section 17 – "Internal Audits"); the review and analysis of data (Section 27 – "Quality Assurance for Environmental Testing"); the corrective action (Section 14 – "Corrective Action") and preventive action (Section 15 – "Preventive Action") process; and the annual management review of the quality management system (Section 18 – "Management Reviews") where the various aspects of the management/quality system are summarized, and evaluated and plans for improvement are developed.

Section 14

CORRECTIVE ACTION
(TNI V1:M2 – Section 4.11)

Corrective action is the action taken to minimize or eliminate the cause(s) of non-conformity or other undesirable situation in order to minimize or prevent recurrence.

Deficiencies cited in external assessments, internal audits, data reviews, customer feedback/complaints, control of non-conforming work, or managerial reviews typically require investigation and corrective action. Corrective actions are discussed in *LP 18, Preventative and Corrective Actions Policy.*

14.1 General Procedure

Once a non-conformance or deviation is found, an evaluation of it must occur. If the non-conformance is easily corrected (through "technical corrective action"), root cause analysis is not warranted. If the non-conformance cannot be easily corrected, then root cause analysis must be performed as listed in LP18. Corrective actions must be implemented in a timely manner and may be captured on a variety of forms, such as data packets, Data Review Forms (DRF), Corrective Action Detail Reports, Case Narratives, and others. Once approved, corrective actions are implemented, and are then followed by an audit. Corrective actions are reviewed periodically by management. An electronic file folder is used to document and track corrective actions for such reviews.

All laboratory staff are responsible for initiating corrective actions whenever a non-conformance is found that could reoccur (beyond expected random QC failures) or where there is doubt about the compliance of the laboratory to its own policies and procedures. Technical managers are responsible for monitoring and insuring the documentation of corrective actions.

14.1.1 Cause Analysis

When failures due to systematic errors have been identified, the first step of the corrective action process starts with the initial investigation and determination of root cause(s) of the problem. Records are maintained as outlined in *LP18, Preventative and Corrective Action Policy*.

Where there may be non-systematic errors, and as such the initial cause is readily identifiable or expected random failures (e.g. failed quality control), root cause analysis is not performed and the process begins with selection and implementation of corrective action (also see Section 14.3 "Technical Corrective Actions").

14.1.2 Selection and Implementation of Corrective Actions

The process in *LP18, Preventative and Corrective Action Policy* is used for the identification, classification, and implementation of corrective actions. The appropriate Technical Manager insures that corrective actions are discharged properly in a timely manner.

14.1.3 Monitoring of Corrective Action

Technical Managers monitor implementation and documentation of the corrective action to insure that the corrective actions were effective. Follow up audits may be conducted to insure continued implementation of corrective actions as discussed in LP18.

14.2 Additional Audits

Where the identification of non-conformances or departures from normal lab procedures cast doubt on the laboratory's compliance with its own policies and procedures or on its compliance with the *TNI Standard*, the laboratory insures that the appropriate areas of activity are audited in accordance with Section 17 – "Internal Audits" as soon as possible.

In many cases, the additional audits are follow-ups after corrective actions have been implemented to insure effectiveness and continued implementation.

14.3 Technical Corrective Action

Analysts routinely implement corrective actions for data with unacceptable QC measures following the process outlines in LP18. Generally, the first level correction may include re-analysis without further assessment. If the test method SOP addresses specific actions to take, they are followed. Otherwise, corrective actions start with assessment of the cause of the problem.

Corrective actions for non-systematic errors or expected random failures are documented in the data packet. Corrective actions for non-conformances that may reoccur (beyond expected random QC failures) or where there is concern that the laboratory is not in compliance with its own policies and procedures usually require that *LP 18, Preventative and Corrective Actions Policy* be followed and a Corrective Action Detail Report completed. Other forms may be used that better suit the situation.

Technical managers' review the forms used to document corrective actions and may suggest improvements, alternative approaches, or other procedures.

If the data reported are affected adversely by the non-conformance, the affected data is clearly identified in the report to the customer and/or the customer may be otherwise notified.

Section 15

PREVENTIVE ACTION
(TNI V1:M2 – Section 4.12)

Preventive action is a pro-active process to identify opportunities for improvement rather than a reaction to the identification of problems or complaints, see *LP18 Preventative and Corrective Actions.*

Preventive action includes, but is not limited to: review of QC data, regularly scheduled staff quality meetings to insure staff is knowledgeable in quality procedures, review of client feedback to look for improvement opportunities, review of proficiency testing data to look for analytes that were nearly missed, annual managerial reviews, scheduled instrument maintenance, and other actions taken to prevent problems.

When improvement opportunities are identified or if preventive action is required, action plans are developed, implemented and monitored to reduce the likelihood of the occurrence of non-conformities. The Preventative Action Report (in LP18) is a useful tool to document and track preventative actions. Preventative actions may also be listed in the Actions Items of the Annual Management Report.

All personnel have the authority to offer suggestions for improvements and to recommend preventive actions (see *LP15 Data Integrity, Deviations, Improper Practices*); however management is responsible for implementing preventive action.

Section 16

CONTROL OF RECORDS
(TNI V1:M2 – Section 4.13)

Records are data recordings that include annotations, such as daily refrigerator temperatures posted to a laboratory form, lists, spreadsheets, or analyst notes on a chromatogram. Records may be on any form of media, including electronic and hard copy. Records allow for the historical reconstruction of laboratory activities related to sample-handling and analysis.

The laboratory maintains a record system appropriate to its needs, records laboratory activities, and complies with applicable standards or regulations as required. Records of original observations and derived data are retained to establish an audit trail. Records help establish factors affecting the uncertainty of the test and enable test repeatability under conditions as close as possible to the original.

16.1 Records Maintained

Records of procedures to which a sample is subjected while in the possession of the laboratory are kept. The laboratory retains original observations, calculations and derived data (with sufficient information to produce an audit trail), calibration records, personnel records, and a copy of the test report for a minimum of five years from generation of the last entry in the records. At a minimum, the following records are maintained by the laboratory to provide the information needed for historical reconstruction (that are applicable):

i) raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' worksheets and data output records (chromatograms, strip charts, and other instrument response readout records);

ii) written description or reference to the specific method(s) used, which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value (a copy of all pertinent Standard Operating Procedures). Many analyses employ a calibration curve to determine sample values; since this is a basic premise in Chemistry, it is not specifically described nor referenced within analytical SOPs.

iii) laboratory sample ID code (LIMS ID number);

iv) date of analysis;

v) time of analysis is required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., extractions and incubations);

vi) instrumentation identification and instrument operating conditions/parameters (or reference to such data);

vii) manual calculations;

viii) analyst's or operator's initials/signature or electronic identification;

ix) sample preparation, including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;

x) test results (including a copy of the final report);

xi) standard and reagent origin, receipt, preparation, and use;

xii) calibration criteria, frequency, and acceptance criteria;

xiii) data and statistical calculations, review, confirmation, interpretation, assessment, and reporting conventions;

xiv) quality control protocols and assessment;

xv) electronic data security (specified by user level assigned), software documentation and verification (done by software developer/manufacturer), software and hardware audits (annual excel calculation checks and LIMS audit), backups (performed by Pinellas County BTS Dept.), and records of any changes to automated data entries (not applicable);

xvi) method performance criteria including expected quality control requirements;

xvii) proficiency test results;

xviii) records of demonstration of capability for each analyst;

xix) a record of names, initials, and signatures for all individuals who are responsible for signing or initialing any laboratory record (see Master List of Documents);

xx) correspondence relating to laboratory activities for a specific project;

xxi) corrective action reports;

xxii) preventive action records;

xxiii) copies of internal and external audits including audit responses;

xxiv) copies of all current and historical laboratory SOPs, policies and *Quality Manuals* (may be archived off-site in Records Management Dept.);

xxv) sample receiving records (including information on any inter-laboratory transfers);

xxvi) sample storage records;

xxvii) data review and verification records;

xxviii) personnel qualification, experience and training records;

xxix) archive records (may be archived off-site in Records Management Dept.); and

xxviv) management reviews.

