# Standard Operating Procedure – Sampling Plan

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1 POINT OF CONTACT

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2 OBJECTIVE

Sample water quality, water clarity, and macrophytes within an embayment following guidelines of the Unified Water Study (UWS). Frequency of sampling and daily order of events are specified.

3 DEFINITIONS AND ABBREVIATIONS

Embayment: A recess in a coastline or an indentation off a shoreline which forms a bay. In Long Island Sound, the names of embayments often include the words Harbor (27%), River (23%), Cove (19%), Bay (10%), Creek (10%), and Pond (7%); with a few including the names Brook, Gut, Inlet, or Lake.

Field Team: Person or group of people working together to sample a station.

Macroalgae (macroalga, singular.): Commonly referred to as seaweed. This is a group of plant-like organisms. They do not have the vascular system and roots of a true plant. The “macro” prefix indicates these organisms are visible with the naked eye, no magnification is required to view the whole organism; although, magnification with a hand lens or loupe may be necessary to view the structure of the organism. In comparison, microalgae are the phytoplankton in the water which are too small to see with the naked eye.

Macrophyte: Plants and macroalgae that are viewable with the naked eye. This term includes macroalgae, seagrass (eelgrass, Zostera marina; widgeon grass, Ruppia maritima), and marsh grass.

Monitoring Group: The group conducting the field work.

Seagrass: A true plant, not an alga; they have the vascular system and roots of a land plant. These plants are fully submerged at all times (though there are a few species not found in Long Island Sound which are intertidal). Long Island Sound has two species of seagrass: Zostera marina (eelgrass), which is the most commonly seen seagrass in our area; and Ruppia maritima (widgeon grass).
Section: The reporting regions for the embayment report card. Each section must include a minimum of three stations. Sections will be assigned a unique name by the UWS; examples are included below.

<table>
<thead>
<tr>
<th>Number of Sections</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Sections</td>
<td>whole</td>
<td>inner inner outer</td>
<td>outer</td>
</tr>
<tr>
<td>Abbreviations for Sections</td>
<td>W</td>
<td>I O</td>
<td>I M O</td>
</tr>
</tbody>
</table>

Site: The whole embayment, as defined by the UWS list. Each site has a unique three letter code assigned by the UWS; for example, Little neck Bay, NY is “LNE”.

Sonde: An instrument probe that automatically transmits information about its surroundings underground, under water, in the atmosphere, etc.

SOP: Standard operating procedure; this document is a SOP.

Station: The location where samples are collected, identified by a GPS location.

UWS: Unified Water Study

UWS Coordinator: The person designated as the point of contact for the UWS.

UWS Scientific Advisor: Estuarine or water quality scientists designated as advisors to the UWS.

4 OVERVIEW

Sampling occurs in the months of May through October, though a shorter season is acceptable for inclusion in the UWS.

Three types of stations are included:

1) Water quality stations are sampled within three hours of sunrise. A minimum of four per embayment are required. If multiple sections of the embayment are to be evaluated, a minimum of three stations are required per section. Water quality stations are sampled a minimum of once per month from June to September. Ideally, sampling occurs twice per month from May to October.

2) Secchi Disc stations are included for groups who cannot logistically return to the water quality stations between the hours of 9 a.m. and 2 p.m. When a group has many water quality stations, fewer secchi disc stations may be required. Secchi disc stations should be located in areas that are deep enough that the Secchi disc disappears. A nearby Secchi disc station may be designated when a water quality station is located in a shallow area (where the bottom is viewable). Secchi disc stations are sampled at the same frequency as water quality stations.

3) Macrophyte stations are land-based or boat-based. They are sampled only mid-summer and will typically be sampled on different days from the water quality or Secchi disc stations. Sampling occurs on three separate days between July 15 and August 7.
Monitoring groups must collect the following data to be included in the UWS:

- for each water quality station
  - GPS coordinates of stations, recorded each sample date
  - date and time
  - total depth
    - 0.5 m below the surface, 0.5 m above bottom, mid-depth if total depth >10 m
      - temperature
      - salinity
      - dissolved oxygen (if using Winkler titration, also collect barometric pressure)
    - 0.5 m below the surface
      - chlorophyll \(a\)
      - turbidity (choose between turbidity and Secchi depth)
  - at 1 station per field day, conduct two profiles and read depth and GPS twice
- for each Secchi depth station (choose between Secchi depth and turbidity)
  - GPS coordinates of stations
  - date and time
  - total depth
  - Secchi depth
- for each macrophyte station
  - GPS coordinates of stations
  - date and time
  - photos of macrophytes
- within 2 days of the field sampling day, read the GPS of a land-based reference station

5 SOURCES

These procedures are based on the EPA Volunteer Estuary Monitoring Manual (EPA, 2007) and follows methods used in the EPA National Coastal Assessment (EPA, 2001). The EPA Volunteer Estuary Monitoring Manual (EPA, 2007) provides a wealth of specific data for monitoring groups. All groups should refer to the EPA manual for specific guidance. This SOP provides specific monitoring details relevant to the UWS.

6 MATERIALS AND EQUIPMENT

6.1 Safety

- safety plan – every volunteer should have a copy
  - Find out the location and telephone number of the nearest telephone and write it down, or have a cellular phone available.
  - Locate the nearest medical center and write down directions for guiding emergency personnel to your stations.
  - Have each member of the sampling team complete a medical form that includes emergency contacts, insurance information, and relevant health information such as allergies, diabetes, epilepsy, etc. An example is provided at the end this SOP. Please note – this form should be kept confidential, but is required. Whoever coordinates your
monitoring efforts should have a copy and should review the form. A second copy should be kept with the field team in the event of an emergency; the form for each team member should be sealed in an envelope with their name. If you sample alone, leave this envelope somewhere obvious to rescuers and be sure it is labelled as “Emergency Medical Information.”

- Each team member should have contact information for all field team members. This list could be kept in your field box or use packing tape to affix it to the back of a clipboard or some other item you always have in the field.
  - full name
  - cell phone
  - home phone
  - email address
  - car color, make, model, and license plate
  - emergency contact information

- Every monitoring team should have a shore-based check-in for each sampling day. This is a person who knows who is on the team, where they will be, and the time they are expected back. If the field team does not check in, the shore person should know the procedures to follow to report the team missing. The following is an example:
  - Call the cell phones and home phones of all team members.
  - Check the stations for parked vehicles – if the vehicle is present, start a search.
  - If the team is considered missing at sea, contact the Coast Guard; if the team is missing on land, contact the police.

- first aid kit
  - telephone numbers of emergency personnel (e.g., police, ambulance service)
  - first aid manual which outlines diagnosis and treatment procedures
  - antibacterial or alcohol wipes
  - first aid cream or ointment
  - acetaminophen and ibuprofen for relieving pain and reducing fever
  - several band-aids
  - several gauze pads, 3 or 4 inches square
  - 2-inch roll of gauze bandage
  - triangular bandage
  - large compress bandage
  - 3-inch wide elastic bandage
  - needle for removing splinters
  - tick spoon for removing ticks
  - doctor-prescribed antihistamine for any participant who is allergic to bee stings

- cell phone
- water & snacks
- appropriate shoes and clothes (and extras); protection from the sun
- other items to consider:
  - reflective safety vest, especially if walking along a road
  - flash light
  - back pack for sampling equipment, so hands are free
6.2 Sampling Gear – All Stations

**REQUIRED (PUT IN A SMALL TOOL BOX)**
- site maps with stations indicated on map
- GPS coordinates for stations
- list of UWS unique station IDs for the site
- clip boards
- pencils
- pencil sharpener
- permanent marker
- field data sheets
- labels (if required)
- labeling tape
- electrical tape (this tape works well underwater; comes in many colors)
- duct tape (very useful in many situations)

**OPTIONAL, BUT VERY USEFUL (PUT IN A SMALL TOOL BOX)**
- clear packing tape (can be used to cover writing on bottles or affix a label that is not sticking)
- extra batteries for any electrical sampling gear
- tailor’s tape measure (seamstress measuring tape), with metric scale – comes in handy when you need to re-mark a line
- basic tools (pliers, wrench, screw drivers, etc.)
- plastic baggies
- scissors, pocket knife, nail clippers
- cable ties

6.3 Sampling Gear - Water Quality Station and Secchi Depth Station

The choice of sampling gear for water quality and Secchi depth will depend on the funds available for purchasing equipment and the number of teams you will be fielding. Examples of arrangements are provided in the “Water Quality Equipment SOP.”

6.4 Sampling Gear - Macrophyte Station

→ GPS unit
   - GPS unit or GPS app for a smart phone

→ Digital camera with resolution >5 megapixels (most smartphone cameras meet this criteria)

→ Bucket or plastic bin, for putting macroalgae in if it is very muddy or falling off rake

→ Bow rake with ~7 m (~20 feet) of rope attached to the tine-end of the rake and attached to the handle (cable tie, duct tape, etc.). The rake should be a heavy duty bow rake with forged steel rakehead, 16 inches wide, with 15 or 16 tines. The total length (handle to tines) should be around 60 inches. A rake with an ash wood handle is appropriate; however, fiberglass or
another handle material is also acceptable.

→ Weight for the bow rake, to help it sink. Dive weights or heavy fishing weights can be attached to the rake with cable ties, hose clamps, etc.