16.2 Records Management and Storage

The laboratory maintains records such as laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage, and reporting. Data is recorded immediately and legibly in permanent ink (data generated by automated data collections systems is recorded electronically). Corrections are initialed and dated with the reason noted for corrections other than transcription errors. A single line strikeout is used to make corrections so that the original record is not obliterated.

All data stored on the Pinellas county network system as well as laboratory computers are backed up according to the SOP titled *LP29, Analytical Data Retention and Recovery Policy*.

Records, including electronic records are retrievable, legible, and protected from deterioration or damage; held secure and in confidence; and are available to accrediting bodies for a minimum of five years or as required by regulation or contract. Records that are stored only on electronic media are supported by the hardware and software necessary for their retrieval. Access to protected records is limited to laboratory management to prevent unauthorized access or amendment.

Additional information regarding control of data is included in Section 22.5 – "Control of Data".

Procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records are found in the *Pinellas County Records & Information Management User's Manual*. Quality records shall include reports from internal audits and management reviews as well as records of corrective and preventive actions.

Archived information and access logs are protected against fire, theft, loss, environmental deterioration, vermin, and in the case of electronic records, electronic or magnetic sources. Archived records have limited access and are checked out through an electronic access log. This system in maintained by the Pinellas County Clerk of the Circuit Court.

In the event that the laboratory transfers ownership or goes out of business, records are maintained or transferred according to client instructions. Appropriate regulatory and state legal requirements concerning laboratory records shall be followed.

16.3 Legal Chain of Custody Records

The laboratory does not use Legal Chain of Custody because we do not receive evidentiary samples that may be used as legal evidence. Any samples that are of that nature would be directly sent by the collector to a private, contracted laboratory that has that capability.

Section 17

AUDITS
(TNI V1:M2 – Section 4.14)

Audits measure laboratory performance and/or verify compliance with method, accreditation/certification, regulatory, and project requirements. Audits provide management with an on-going assessment of the management system. They are also instrumental in identifying areas where improvement in the management/quality system will increase the reliability of data. Audits may be categorized into one or more of four types: internal, external, performance, and system.

17.1 Internal Audits

The laboratory prepares a schedule of internal audits to be performed during the year. These audits verify compliance with the requirements of the management/quality system, analytical methods, SOPs, the *Quality Manual*, ethics policies, data integrity, other laboratory policies, and the TNI Standard.

It is the responsibility of the Quality Manager to plan and organize audits as required by the schedule and requested by management. These audits are carried out by trained and qualified personnel who are, wherever resources permit, independent of the activity to be audited.

In addition to the scheduled internal audits, it may sometimes be necessary to conduct special audits as a follow-up to corrective actions, PT results, complaints, regulatory audits, or alleged data integrity issues. These audits usually address specific issues.

The area audited, the audit findings, and corrective actions are recorded. Audits are reviewed after completion to insure that corrective actions were implemented and effective.

17.2 External Audits

It is the laboratory's policy to cooperate and assist with all external audits, whether performed by clients, an accrediting body, or an approved third-party assessment organization contracted with the accrediting body. Management insures that all areas of the laboratory are accessible to auditors as applicable and that appropriate personnel are available to assist in conducting the audit.

17.3 Performance Audits

Performance audits may be Proficiency Test Samples, internal single-blind samples, double-blind samples through a provider or client, or anything that tests the performance of the analyst and method.

Proficiency Test Samples are discussed in Section 27.3 – "Proficiency Test Samples or Interlaboratory Comparisons". Internal single- and double-blind samples may be

run through the laboratory randomly. *LP 9 Blinds and Interlab Studies* SOP is used to execute such studies.

17.4 System Audits

The Laboratory's management system is audited through annual management reviews. Refer to Section 18 – "Management Reviews" for further discussion of management reviews.

17.5 Handling Audit Findings

Internal or external audit findings (or deficiencies) are responded to within the time frame agreed to at the time of the audit or as required by certification. The response may include action plans that may not be completed within the response time frame. A completion date is established by management for each finding and included in the action plan response.

The responsibility for developing and implementing corrective actions to findings is the responsibility of whomever management assigns, usually the Sr. Chemist assigned to that general area of operation. Non-audit/assessment-type corrective actions are documented through the corrective action process described in Section 14 – "Corrective Actions". For external assessments, corrective actions are documented on the "*State of Florida Department of Health Statement of Deficiencies and Plan of Correction*" (form). For internal audits, corrective actions are documented on a similar form entitled, "*Pinellas County Utilities Laboratory, Internal Audit, Statement of Findings and Corrective Action Plan*".

Audit findings that cast doubt on the effectiveness of the laboratory operation to produce data of known and documented quality or that question the correctness or validity of sample results must be investigated in a timely manner. Corrective action procedures described in Section 14 – "Corrective Action" must be followed. Clients must be notified in writing if the investigation shows the laboratory results have been negatively affected and/or the clients' requirements have not been met. Laboratory management insures that the client is notified in a timely manner after the laboratory completes corrective actions and has determined if the client's results are affected.

All investigations that result in findings of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients. See Section 19 (Data Integrity Investigation) for additional procedures for handling inappropriate activity.

Section 18

MANAGEMENT REVIEWS
(TNI V1:M2 – Section 4.15)

Top management reviews the management system on an annual basis and maintains records of review findings and actions.

18.1 Management Review Topics

The following are reviewed to insure their suitability and effectiveness:

- the suitability of policies and procedures;
- reports from managerial and supervisory personnel;
- the outcome of recent internal audits;
- corrective and preventive actions;
- assessments by external bodies;
- the results of inter-laboratory comparisons or proficiency tests;
- changes in the volume and type of the work;
- customer feedback;
- complaints;
- recommendations for improvement;
- other relevant factors, such as quality control activities, resources, and staff training.

18.2 Procedure

Management reviews are held in the first quarter of each calendar year. Management, Sr. chemists, and other related personnel attend and present information and reports covering the topics listed in 18.1, above, as well as any other operational issues/reports deemed appropriate. Minutes are taken and stored by year in the laboratory's computer system in H:\Dept SOPs\Annual Mgmt Mtg. Action Items are listed within the minutes and are assigned to staff (including management) as deemed appropriate. Management will determine appropriate completion dates for action items and insure they are completed within the agreed upon time frame.

Section 19

DATA INTEGRITY
(TNI V1:M2 – Sections 4.2.8.1, 5.2.7)
and
DATA INTEGRITY INVESTIGATIONS
(TNI V1:M2 – Section 4.16)

The laboratory is committed to insuring the integrity of its data and providing data of known and documented quality to its clients. The elements of the Data Integrity include:

- documented data integrity procedure is reviewed, approved, signed, and dated by top management
- management reviews the data integrity procedure(s)
- documented data integrity procedure is read and signed by all lab staff, including management
- data integrity training is provided annually with a signature attendance sheet
- procedure for confidential reporting of alleged data integrity issues
- an audit program that looks at data integrity

19.1 Ethics and Data Integrity Procedures

The *Data Integrity, Deviations, Improper Practices SOP (LP15)* provides comprehensive information about policies and procedures for data integrity and related topics. Management reviews, approves, and signs/dates this SOP for each revision. This SOP is updated on an as needed basis. LP15 is also read, signed, and dated by all lab staff in acknowledgement of understanding and agreeing to follow it. Other procedures related to data integrity include:

- Data Integrity Training (LP15 & section 19.2 of this manual)
- Data Recall (LP15)
- Manual Integration Policy (LP30)
- Preventative and Corrective Action Policy (LP 18 & sections 14 & 15 of this manual)
- Data Integrity Investigations (LP 15 & section 19.3 of this QM)
- Pinellas County Statement of Ethics & training video (http://www.pinellascounty.org/hr/training/pdf/Ethics-Training.pdf)

19.2 Training

General county government ethics training, *Ethics Essentials*, may be provided to new staff members by a Pinellas County Government Attorney or by an on-line training video. This training discusses ethical and legal responsibilities of county employees. Upon completion of the training, an Ethics and Data Integrity Agreement is signed, and kept in the employee training file.

Annually, staff members are trained specifically on data integrity and laboratory ethics issues. Staff members read and sign the LP 15 SOP to acknowledge they

read, understand, and agree to follow it. They also must sign the attendance sheet from the annual refresher training.

On an ongoing basis as staff learns new procedures, they are trained on the importance of following policies and procedures, proper documentation, and how to maintain data integrity.

Data integrity training emphasizes the importance of proper written documentation on the part of the analyst with respect to those cases where analytical data may be useful, but are in one sense or another partially deficient.

The following topics and activities are covered:

- organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting;
- how and when to report data integrity issues;
- record keeping;
- training, including discussion regarding all data integrity procedures;
- data integrity training documentation (*LP15 Data Integrity, Deviations, Improper Practices*);
- in-depth data monitoring and data integrity procedure documentation; and
- specific examples of breaches of ethical behavior such as improper data manipulations, adjustments of instrument time clocks, and inappropriate changes in concentrations of standards.

19.3 Confidential Reporting of Ethics and Data Integrity Issues

Confidential reporting of data integrity issues is described *LP15 Data Integrity, Deviations, Improper Practices*.

19.3 Investigations

Investigations resulting from data integrity issues are conducted confidentially by management. Investigations are documented and notifications are made to clients who received any affected data. Procedures for such investigations are handled by management on a case-by-case basis and are dependent on the type and severity of the issue.

Section 20

PERSONNEL
(TNI V1:M2 – Section 5.2)

The laboratory employs competent personnel based on education, training, experience and demonstrated skills as required. The laboratory's organization chart can be found in the Master List of Documents.

20.1 Overview

All personnel are responsible for complying with all quality and data integrity policies and procedures that are relevant to their area of responsibility.

All personnel who are involved in activities related to sample analysis, evaluation of results or who sign test reports, must demonstrate competence in their area of responsibility. Appropriate supervision is given to any personnel in training and the trainer is accountable for the quality of the trainees work. Personnel are qualified to perform the tasks they are responsible for based on education, training, experience and demonstrated skills as required for their area of responsibility.

The laboratory has defined the minimum expectation with respect to education, training and skills for every position classification in the laboratory. These are outlined Pinellas County Government's website on the Human Resources web pages.

Specific training needs are identified at the time of employment and when personnel are moved to a new position or new responsibilities are added to their job responsibilities. Ongoing training, as needed, is also provided to personnel in their current jobs. The effectiveness of the training may be evaluated before the training is considered complete.

Pinellas County Government provides training for job enhancement, career development, specific skills, as well as many other types of training. This information may be accessed on-line at the Human Resources web pages.

Contracted personnel, when used, may be required to meet the same competency standards and follow the same policies and procedures that laboratory employees. The laboratory shall insure that contracted personnel are supervised, competent, and work in accordance with the laboratory's management system.

20.2 Job Descriptions

Job descriptions are available for all positions that manage, perform, or verify work affecting data quality, and are located Pinellas County Government's website on the Human Resources web pages. These job descriptions include the specific tasks, minimum education and qualifications, skills, and experience required for each position.

20.3 Training

All personnel are appropriately trained and competent in their assigned tasks before they contribute to functions that can affect data quality. It is management's responsibility to assure that personnel are trained. Training records may be used to document management's approval of personnel competency. The date on which authorization and/or competence is confirmed is included.

Training records are maintained by both Management and each staff member and includes both internal and external training. Training is documented both electronically and in training files held within the laboratory (green training binders & lab training binder).

20.3.1 Training for New Staff

New staff members are given the training outlined in the Training Checklists (see Master List of Documents for location).

20.3.2 Ongoing Training

Ongoing training is determined each year by management and is customized to what management views as needed and may included items listed in the Training Checklists (see Master List of Documents for location).

Section 21

ACCOMODATIONS AND ENVIRONMENTAL CONDITIONS
(TNI V1:M2 – Section 5.3)

21.1 Environmental Conditions & Security

The laboratory facility is a stand-alone building constructed in 1990 for laboratory use only. The lab was expanded in late 2005 through early 2006 to about 18,000 square feet. The laboratory has twelve separate labs to insure separation of analyses: microbiological, metals, nutrients, and wet chemistry. Each lab was specifically designed to optimize safety, usability, and analytical requirements as well as to minimize contamination. Chemicals are stored within the various labs for ease of use. Refrigerators, special cabinets, fume hoods, ventilation, or other special features are specific to each lab's purpose. Wastes are stored in the storage room in designated cabinets or other special storage containers. There is a separate sample receipt area and a large walk-in refrigerator for sample storage. Finally, there are two computer/electrical rooms to accommodate various computer/electrical equipment.

Most tests performed do not have special environmental requirements that are specified or are different than typical lab conditions. However, biological sterility is monitored in the microbiology lab to insure that conditions do not invalidate results or adversely affect any measurements (see Microbiology procedures for specifics).

Electrical power is supplied by the local public utility unless there is an outage, whereby an internal uninterrupted power source is automatically utilized. This system is tested on a weekly basis to insure proper operation.

Environmental tests would be stopped if the environmental conditions could jeopardize the analytical results.

21.2 Work Areas

Analytical testing is performed solely within the laboratory. The laboratory work spaces are adequate for their use, and appropriately clean to support environmental testing and insure an unencumbered work area. Laboratory space is arranged to minimize cross-contamination between incompatible areas of the laboratory (see 21.1 for more specifics).

The laboratory procedure for good housekeeping may be found in the laboratory's computer system at H:\Dept SOPs\Dept Policies\Annual Policy Training File\Housekeeping.doc. Smoking within the laboratory building is prohibited.

21.3 Floor Plan

The laboratory floor plan may be accessed from the Master List of Documents.