7 METHODS

7.1 Parameters to Sample

Monitoring groups must collect the following data to be included in the UWS:

- for each water quality station
  - GPS coordinates of stations, recorded each sample date
  - date and time
  - total depth
    - 0.5 m below the surface, 0.5 m above bottom, mid-depth if total depth >10 m
      - temperature
      - salinity
      - dissolved oxygen (if using Winkler titration, also collect barometric pressure)
    - 0.5 m below the surface
      - chlorophyll a
      - turbidity (choose between turbidity and Secchi depth)
  - at 1 station per field day, conduct two profiles and read depth and GPS twice
- for each Secchi depth station (choose between Secchi depth and turbidity)
  - GPS coordinates of stations
  - date and time
  - total depth
  - Secchi depth
- for each macrophyte station
  - GPS coordinates of stations
  - date and time
  - photos of macrophytes
- within 2 days of the field sampling day, read the GPS of a land-based reference station

7.2 Timing of Sampling

7.2.1 Timing During the Year

WATER QUALITY STATIONS & SECCHI DEPTH STATIONS

The target sampling frequency is two sampling events per month, May through October. Sampling dates should be 10 to 18 days apart.

All water quality and water clarity parameters should be sampled during a sampling event. At one station per field day, conduct two replicate profiles.
In the occurrence of equipment failure or other unforeseen difficulty, a minimum of one sample per month during June through September, and six total samples is required for inclusion in the UWS.

**Macrophyte Survey Sampling Frequency**

Macrophyte surveys will occur between July 15 and August 7 of every sampling season, with 3 survey events total. One survey per week is best. If this is not possible, maximize the days between sampling. All three days cannot be sampled in the same 7-day window.

**Overview of Sampling Frequency**

The calendar below provides an example of sampling frequency throughout the season. Dates highlighted in orange are water quality and Secchi disk sampling dates (e.g. May 11). The green text (July 15 – August 7) are potential dates for macrophyte sampling. The dates highlighted in green are the 3 planned macrophyte sampling dates (e.g. July 21).
7.2.2 Timing of Intercomparisons

If your organization uses multiple field teams with multiple sets of field equipment, each field team will need to compare their equipment to a set of reference equipment to verify that all reading within the organization are comparable.

When multiple field teams from your organization are sampling different stations at the same time, intercomparison will be conducted at the start, mid-point, and end of the sampling season. Intercomparison will be conducted by all field teams meeting with the Monitoring Field Coordinator and sampling estuarine water from a bucket to compare readings. The Monitoring Field Coordinator’s equipment will be used as the reference set of equipment. The water sampled may be collected and transported to a convenient location for intercomparison. The Monitoring Field Coordinator may meet with field teams individually or in a group.

Results of the intercomparisons should be kept by the Monitoring Field Coordinator and submitted to the UWS Coordinator. The relative percent difference of the instruments and analytical readings should agree within the following specifications (see QAPP for more details):

- Temperature: 10%
- Salinity: 10%
- Dissolved Oxygen: 20%
- Turbidity: 20% of reading or ± 0.5 NTU, whichever is greater
- Filtered Chlorophyll $a$: ± 2 µg/L if < 15 µg/L; 20% if > 15 µg/L

Relative percent difference (RPD) of duplicate samples is used as one index of precision. This is defined as the absolute difference between the duplicates divided by the average of the duplicates. The allowable RPDs for each parameter are provided in in the QAPP and summarized above. A difference greater than the designated RPD requires further investigation of the sample run. If the difference is large enough, it indicates failure (unless the average of the two samples is less than 10 times the method detection limit), and results in reanalysis of the entire set of replicates from that station depth, unless there is a reasonable and supported explanation for the inconsistency. Duplicate precision will be analyzed by calculating the RPD using the equation:

$$\text{RPD} \% = \frac{|x_1 - x_2|}{(x_1 + x_2)/2} \times 100$$

where $x_1$ is the original sample concentration and $x_2$ is the duplicate sample concentration.

The Microsoft Excel formula for calculating the RPD is:

$$= \text{ABS}(X1-X2) / ((X1+X2) / 2) * 100$$

where $X1$ is the original sample concentration and $X2$ is the duplicate sample concentration.

Note – the “UWS Date Entry Template” evaluates the RPD and will flag replicates that are not within the recommended allowances.
7.2.3 Timing During a Sample Day

Sampling of dissolved oxygen occurs in the morning (within 3 hours of sunrise), to capture the lowest dissolved oxygen values in the system. If you are using the LaMotte Dissolved Oxygen kit, also record barometric pressure.

Secchi depth must be recorded when the sun is high enough in the sky to get good light penetration into the water (9 a.m. to 2 p.m., in summer).

Chlorophyll $a$ and turbidity should be sampled at the same time as dissolved oxygen, to allow for linking of these parameters to their corresponding temperature, salinity, and dissolved oxygen (Tables 1 and 2).