21.4 Building Security

Security cards are issued to employees or other entities that require access to the property. The extent of security clearance for each card is dependent on the level of access that is needed and/or permitted.

The laboratory property is fenced with a gate that is closed after regular business hours, weekends, and holidays. The gate can only be opened with an active, approved security card. Access to the laboratory may be attained, but is restricted. Different laboratory entrance doors require different levels of security clearance. Non-laboratory employees, such as the monitoring staff, only have access to the sample receipt area, while laboratory staff has access to the entire building. As necessary, other people may gain access to various areas within the laboratory, but they are accompanied by a laboratory staff member.

A Visitor's Logbook is maintained for visitors to sign in and out. Visitors, usually building maintenance, may be issued a temporary security access card that is returned before leaving or at the end of the day. Visitors are accompanied by laboratory personnel when in secure areas of the building.

Signs are used to designate secure areas.

Section 22

ENVIRONMENTAL METHODS AND METHOD VALIDATION
(TNI V1:M2 – Section 5.4 and Sections 1.4, 1.5 and 1.6 of Technical Modules TNI V1:M 3-7)

Methods and/or procedures are available for all activities associated with the analysis of samples including preparation and testing. For purposes of this section, "method" refers to both the sample preparation and determinative methods.

Before being put into use, a test method is confirmed by a demonstration of capability and/or method validation process.

Methods used by the laboratory are published, reference methods. Deviations from the methods are allowed only if the deviation is documented, technically justified, authorized by management and accepted by the customer

22.1 Method Selection

A reference method is a method issued by an organization generally recognized as competent to do so. (When ISO refers to a standard method, that term is equivalent to reference method.) When a laboratory is required to analyze a parameter (aka analyte) by a specified method due to a regulatory requirement, the parameter/method combination is recognized as a reference method.

The laboratory utilizes methods that meet the needs of the customer and are appropriate for the type of sample, analyte(s) needed, etc. Such methods are based on the latest edition of a standard (not method) unless it's not appropriate or possible to do so. An example of when it is not appropriate is when our customers require that we utilize test methods that are listed in various regulations/rules such as 40 CFR 136, 40 CFR 141, etc. In these cases, the laboratory uses the test methods listed in that source. Also, the laboratory is certified for a limited number of methods, and we only utilize a single revision of a method. Therefore, a customer generally cannot select an old, outdated revision of a method.

If a method proposed by a customer is considered to be inappropriate or out-dated, the customer is informed and the issue resolved before proceeding with the analysis of any samples. If a method cannot be run at our lab, the samples will be sent to our subcontracted laboratory.

If a method is not specified by the customer, an appropriate method will be selected based on our certification, the customer's needs, and to whom it will be reported. The customer will be informed of the selected method and must approve its use before being used to report data. Generally, our laboratory uses:

- methods mandated by the applicable regulatory authorities

- methods published in international, regional or national standards, other technical organizations (e.g. ASTM, Standard Methods, AOAC)
- manufacturer-developed methods

If the end use of the data is not regulatory, the laboratory will collaborate with the customer to determine their needs in terms of reporting level (e.g., LOD, LOQ), bias (e.g., screening versus quantitative) and the laboratory capabilities and capacity. Based on these criteria, an appropriate method will be selected.

22.2 Laboratory-Developed Methods

Not applicable at this time.

22.3 Method Validation

Validation is the confirmation, by examination and objective evidence, that the particular requirements for a specific intended use are fulfilled. Validation is designed so that the laboratory can demonstrate that the method is appropriate for its intended use. Method validation records shall be retained while the method is in use.

Generally, the laboratory follows the TNI Standard and the individual reference method for performing method validations. Additional requirements, if any, are included where required. The laboratory only uses established reference methods; we do not develop our own methods. Therefore, no other validation process is used.

Method Validation and Demonstration of Capability procedures can be found in *LP5, Method Validation (Chemistry), LP6, Method Validation (Microbiology), and LP10, DOC/CDOP Procedures.*

22.4 Estimation of Analytical Uncertainty

Analytical Uncertainty is a subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.

When requested, the laboratory will provide an estimate of the analytical uncertainty based on the article, "*Estimation of Laboratory Analytical Uncertainty Using Laboratory Control Samples*" by Thomas Georgian, Ph.D.

22.5 Control of Data

To insure that data are protected from inadvertent changes or unintentional destruction, the laboratory uses procedures to check calculations and data transfers (both manual and automated).

22.5.1 Computer and Electronic Data Requirements

The laboratory assures that computers, automated equipment, or microprocessors used for the acquisition, processing, recording, reporting, storage, or retrieval of environmental test data are:

- documented in sufficient detail and validated as being adequate for use;
- protected for integrity and confidentiality of data entry or collection, data storage, data transmission and data processing;
- maintained to insure proper functioning and are provided with the environmental and operating conditions necessary to maintain the integrity of environmental test data; and
- held secure including the prevention of unauthorized access to, and the unauthorized amendment of, computer records. Data archive security is addressed in Section 16 – "Control of Records" and building security is addressed in Section 21- "Accommodations and Environmental Conditions".

All calculations done electronically are subject to appropriate checks in a systemic manner. Commercial off-the-shelf software in general use within their designed application range are considered to be sufficiently validated by the vendor.

For many analytical procedures, the laboratory uses spreadsheets to record raw data and to apply simple, scientific processing to obtain final results (such as applying method-related calculations, dilution factors, scientific rounding, assessment of significant figures, etc.). To insure that the worksheet formulae are correct, the laboratory tests each set of cells used for input of the data as well all cells used for calculations. These checks are performed when the spreadsheet is initially created and then annually thereafter, or more frequently as driven by appropriate corrective actions. After a spreadsheet has been initially created and validated, the calculations (cells) are protected from inadvertent manipulations.

An annual inventory is taken of all method-related spreadsheets that have calculations embedded within them. The SOP titled *LP23, Computerized Calculation Checks* describes the process used to verify and document spreadsheet calculations. Hard copies of the annual inventory and checks are stored in this SOP manual, while electronic copies are stored in the same folder as the day-to-day data files.

The laboratory controls access to all program functions within the LIMS. These are used to acquire, process, record or report data. This system is password-protected and each employee is granted access only to those modules that he or she needs. The password is unique to the individual and cannot be shared. All programs that are used outside of the LIMS (Excel and lab instrumentation software) to acquire, process, record or report data are also controlled and limited to laboratory staff only.

A general description of how system backups are performed by the Pinellas County BTS department may be found in *LP29, Analytical Data Retention and Recovery Policy.*

22.5.2 Data Reduction

The analyst calculates final results from raw data or appropriate computer programs provide the results in a reportable format. The test methods provide required concentration units, calculation formulas, and any other information required to obtain final analytical results.

The laboratory has a *Manual Integration Procedure (LP30)* that must be followed when integrating peaks during data reduction.

Procedures for use of significant figures are discussed within each analytical method SOP.

Raw data printouts are retained as part of the data packet. These packets are stored after the approval process in binders or files within the laboratory. These records are maintained as described in Section 16 – "Control of Records".

22.5.3 Data Review Procedures

Data review procedures are located in Section 27.4 – "Data Review".

Section 23

CALIBRATION REQUIREMENTS
(TNI V1:M2 – Sect 5.5 and Section 1.7 of Technical Modules TNI V1:M 3-7)

23.1 General Equipment Requirements

The laboratory provides all the necessary equipment required for the performance of the scope of environmental testing performed by the laboratory.