**Table 1: Text summary of required sampling times within a sample day**

<table>
<thead>
<tr>
<th>Parameter/Survey</th>
<th>Required time interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissolved Oxygen (mg/l)</td>
<td>Collected within 3 hours of sunrise</td>
</tr>
<tr>
<td>Temperature</td>
<td>Collected within 3 hours of sunrise (with dissolved oxygen)</td>
</tr>
<tr>
<td>Salinity</td>
<td>Collected within 3 hours of sunrise (with dissolved oxygen)</td>
</tr>
<tr>
<td>Chlorophyll $a$</td>
<td>Collected within 3 hours of sunrise (with dissolved oxygen)</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>Collected within 3 hours of sunrise (with dissolved oxygen)</td>
</tr>
<tr>
<td>Secchi Depth</td>
<td>9 AM – 2 PM</td>
</tr>
<tr>
<td>Sample Site Depth</td>
<td>At time of sampling</td>
</tr>
<tr>
<td>Macrophyte Survey</td>
<td>close to low tide for wrackline survey, close to high tide for hardenened shorelines, boat surveys any time of day</td>
</tr>
</tbody>
</table>

**Table 2: Visual summary of required sampling within a sample day (sunrise at 6 am).**

<table>
<thead>
<tr>
<th>parameter</th>
<th>6-7am</th>
<th>7-8am</th>
<th>8-9am</th>
<th>9-10am</th>
<th>10-11am</th>
<th>11-12pm</th>
<th>12-1pm</th>
<th>1-2pm</th>
</tr>
</thead>
<tbody>
<tr>
<td>dissolved oxygen (barometric pressure), temperature, salinity, depth</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>chlorophyll $a$, turbidity, depth</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secchi depth, depth</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>macrophytes</td>
<td>soft shorelines (wrackline survey) – within 3 hours of low tide hard shorelines (rake toss) – any time of day boat survey – any time of day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7.3 Sampling Depths

7.3.1 Temperature, Salinity, Dissolved Oxygen

If total depth at the station is greater than 10 m, take three samples: one at 0.5 m below the surface, one at mid depth, and another at 0.5 m above the bottom.

If total depth at the station is less than 10 m, take two samples: one at 0.5 m below the surface and the other at 0.5 m above the bottom.

If total depth at the station is less than 1.5 m, take one sample halfway to the bottom.

Always record the depth of the sample.

Note: This sampling depth regime is the minimum for inclusion in the UWS. Groups are encouraged to add more sampling depths. Suggested: 1 m intervals from 0.5 m above the bottom to 0.5 m below the surface.

7.3.2 Chlorophyll \textit{a}, Turbidity

Chlorophyll \textit{a} and turbidity samples are collected 0.5 m below the surface.

Always record the depth of the sample.

Note: For stations where total depth is less than 1.5 m, water quality is collected at mid-depth, but chlorophyll \textit{a} and turbidity should be collected at 0.5 m.

7.4 Collecting Water Samples

7.4.1 Subsurface Oceanographic Sampling Bottles

Used for sampling at depth. Can be used to sample at 0.5 m.

The Van Dorn bottle is typically aligned horizontally while the Niskin bottle is typically arranged vertically. Either bottle is fine, the UWS does not have a preference; water should be relatively well-mixed at the sample depth.

- Cock the water sampler according to manufacturer’s instructions.
- Lower the sample bottle to the desired depth.
- Swish at the target depth to rinse the sample bottle.
- Send the messenger down the rope to close the water sampler.
- Pull the water sampler to the surface with a slow and steady motion.
These bottles are not specifically designed for collecting water for dissolved oxygen. Using these samplers for dissolved oxygen without modification will agitate the water as it enters the dissolved oxygen sample bottle, introducing bubbles and changing the dissolved oxygen concentration. Check with the UWS coordinator before using the following water collection method for dissolved oxygen via the titration method; additional training is required.

- If the sample bottle has an outlet nozzle, attach a plastic tube to the nozzle. The tube should be long enough to reach to the bottom of the dissolved oxygen sample bottle. With the tube outlet at the bottom of the dissolved oxygen bottle, allow the water to overflow three times the volume of the dissolved oxygen sample bottle.

- If the sample bottle does not have an outlet nozzle, you will need a bucket. Rinse the bucket three times with surface water. Collect the water sample. Very gently – empty the water into the bucket. Use a plastic tube to siphon water from the bucket into the dissolved oxygen sample bottle. The tube should be long enough to reach to the bottom of the dissolved oxygen sample bottle. With the tube outlet at the bottom of the dissolved oxygen bottle, allow the water to overflow three times the volume of the dissolved oxygen sample bottle.

7.4.2 LaMotte Dissolved Oxygen Sampler, 1054-DO

The design of this sampler specifically collects water in a manner that is appropriate for dissolved oxygen determination via titration. This sampler avoids agitating the water, avoiding introducing air bubbles and changing the oxygen concentration of the water.

- Rinse the sample bottle and housing three times with surface water before sampling.
- Remove the plastic center plug with inlet tubing attached.
- Insert the collecting bottle, with the cap removed, into the chamber of the cylinder.
- Replace the plastic center plug. Ensure the inlet tubing is in the collecting bottle.
- Attach two-pound weight to the bottom bridle of the sampler by the snap clamp.
- Attach the snap clamp on the calibrated line to the bridle on the top of sampler.
- Quickly lower the water sampler to the desired depth and leave until full. Usually 3 – 5 minutes and can be determined when the bubbles from the sampler cease to appear.
- Carefully retrieve the water sampler.
- Remove the plastic center plug to expose the collecting bottle in the inner chamber.
- Immediately remove the sampling bottle and fix chemically for dissolved oxygen determination.
- Immediately insert thermometer into the water left in the sampler.
- The remaining water in the sampler may be used for determination of other parameters.
7.4.3 Subsurface Sampling Poles

These sampling poles are designed to sample water from a specific depth. A pull-ring extending from the handle opens and closes the plunger on the telescoping pole once the jar is at the appropriate depth. The 7300 Series Telescopic Jar Samplers have a chemical-resistant polypropylene sampler head connected to an aluminum telescoping pole. The head accepts a wide variety of wide-mouth jars.

- Rinse the sample bottle three times with surface water.
- Lower the water sampler to the desired depth, open the plunger and leave until full. May be determined by when the bubbles from the sampler cease to appear.
- Close the plunger and retrieve the sample.

7.4.4 Homemade Sampling Pole

A sampling pole can be fabricated by a handy member of your organization. The key criteria for acceptability is the ability to sample from a specific depth without contaminating the sample. The method often involves reaching into the water with the sample bottle inverted and full of air, then righting the bottle and allowing it to fill at the appropriate depth.

Homemade poles will typically work only for 0.5 m below the surface; deeper depths require alternate methods of sampling. The issue with deeper sampling depths is the need to cover the sampling bottle so that water from the surface is not mixed in to a deep sample as the open container is pulled up through the water column.

A homemade pole may also be used to allow the field team to reach below the surface when standing on a dock or some other structure that puts you too high above the water surface to reach to 0.5 m below surface with your arm.

- Rinse the sample bottle three times with surface water.
- Remove the cap from the bottle.
- Holding the bottle with the mouth down, lower it to 0.5 m below the surface.
- Invert the bottle so that air empties out of the bottle and the bottle fills with water.
- Place your hand over the mouth (or cap the bottle) and bring to the surface.

7.4.5 Reaching in with Your Arm

You may use your arm and a sample bottle to sample 0.5 m below the surface.

For Tier 1 UWS protocol, gloves are not required. For Tier 2 UWS protocol (sampling of nutrients), this collection method involving placing your hand over the mouth of the bottle is unacceptable.

The bottle must be rinsed three times before filling. Follow the filling procedure, discarding rinse water.

- Remove the cap from the bottle.
- Holding the bottle with the mouth down, lower it to 0.5 m below the surface.
- Invert the bottle so that air empties out of the bottle and the bottle fills with water.
- Place your hand over the mouth (or cap the bottle) and bring to the surface.
7.5 Required Replicates and Verification

During a field day, use the field data sheet as a reminder for the number of replicates required for each parameter.

*Table 3: Required replicates, blanks, and verification readings.*

<table>
<thead>
<tr>
<th>parameter &amp; technique</th>
<th>replicates required</th>
<th>verification and/or blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS coordinates</td>
<td>1 reading per station&lt;br&gt;at 1 station per day, take a second&lt;br&gt;reading before leaving the station</td>
<td>read a land-based reference station&lt;br&gt;within 2 days of the field sampling day</td>
</tr>
<tr>
<td>sampling with multiparameter sonde</td>
<td>1 reading at each depth, wait for reading to stabilize before recording&lt;br&gt;at 1 station per day (typically the last station), do two replicate profiles – do one complete profile, then do a second</td>
<td>verify depth by lowering sonde to known depth&lt;br&gt;verify chlorophyll <em>a</em> by reading water in a bucket and filtering 2 samples from the bucket&lt;br&gt;read standards at the start and end of a sample day (salinity, oxygen in 100% water saturated air, turbidity); day before and after sample day is acceptable</td>
</tr>
<tr>
<td>refractometer</td>
<td>1 reading from each depth&lt;br&gt;1 station per day, collect two separate samples from each depth for analysis</td>
<td>read 0 ppt water and a standard of known salinity at the start and end of the day; day before and after sample day is also acceptable</td>
</tr>
<tr>
<td>dissolved oxygen by titration</td>
<td>2 independently obtained samples from each depth at all stations</td>
<td>none</td>
</tr>
<tr>
<td>filtered chlorophyll <em>a</em></td>
<td>2 filtered samples of a single water sample collected from 0.5 m below the surface at all stations</td>
<td>2 blanks per day</td>
</tr>
<tr>
<td>turbidity from collected water sample</td>
<td>1 reading from a single water sample collected from 0.5 m below the surface&lt;br&gt;1 station per day, collect two separate samples for analysis</td>
<td>read 0 NTU water at the start and end of the day; day before and after sample day is also acceptable</td>
</tr>
<tr>
<td>Secchi depth</td>
<td>3 independent readings of Secchi depth at each station</td>
<td>none</td>
</tr>
<tr>
<td>macrophytes</td>
<td>3-6 stations per embayment</td>
<td>photos of each rake toss or the beach being sampled, reviewed by UWS science advisors</td>
</tr>
</tbody>
</table>
7.6 Order of Events When Sampling a Water Quality or Secchi Depth Station

7.6.1 Prepare for Sampling Trip

A. Calibrate all instruments.
B. Collect all field supplies.
C. Complete the pre-field trip check sheet.
D. Arrange for a shore person (someone to check on you if you don’t come back at the designated time.)