All equipment and software used for testing are capable of achieving the accuracy required for complying with the specifications of the environmental test methods unless otherwise specified in the individual analytical SOPs.

Equipment (equipment & instrumentation) is operated only by authorized and trained personnel (see Section 20 – "Personnel").

Procedures for the use, maintenance, handling and storage of equipment are readily available to laboratory personnel, as provided by the manufacturer of the equipment. These procedures insure proper functioning of the equipment and help prevent contamination or deterioration. Equipment maintenance information may be found in the method manual (yellow book), other related manuals, or within the equipment computer software. The laboratory maintains *Equipment Info Records* files that include individual records for each piece of equipment.

Equipment is calibrated and/or verified before being placed into service to insure that it meets laboratory specifications and relevant standard specifications. This is done by performing an initial Demonstration of Capability which is filed within the method manual (see *LP5, Initial Test Method Evaluation (Chemistry) and LP6, Initial Test Method Evaluation (Microbiology)*).

Test equipment, including hardware and software, are safeguarded from adjustments that would invalidate the test result measurements by limiting access to the equipment and using password protection where possible.

Equipment that has been subject to overloading, mishandling, giving suspect results, or shown to be defective or outside specifications is taken out of service. The equipment is isolated to prevent its use or clearly labeled as being out of service until it has been shown to function properly. If it is shown that previous tests are affected, then procedures for nonconforming work are followed and results are documented (see Section 12 – "Control of Nonconforming Environmental Testing Work" and Section 14 – "Corrective Action").

Equipment used by the laboratory does not go outside of the permanent control of the laboratory. This does not apply to our laboratory as our equipment stays within control of the laboratory.

Each item of equipment and software used for testing and significant to the results is uniquely identified. Some software is shared between equipment and therefore,

would only have a single unique identification used in conjunction with multiple pieces of equipment. Records of equipment and software are maintained. This information includes the following:

a) identity of the equipment and its software;

b) manufacturer's name, type identification, serial number or other unique identifier;

c) checks that equipment complies with specifications of applicable tests;

d) current location;

e) manufacturer's instructions, if available, or a reference to their location;

f) dates, results and copies of reports and certificates of all calibrations, adjustments, acceptance criteria, and the due date of next calibration (kept within the method manual (yellow book) and may also be posted on the equipment);

g) maintenance plan where appropriate, and maintenance carried out to date; documentation on all routine and non-routine maintenance activities and reference material verifications;

h) any damage, malfunction, modification or repair to the equipment;

i) date received and date placed into service (optional); and

j) condition when received, if available (new, used, reconditioned)(optional).

23.2 Support Equipment

Support Equipment includes, but is not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, temperature measuring devices, volumetric dispensing devices, and thermal/pressure sample preparation devices.

Support equipment is maintained in proper working order. Records are kept for all repair and maintenance activities, including service calls, within the individual method manuals (yellow books) or related logs.

Raw data records are retained to document equipment performance. These records include logbooks, data sheets, or equipment computer files, etc.

23.2.1 Support Equipment Maintenance

Maintenance of support equipment, such as balances, is conducted at least annually.

Maintenance on other support equipment, such as ovens, refrigerators, etc. is conducted as required by method or regulation.

Procedures and records of maintenance to support equipment are documented in various places, such as instrument maintenance logs (kept near the equipment), maintenance sections within method manuals (yellow books), electronic logs (on

equipment computer), or the equipment file cabinet located in the front office. Each piece of support equipment does not necessarily have its own logbook and may be shared with similar equipment or maintenance checks (i.e. all balance maintenance is kept together in a single yellow book). Specific maintenance protocols are listed within SOPs related to the equipment or in separate SOP yellow books for that equipment (i.e. micro equipment SOPs).

23.2.2 Support Equipment Calibration

Support equipment, such a balances, weights, and thermometers, are calibrated or verified annually bracketing the range of use with NIST-traceable references, where available. If the results of the calibration of support equipment are not within specifications: (1) the equipment is removed from service until repaired or (2) records are maintained of correction factors to correct all measurements. If correction factors are used this information is clearly marked on or near the equipment.

Support equipment such as balances, ovens, refrigerators, freezers, incubators, and water baths are verified with a NIST traceable reference, if available, as required by the TNI Standard, method, or regulation (see LP25, *Verification of Thermometer Readings* SOP and LP27, *Balance Calibration and Verification of Weights* SOP). Each day prior to use, support equipment is checked to insure acceptable operation. Where appropriate, an acceptance criterion is located within the log related to that equipment. Such checks are documented.

Volumetric dispensing devices (except Class A glassware) are checked for accuracy on a quarterly basis (see LP26, *Accuracy Check of POVA: Plunger Operated Volumetric Apparatus* SOP). These checks are documented as described in the aforementioned SOP.

For microbiology analyses records for autoclaves used in the laboratory are required for the following:

- initial performance of the autoclave functional properties (supplied by the installer);
- temperature demonstration of sterilization continuous monitoring device or maximum registering temperature;
- for every cycle, record date, contents, maximum temperature reached, pressure, time in sterilization mode, total run time, and analysts initials;
- quarterly check of autoclave timing device against a stopwatch; and
- annual maintenance check to include a pressure check and verification of temperature device.

For microbiology analyses, there are additional records that are required as listed in *EL-TNI V1M5-2009 1.7.3.7b*. These are kept in the microbiology laboratory area.

23.3 Analytical Equipment

23.3.1 Maintenance for Analytical Equipment

All equipment is properly maintained, inspected, and cleaned.

Maintenance of analytical instruments and other equipment may include regularly scheduled preventive maintenance or maintenance on an as-needed basis. Instrument malfunction is documented in Instrument Maintenance Logs or other records (such as Corrective Action Detail Reports) which are kept as required. A description of what was done to repair the malfunction and proof of return to control are also documented in the log. If the equipment was repaired by an outside source, a copy of the repair bill may be placed in the logbook if it has sufficient detail to explain what was done.

23.3.2 Instrument Calibration

Information on instrument calibration can be found in the individual analytical SOPs or other related SOPs.

Initial instrument calibration and continuing instrument calibration verification are an important part of insuring data of known and documented quality. If more stringent calibration requirements are included in a mandated method or by regulation, the laboratory will meet those requirements.

Section 24

MEASUREMENT TRACEABILITY
(TNI V1:M2 – Section 5.6)

Measurement traceability is generally tracing an unbroken chain of comparisons of standards to certified materials. Certificates with specific reference numbers may be supplied by vendors to establish traceability.

All equipment used affecting the quality of test results are calibrated prior to being put into service and on a continuing basis (see Section 23 – "Calibration Requirements"). These calibrations utilize materials/standards that are traceable to national standards of measurement, where available.

If traceability of measurements to SI units is not possible or not relevant, evidence for correlation of results through interlaboratory comparisons, proficiency testing, or independent analysis is provided, where possible.

24.1 Reference Standards

Reference standards are standards of the highest quality available at a given location, from which measurements are derived.

Reference Standards, such as ASTM Class weights, and NIST/NBS thermometers, are used for calibration; the weights are also used for the daily balance checks. Their use in this manner is acceptable unless it is shown that their performance as reference standards is compromised.

Reference standards, such as ASTM Class weights, are initially calibrated by an entity that can provide traceability to national or international standards (i.e. the manufacturer prior to purchase). Subsequently, the weights are checked by lab staff annually shortly after the balances have been serviced. A record of this is kept in the *Balance Calibration and Weights* yellow book. As long as the weights meet ANSI/ASTM E617 Class 3 specifications during these annual checks, they are not replaced. If they fail these specifications, they are removed from service. Generally, weight sets are not sent out for calibration; they are replaced by new weights since it is more economical to replace them than to "recalibrate" them.

Item	Calibration / Verification Procedure
Thermometers (NIST-traceable)	Verification of Thermometer Readings SOP
Weights (ASTM class)	Balance Calibration and Weight Verification SOP

24.2 Reference Materials

Reference materials are substances that have concentrations that are sufficiently well established to use for calibration.

Reference materials, where commercially available, are traceable to national standards of measurement, or to Certified Reference Materials, usually by a Certificate of Analysis (C of A).

Purchased reference materials require a C of A, where available. Also, C of As are readily available on-line, and can be referenced when requested.

Reference materials are checked as far as is technically and economically practical. Reference materials are checked against a second source at first time of use, and with each calibration. Second source reference materials may be from a different manufacturer or from a different lot from the same manufacturer. Reference materials and subsequently-prepared standards are consumed or disposed of by the expiration date.

24.3 Transport and Storage of Reference Standards and Materials

The laboratory handles and transports reference standards and materials in a manner that protects the integrity of the materials. Reference standard and material integrity is protected by separation from incompatible materials and/or minimizing exposure to degrading environments or materials.

Reference standards and materials are stored according to manufacturer's recommendations, method SOP requirements and separately from samples. Storage information of these materials may be found in the individual analytical SOPs.

24.4 Labeling of Reference Standards, Reagents, and Reference Materials

The laboratory has procedures for purchase, receipt and storage of standards, reagents and reference materials. Purchase procedures are described in Section 9 – "Purchasing Services and Supplies".

Expiration dates may be extended if the reference standard or material's integrity is verified. Expired standards are checked against a second source that is not expired; where a second source may be a vendor certified different lot.

Reagent quality is verified upon receipt as described in Section 9 – "Purchasing Services and Supplies".

24.4.1 Stock Standards, Reagents, Reference Materials and Media

Records for all standards, reagents, reference materials, and media include:

- the manufacturer/vendor name (or traceability to purchased stocks or neat compounds)
- the manufacturer's C of A or purity (if supplied)
- the date of receipt
- recommended storage conditions

The *Chemical Receipt Log* is a log for all reagents, standards, media, etc. that are purchased for laboratory use. This log records the manufacturer/vendor, chemical name, concentration (of standards), manufacturer lot #, catalog #, receiver's initials, expiration date, and inspected for use. A unique ID # is assigned upon receipt and recorded in this log.

If the original container does not have an expiration date provided by the manufacturer or vendor, it is not required to be labeled with an expiration date. If an expiration date is provided, the container must be labeled with the expiration date.

In methods where the purity of reagents is not specified, analytical reagent grade is used. If the purity is specified, that is the minimum acceptable grade. Purity is verified by checking the purity information on the label or C of A and documented according to Section 9 – "Purchasing Services and Supplies".

24.4.2 Prepared Standards, Reagents, Reference Materials and Media

Records for standards, reagents, reference materials, and media preparation include:

- traceability to purchased stock or neat compounds
- reference to the method of preparation
- date of preparation
- an expiration date after which the material shall not be used (unless its reliability is verified by the laboratory)
- preparer's initials (if prepared)

This information is recorded within the standard, reagent, and media preparation logs which are kept within method manuals or related logs within the laboratory. All containers of prepared standards, reagents, or materials are labeled with a unique ID and an expiration date. Sometimes an expiration date may be listed as a specific time period from the date of preparation rather than a specific date (i.e. "good for 2 weeks from prep date"). The unique ID is determined by combinations of the chemical name or chemical abbreviation and some version of the date. The date used may be listed in different orders, such as mm/dd/yy, yy/mm/dd, etc.

Prepared reagents are verified to meet the requirements of the test method by checking against a second source at first time of use. In most cases, the analysis of an Initial Calibration Verification (ICV) standard or a Laboratory Control Sample (LCS), and Initial Method Blanks may be used to verify reagents.

Section 25

COLLECTION OF SAMPLES
(TNI V1:M2 – Section 5.7)

Pinellas County Utilities Laboratory does not provide sampling services for any regulatory or permitted compliance purposes. Limited sampling is performed for special projects by non-analytical personnel for projects unrelated to this manual and TNI certification.

Generally the laboratory's responsibility in the sample collection process lies in sometimes supplying the sampler with items such as coolers, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory.

Section 26

HANDLING SAMPLES AND TEST ITEMS
(TNI V1:M2 – Section 5.8 and Section 1.7 of Technical Modules TNI V1:M 3-7)

26.1 Sample Receipt

When samples are received at the laboratory, the Chain of Custody (COC) is reviewed, samples' condition are documented, samples are given unique identifiers, and they are logged into the sample tracking system (Laboratory Information Management System or LIMS).

26.1.1 Chain of Custody

The COC from the sample collection personnel is reviewed upon delivery of samples to the laboratory. Generally, this documentation is completed in the field and provides a written record of the handling of the samples from the time of collection until they are received at the laboratory. *LP1 Sample Handling & Acceptance* SOP outlines the information that is needed on this record. The COC also provides information on what type of testing is being requested and can act as an order for laboratory services in the absence of a formal contract. COC formats vary widely and are considered acceptable as long as they contain the required information. Chain of Custody and any additional records received at the time of sample submission are maintained by the laboratory. These forms are scanned electronically and stored in the laboratory computer system. Originals are returned to the customer with the final report. The laboratory does not deal with "Legal Chain of Custody" samples. This type of work would be sent directly to a laboratory that is capable of handling such work.

26.2 Sample Acceptance

The laboratory has a sample acceptance policy, LP1 *Sample Handling & Acceptance* SOP, which is available to sample collection personnel. It emphasizes the need for use of water resistant ink, providing proper documentation (to include sample ID, location, date and time of collection, collector's name, preservation type, sample type and any special remarks about the sample), labeling of sample containers to include a unique sample ID, use of appropriate containers, adherence to holding times, and sample volume requirements. In addition, the laboratory has nonconformance/corrective action procedures to handle samples that don't meet the requirements above or show signs of damage, contamination or inadequate preservation. Data will be appropriately qualified where samples are reported that do not meet sample acceptance requirements.

The laboratory checks samples for the conditions listed in LP1 *Sample Handling & Acceptance* SOP, where appropriate, to evaluate sample acceptance. If these conditions are not met, the client is contacted, and then the sample is rejected as agreed with the client or the decision to proceed is documented and agreed upon

with the client, or the condition is noted on the Chain of Custody form and/or lab receipt documents, and the data are qualified in the report.

26.3 Sample Identification

Samples are uniquely identified in a permanent chronological record in our LIMS to prevent mix-up and to document receipt of all sample containers. The samples are assigned sequential numbers as described in *LP1, Sample Handling & Acceptance*.