7.6.2 Dawn Sampling – within 3 hours of sunrise

A. Record station information on the data sheet. *Be sure to complete all sections of the data sheet completely, for every data sheet.* If you are using the LaMotte Winkler Titration for dissolved oxygen, be sure to record the barometric pressure (available on most Smart Phones).
B. Using the total depth of the station, determine sampling depths for water quality parameters (see Section 7.3.1).
C. Collect water samples and store or process properly according to the parameter-specific sampling SOP. See specific order of events in following flow chart.
   a. Depending on gear used, water samples may be collected for chlorophyll $a$, turbidity, temperature, salinity, dissolved oxygen.
   b. Sample the surface, then mid-depth, then bottom. Rinse all equipment with sample water before collecting a sample.
      i. Sampling equipment (e.g. Van Dorn bottle) should be swished at the appropriate depth to flush with sample water.
      ii. Sample collection bottles (e.g. LaMotte Dissolved Oxygen Sampler, Subsurface Sampling Poles) must be rinsed three times with sample water from the surface. To do this, remove the cap from the bottle, holding the bottle with the mouth down, lower it to 0.5 m below the surface. Invert the bottle so that air empties out of the bottle and the bottle fills with water. Place your hand over the mouth (or cap) and bring to the surface. Shake out excess water before collecting the sample.
      iii. Sample storage bottles require three small volume rinses with the sample form the appropriate depth.
   D. For filtered chlorophyll $a$, filter two blanks per day, per embayment. If you have multiple teams sampling, only one team needs to do the blank.
E. Collect profile data using the multiparameter sonde.
F. At one station per day repeat measurements where only one replicate is typically collected. The last station of the day is a good choice in terms of time management.
   a. Repeat the sonde profile. Complete the first profile, sampling at each depth. Complete a second profile.
b. Collect a separate water sample for salinity and turbidity analysis from each depth.

c. Record the depth and GPS coordinates a second time, just before leaving the station.

G. Read a calibration standard just following calibration and following the field trip to verify readings, for all parameters where this applies.

WATER QUALITY STATIONS – order of events
Cross out the boxes that do not apply on the version of the quick sheet that you take into the field. Bold boxes should be done by all field teams.

7.6.3 Mid-day Sampling – 9 a.m. to 2 p.m.

A. Record station information on the data sheet. *Be sure to complete all sections of the data sheet completely, for every data sheet.*

B. Sample for Secchi depth following the procedures detailed in the Secchi Depth SOP.

7.6.4 End of Field Day

A. Analyze any samples being held for analysis, if analysis is required at the end of the sample day. Possibilities include dissolved oxygen via titration, salinity, turbidity, filtering of chlorophyll $a$ sample. See specific order of events in the flow chart.

B. If using a multiparameter sonde to sample chlorophyll $a$, place the sonde in a bucket of estuarine water, read the sonde, and filter samples for chlorophyll $a$ analysis for verification of the sonde readings.
C. Verify all sections of the data sheet have been completed.
D. Store samples according to the relevant parameter-specific SOP.
E. Within 2 days of sampling, record the GPS of a reference station on land to verify the accuracy and precision of the GPS coordinates. See “Station Selection SOP” for more information.

8 TROUBLESHOOTING / HINTS

 Gather field equipment the day prior to sampling. Check the field equipment in the morning, before you head out into the field. Creating a checklist is very helpful in prepping for your field day. Include personal items (sunscreen, bug spray, etc.) and safety equipment on the checklist.
 Always carry a copy of this SOP and the relevant parameter-specific SOPs.
 Print out the “quick sheets” for relevant SOPs to use as a reminder in the field. Do not laminate these as you will want to add notes. A plastic page-protector taped close can be used to keep these sheets dry.

9 DATA PROCESSING AND STORAGE

The UWS Coordinator will be the custodian of the finalized data files. The UWS Coordinator will maintain a database which includes the unique site codes, section codes, and station codes for the embayment. Each unique station code will be affiliated with the corresponding GPS for the station.

The monitoring group is responsible for obtaining data, entering data into the UWS data template, and delivering the data to the UWS Coordinator.

The monitoring group is responsible for assuring that the correct unique station ID assigned by the UWS is properly matched with the local organizations station ID codes. Both codes (monitoring group’s station code and UWS unique station ID) will be entered into the data template, along with the GPS coordinates.

Field data entry, data entry into the Excel-based data entry template, and reporting of data are covered in the “Recording and Reporting SOP.”