The following information is included in the LIMS:

- Client
- Project Name
- Collection Personnel
- Sampling Date and Time
- Unique Field Identification (date/time + location)
- Analyses Requested (including applicable method numbers)
- Date and Time of receipt at lab
- Signature/Initials of person receiving samples and/or logging into LIMS
- Comments regarding sample condition, if questionable, and/or rejection (if any)
- Unique laboratory identification number that is linked to the unique field identification and requested analyses

26.4 Sample Aliquots / Subsampling

In order for analysis results to be representative of the sample collected in the field, the laboratory has a subsampling procedure which may be found in *LP1 Sample Handling & Acceptance* SOP. Subsampling is used on an as needed basis.

26.5 Sample Storage

Sample storage conditions are monitored for any required criteria in logs associated with that piece of support equipment.

Samples that require thermal preservation are stored under refrigeration at the target temperature of 4°C, with a range of above freezing to 6°C.

Samples are held secure, as required. Samples are accessible only to laboratory personnel.

Samples are stored apart from standards, reagents, food or potentially contaminating sources, and such that cross-contamination is minimized. All portions of samples, including extracts, digestates, leachates, or any product of the sample is maintained according to the required conditions.

26.6 Sample Disposal

Samples that are not consumed during analyses (such as Micro samples) are retained a minimum of six weeks, or as space allows, unless other arrangements have been made with the client.

Samples are disposed of according to Federal, State and local regulations. Procedures are described in the individual analytical SOPs in the *Waste Management* section for the disposal of samples, digestates, leachates, and extracts.

26.7 Sample Transport

Samples that are transported under the responsibility of the laboratory, where necessary, are done so safely and according to storage conditions. This includes moving bottles within the laboratory. Specific safety operations are addressed outside of this document.

Sample shipping procedures are described in *LP8, Sample Shipping Procedures* SOP.

Section 27

QUALITY ASSURANCE FOR ENVIRONMENTAL TESTING *(TNI V1:M1, V1:M2 – Section 5.9 and Section 1.7 of Technical Modules TNI V1:M 3-7)*

TNI Standard - EL-V1M2-2009, section 3.0 defines Quality Assurance as "an integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to insure that a process, item, or service is of the type and quality needed and expected by the client." The quality control (QC) techniques are the most well known aspect of quality assurance, and they are used continuously to monitor and improve the quality of our service/product. Management and the Quality Assurance Officer are charged with administering the Quality Assurance program.

Laboratory staff and management monitors various QC measurements such as blanks, laboratory control samples (LCS), matrix spikes (MS), duplicates, and internal standards to assess precision and accuracy. Calibrations are reviewed, and Proficiency Testing samples are analyzed to assess laboratory performance.

Quality control data are analyzed and, when found to be outside pre-defined criteria, action is taken to correct the problem and to determine how to treat the affected data. Data associated with unacceptable QC may still be deemed reportable but will be qualified so the end user of the data may determine the usability of the data - see Section 28 – "Reporting of Results".

27.1 Essential Quality Control Procedures

The quality control procedures specified in analytical methods are followed by laboratory personnel. If it is not clear which is the most stringent, those mandated by test method or regulation are followed.

For test methods that do not provide acceptance criteria for an essential quality control element or where no regulatory criteria exist, acceptance criteria are developed following *LP12, Development of QC Criteria* SOP. These limits may be found within the individual analytical SOPs or on the associated Data Review Form.

Written procedures to monitor routine quality controls are located in the individual analytical SOPs, except where noted, and may include such procedures as:

- use of laboratory control samples and blanks to serve as positive and negative controls for chemistry methods;
- use of laboratory control samples to monitor test variability of laboratory results;
- use of calibrations, continuing calibrations, certified reference materials and/or PT samples to monitor accuracy of the test method;
- measures to monitor test method capability, such as limit of detection, limit of quantitation, and/or range of test applicability, such as linearity;

- use of regression analysis, internal/external standards, or statistical analysis to reduce raw data to final results;
- use of reagents and standards of appropriate quality and use of second source materials as appropriate;
- procedures to insure the selectivity of the test method for its intended use;
- measures to insure constant and consistent test conditions, such as temperature, humidity, etc., when required by test method;
- use of sterility checks for equipment, media and dilution water for microbiology; and
- use of positive and negative culture controls for microbiology.

27.2 Quality Control Practices

Analytical data is deemed to be in control when generated with QC samples that fall within associated acceptance limits. QC samples that fall outside these limits indicate nonconforming data which requires corrective action and/or for the data to be qualified (see Section 12 – "Control of Nonconforming Environmental Testing Work" and Section 14 - "Corrective Actions"). All QC measures are evaluated on an on-going basis, using quality control acceptance criteria. Examples of typical quality controls/elements may include.

27.2.1 Method Performance Controls

27.2.1.1 Method Blanks (Negative Control)

27.2.1.2 Laboratory Control Samples (Positive Control)

27.2.2 Sample Specific Controls

27.2.2.1 Matrix Spikes (Matrix-related Precision & Accuracy)

27.2.2.2 Matrix Spike Duplicates (Matrix-related Precision)

27.2.3 Other Quality Controls

27.2.3.1 Selectivity is assured through:

a) absolute and relative retention times in chromatographic analyses;
b) use of acceptance criteria for mass-spectral tuning;
c) use of the correct method according to its scope assessed during method validation; and

d) use of reference cultures (positive and negative) from a recognized manufacturer (where applicable).

27.2.3.2 Consistency, Variability, Repeatability, and Accuracy are assured through:

a) proper installation and operation of instruments according to manufacturer's recommendations or according to the processes used during method validation;

b) monitoring and controlling environmental conditions (temperature, light, separation from potential contaminants, etc.);

c) selection and use of reagents and standards of appropriate quality;

d) cleaning glassware appropriate to the level required by the analysis as demonstrated with method blanks (in individual analytical SOPs);

e) for microbiology, glassware care includes use of borosilicate glassware, use of detergents designed for laboratory use, testing for alkaline or acid residue with bromothymol blue per instance, and review of inhibitory residue testing when the detergent is changed or annually, whichever is more frequent;

f) following SOPs and documenting any deviation, assessing for impact, and treating data appropriately;

g) testing to define the variability and/or repeatability of the laboratory results, such as replicates (i.e. duplicates);

h) use of measures to assure the accuracy of the test method, including calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples, or other measures; and

i) use of duplicate plate counts on positive samples (microbiology only).

27.2.3.3 Test Method Capability (also see Section 22 – "Environmental Methods and Method Validation") is assured through:

a) establishment of the limit of detection where appropriate;

b) establishment of the limit of quantitation or reporting level; and/or

c) establishment of the range of applicability such as linearity (where applicable).

27.2.3.4 Data reduction is assured to be accurate by:

a) selection of appropriate, widely accepted formulae to reduce raw data to final results such as regression;

b) following specific procedures for data reduction such as manual integration procedures;

c) periodic review of data reduction processes to assure applicability;

d) microbiological calculations & statistical interpretations specified by test method.

27.3 Proficiency Test Samples or Interlaboratory Comparisons

27.3.1 Compliance to Accreditation Requirements

The laboratory analyzes at least two TNI-compliant PT samples per calendar year for each accreditation Fields of Proficiency Testing (FoPT) for which the laboratory is accredited. An exception is made for analytes where there is no PT available from any PTPA-approved PT provider at least twice per year. In these cases the lab will run the PTs in the minimum time frame the PTs are available and not at all if they are not available. See *LP4 WS & WP Studies* SOP for specific information.

The successive PTs are analyzed at least five months apart and no more than 7 months apart unless the PT is being used for corrective action to maintain or reinstate accreditation, in which case the dates of successive PT samples for the same accreditation FoPT is at least fifteen days apart.

27.3.2 PT Sample Handling, Analysis, and Reporting

The laboratory does not share PT samples with other laboratories, does not communicate with other laboratories regarding current PT sample results, and does not attempt to obtain the assigned value of any PT sample from the PT provider.

Proficiency Testing (PT) samples are treated like typical samples using normal laboratory processes where possible, including the same analysts, preparation, calibration, quality control and acceptance criteria, sequence of analytical steps, number of replicates, and sample log-in. PT samples are not analyzed multiple times unless routine environmental samples are analyzed multiple times or multiple dilutions are needed to obtain values within the calibration range (particularly true for multi-analyte methods). There are no special procedures for handling low level PT samples. PT data are reported as listed in *LP4 WS & WP PT Studies SOP.*

The laboratory institutes corrective actions for failed PT samples following the guidelines in *LP4 WS & WP PT Studies SOP*.

Retention of PT records is similar to that maintained for regular environmental samples. In addition, the lab maintains a copy of the online data entry summary when the PT results are submitted online to the manufacturer.

27.4 Data Review

The laboratory reviews data generated in the laboratory for compliance with method, laboratory, regulatory, and client requirements (where applicable).

Analysts are the first level of Data Review. They are responsible for insuring that analytical elements, such as documentation, calibration, validation/verification, failure analysis/corrective actions, special reporting/notifications, required QC, and equipment/instrument performance are reviewed for adherence to method, SOP,

regulatory, customer requirements as well as proper operation and maintenance. This is considered the primary stage of review and is the most important and extensive. Completing the sample result in the LIMS and filling out the Data Review Form (DRF) in the appropriate column signifies that the data and the analytical run has been carefully reviewed and has met all method, laboratory, regulatory, and client requirements (where applicable).

The second level of Data Review occurs at the approval stage where a senior chemist or analytical manager (or designated appointee) reviews the data. The data packet is reviewed, and then the data in the LIMS is checked. Any concerns are reviewed with the analyst before approving. Approval in the LIMS of the data at this stage signifies that the data has been carefully reviewed, has met all aforementioned requirements, and there are no errors in the LIMS. The person doing the approval then completes the DRF in the appropriate column.

A third level of review occurs during report generation by an experienced staff member, but since there is no data packet given to this individual, the depth of review is confined to checking for typos, missing or incorrect information, etc.

Section 28

REPORTING THE RESULTS
(TNI V1:M2 – Section 5.10)

The results of tests performed are reported accurately, clearly, unambiguously, objectively in accordance with instructions contained within the test method, SOP, client requirements, and/or associated regulations.

Laboratory results are reported in a final test report that includes information requested by the client and necessary for the interpretation of the test results including information required by the analytical test method.

Generally, data are reported without qualification if they are above the reported LOQ, lower than the highest calibration standard, and without compromised sample or method integrity. There are a few methods for which an LOD is not required; therefore they have no LOQ either. For these methods, data are reported without qualification if they are above the LOD. The majority of final reports issued are for clients that are internal to our organization, therefore, may be in a simplified format. The lab does not report directly to regulatory authorities.

28.1 Test Reports

The report format has been designed to accommodate each type of test performed and to minimize the potential for misunderstanding or misuse. The laboratory does not issue multiple reports for the same samples where there is different information on each report unless required to meet regulatory needs and approved by the Quality Manager.

Some regulatory reporting requirements, or formats, such as monthly operating reports, may not require all items listed below; however, the laboratory shall provide all the required information to their client for use in preparing such regulatory reports. However, test reports generally contain the following information:

a) a title, such as “Certificate of Analysis”;

b) the name and address of the laboratory;

c) unique identification of the test report (i.e. work order number) on each page; a pagination system that insures that each page is recognized as part of the report and a clear identification of the end of the report (such as 3 of 10);

d) the name and address of the client;

e) the identification of the analytical test method(s) used;

f) a description of, the condition of, and unambiguous identification of the sample(s) tested;

g) the date of sample receipt when it is critical to the validity and application of the results; date and time of sample collection; dates the tests were performed; and the time of sample preparation and/or analysis if the required holding time for either activity is less than or equal to 72 hours;

h) reference to the sampling plan and procedures used by the laboratory where these are relevant to the validity or application of the results (not applicable);

i) the test results with units of measurement; an indication of when results are reported on any basis other than as received (i.e. dry weight vs. wet weight);

j) the name, function, and signature or an equivalent electronic identification of the person authorizing the test report;

k) where relevant, a statement to the effect that the results relate only to the samples;

l) non-accredited tests are clearly identified;

m) clear identification when sample values are outside the calibration range and not diluted to be within the range.

28.2 Supplemental Test Report Information

When necessary for interpretation of the results or when requested by the client, test reports will include the following additional information:

a) deviations from, additions to, or exclusions from the test method, information on specific test conditions, such as environmental conditions;

b) a statement of compliance/non-compliance with requirements or specifications;

c) when requested by the client, a statement on the estimated laboratory uncertainty of the measurement;

d) where appropriate and needed, opinions and interpretations;

e) additional information which may be required by specific methods or client;

f) qualification of results with values outside the calibration range as appropriate.

28.3 Environmental Testing Obtained from Subcontractors

Generally, test reports for work performed by a sub-contracted laboratory are delivered to the client in their entirety. Occasionally test results from subcontractors are incorporated into one of our final reports when requested to do so. However, the subcontractor data are clearly identified. Subcontractors may report their results in writing or electronically. A copy of the subcontractors' report is made available to the client if requested.

28.4 Electronic Transmission of Results

All test results transmitted by telephone, fax, e-mail, or other electronic means comply with the requirements of the TNI Standard and associated procedures to protect the confidentiality and proprietary rights of the client (see Section 10- "Service to the Client").

28.5 Amendments to Test Reports

Material amendments to a test report after it has been issued are made in the form of another report or data transfer. All reports are identified by work order number (which is unique). Amended reports are also issued by work order number, but are clearly identified as "Corrected" or an equivalent form of wording to assure they can be differentiated from other reports. All amended reports meet all the requirements for the initial report and the requirements of this *Quality Manual*.

28.6 Exceptions

Some regulatory reporting requirements or formats, such as monthly operating reports, may not require all items listed previously; however, the laboratory shall provide all the required information to their client for use in preparing such regulatory reports.

Since the laboratory is a captive, in-house laboratory providing data for operational compliance purposes, we strive to include applicable information specified in *EL-TNI V1:M2 Section 5.10* on reports, but if not, it is available for review by the accreditation body. However, formal reports detailing the information are not required if:

a) the in-house laboratory is itself responsible for preparing the regulatory reports; or
b) the laboratory provides information to another individual within the organization for preparation of the regulatory reports. The facility management shall insure that the appropriate report items are in the report to the regulatory authority, if such information is required; or reports issued to clients that are internal to our organization may be in a simplified format in accordance with *EL-TNI V1:M2 Section 5.10.1 paragraph 3.*