10 REFERENCES


11 Quick Sheet – Sampling Plan (2 pages)

Check your packing list the day before a field day and again on the morning of a field day.
Calibrate instruments the day before sampling.
Read a calibration standard just following calibration and following the field trip to verify readings, for all parameters where this applies.
Bring the relevant SOPs and quick sheets with you into the field.

Remember – rinse equipment and collection bottles in sample water before collecting a sample.

Water quality stations - Sample depths are shown in chart to the right.

Use the field data sheet as a reminder for the number of replicates required for each parameter. Sample 1 station / day in duplicate for sonde profiles, salinity by refractometer, turbidity by turbidimeter, GPS, and depth.

For filtered chlorophyll a, filter two blanks per day, per embayment. If you have multiple teams sampling, only one team needs to do the blank.

Chlorophyll a and turbidity are always sampled at 0.5 m below the surface.

SECCHI DEPTH STATIONS (sample between 9 a.m. and 2 p.m.) – order of events
- Record station information on the data sheet. Be sure to complete all sections of the data sheet completely, for every data sheet.
- Sample for Secchi depth following the procedures detailed in the Secchi Depth SOP.

MACROPHYTE STATIONS – use quick sheet from Macrophyte SOP

GPS REFERENCE CHECK
- Within 2 days of sampling, record the GPS of a reference station on land to verify the accuracy and precision of the GPS coordinates.

WATER QUALITY STATIONS (sample within 3 hours of sunrise) – order of events shown in flow chart
- At one station per day repeat measurements where only one replicate is typically collected. The last station of the day is a good choice in terms of time management. (sonde, refractometer, turbidimeter, GPS, depth)
- Bold boxes should be done by all field teams.
1. Collect water samples, working from surface to bottom.
2. Carefully isolate water for dissolved oxygen titration, avoid introducing bubbles or shaking.
3. Store at least 200mL of water in an opaque bottle on ice for chlorophyll, or filter immediately.
4. Add chemicals to fix sample for dissolved oxygen determination via titration. Record barometric pressure.
5. Store at least 400mL of water in an opaque bottle on ice for chlorophyll, or filter immediately.
6. Place thermometer in remaining water sample and read when stable. (Repeat at 1 station / d.)
7. Record station information on data sheet. Use total depth to determine sampling depths.
8. Collect data with multiparameter sonde, working from surface to bottom. (1 station / d, repeat profile)
9a. Filter water samples for chlorophyll a analysis within 4 hours of collection. (1 stn., do a blank) RECORD VOLUME FILTERED
10. Store filters on ice for up to 12 hours. Transfer to a freezer asap.
11. Analyze salinity with the refractometer. Analyze turbidity with the turbidimeter.
12. Titrate dissolved oxygen samples within 8 hours of fixation.

Check all data sheets at end of day. Check that all samples are stored correctly. Rinse all field equipment.

---

Standard Operating Procedure
Sampling Plan
revised January 12, 2017
Page 19 of 20 (+ 7pg appendix)
12 APPENDIX – Data Sheets

The following pages include versions of forms. You may modify these as needed; be sure to include all of the information on these data sheets on any revisions.

Included:

Emergency Contact and Medical Information

Two-page Checklist and Site Information Sheet – One per day is required.

Three Versions of the Field Datasheets – these represent three potential suites of instruments – choose the version that works best for you or create your own.

Recommended:

Copy of the Beaufort Scale, Google “Beaufort Scale Howtoons” for a great looking version of the scale.
Confidential Emergency Contact/Medical Form
(It is recommended that you keep a copy for each member at all activities and events)

This medical information may be necessary in the event of serious illness or accident. Please complete this form accurately and truthfully. The facts you disclose will be kept confidential and the information provided will be given to others only in an emergency situation. Failure to disclose accurate and complete information could compound the seriousness of an accident or illness. Attach additional pages if more space is necessary.

General Information
Name ___________________________ Date of Birth ______________________
Address ________________________________________________________________
Phone ___________________________ Email _________________________________

Emergency Information
Health Insurance Company _________________________________________________
Policy #_____________________________ Phone _____________________________
Physician ___________________________ Phone _____________________________
Please attach a photocopy of your health insurance card.

Person(s) to Contact in the Event of an Emergency
1) Name ___________________________ Relationship _________________________
Address ________________________________________________________________
Phone ___________________________ Email _________________________________
2) Name ___________________________ Relationship _________________________
Address ________________________________________________________________
Phone ___________________________ Email _________________________________

Medications
List all over-the-counter and prescription medications, dosage, and what the medications are used for. Clearly indicate any for which it would be critical or life-threatening if you ran out. Bring sufficient quantities plus a five-day emergency supply with you.

Current Care:
If you are currently under the care of a medical professional (physician, counselor, psychiatrist, psychologist) please indicate conditions and reasons, and explain any possible impact on participation activities:
**Allergies**
List all drug, severe food, bee stings and other allergies and associated symptoms as well as treatments used:

**Health History**
Have you had a tetanus shot in the past 5 years? (This is required.) Y __  N  
Have you received all childhood immunizations? Y __  N  
Are you possibly pregnant? Y __  N  
Do you suffer from any seizures? Y __  N  
Have you been hospitalized in the past year? Y __  N  
Do you wear contacts, glasses or have vision problems? Y __  N  
Do you have any of the following?
- Hemophilia Y __  N __
- Diabetes Y __  N __
- Hernia/Ruptures Y __  N __
- Seizures Y __  N __
- Respiratory Problems (Asthma) Y __  N __
- Chronic Pain Y __  N __
- Ulcer or GI disorder Y __  N __
- Knee conditions Y __  N __
- Back or Neck conditions Y __  N __
- Dizzy Spells, Fainting, Convulsions Y __  N __
- Eating Disorders Y __  N __
- Depression Y __  N __
- Hearing Problems Y __  N __
- Motion Sickness Y __  N __
- High Blood Pressure Y __  N __
- Broken Bones/Dislocations Y __  N __
- Heart conditions Y __  N __
- Stomach, Kidney, Internal Problems Y __  N __
- Other ____________________________________________________________

If you answered yes to any of the above, please describe the diagnosis and treatment, as well as any impact the condition may have your ability to participate in activities:

**General**
Please fully describe anything in your medical history or current condition that might effect your participation in activities or that should be made known to medical personnel in case of an emergency, especially if you are incapacitated.

Explain any restriction of activity for medical reasons.

Are there any treatments you don’t want performed for religious or other reasons?

Do you have any special dietary needs?

**Health and Safety Certification**
I am aware of all my personal medical needs, and consulted with a medical doctor about my plans if I have any serious conditions. There are no health-related reasons or problems that might require accommodation in activities except as explained above, and I have answered all questions fully and truthfully.

Signed: ___________________________ Date: ________________
Address: ________________________________________________
Email: ___________________________ Phone: ___________________________
Parent or Guardian Signature: ___________________________ Date: ________________
(If under age 18)
<table>
<thead>
<tr>
<th>People on Trip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shore Person (and contact #)</td>
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</tbody>
</table>

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<th>checked in a.m.</th>
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<td>SITE BOX</td>
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<td></td>
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<tr>
<td>paper copy of safety plan</td>
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<tr>
<td>paper copy of contact info for team members</td>
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<td></td>
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<tr>
<td>copy of medical forms for team members</td>
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<td>first aid kit</td>
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<td>permanent marker</td>
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<td>labeling tape</td>
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<td>duct tape</td>
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<td>cable ties</td>
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<tr>
<td>scissors, nail clippers</td>
<td></td>
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<tr>
<td>knife</td>
<td></td>
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<tr>
<td>copy of Beaufort scale or a wind meter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STATION INFO AND RECORDING SUPPLIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>site maps with stations indicated on map</td>
<td></td>
<td></td>
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<tr>
<td>GPS coordinates for stations</td>
<td></td>
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</tr>
<tr>
<td>field data sheets</td>
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<tr>
<td>labels (if required)</td>
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<td>pencils</td>
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<td>pencil sharpener</td>
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<td>DEPENDS ON EQUIPMENT</td>
<td></td>
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</tr>
<tr>
<td>sonde</td>
<td></td>
<td></td>
</tr>
<tr>
<td>thermometer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ppt - refractometer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ppt - refractometer pipette</td>
<td></td>
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<tr>
<td>ppt - sample bottle (if analyzing later), 3/stn.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ppt - 0 ppt water for refractometer</td>
<td></td>
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<tr>
<td>Winkler kit - sample bottle</td>
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<tr>
<td>Winkler kit - manganous sulfate</td>
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<td>Winkler kit - alkaline potassium iodide</td>
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<td>Winkler kit - sulfuric acid 1:1</td>
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<tr>
<td>Winkler kit - starch solution</td>
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<tr>
<td>Winkler kit - sodium thiosulfate</td>
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<tr>
<td>Winkler kit - titrator syringe</td>
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<tr>
<td>Winkler kit - glass titration sample vial</td>
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<tr>
<td>Winkler kit - gloves</td>
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<tr>
<td>Winkler kit - eye protection</td>
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<tr>
<td>turb</td>
<td></td>
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<tr>
<td>turb - turbidimeter</td>
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<td>turb</td>
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<tr>
<td>turb - test tubes</td>
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<td>turb - Kimwipes or alternative</td>
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<td>turb - pipetter</td>
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<td>turb</td>
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<tr>
<td>turb - 124 NTU standard</td>
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<td>turb</td>
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<td>turb - ultrapure water (ASTM type I)</td>
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<td>turb</td>
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<tr>
<td>turb - sample bottle (if analyzing later), 1/stn.</td>
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<tbody>
<tr>
<td>SAMPLING EQUIPMENT</td>
<td></td>
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<tr>
<td>GPS device</td>
<td></td>
<td></td>
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<tr>
<td>camera (or phone)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>depth (metered line, fish finder, etc.)</td>
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<tr>
<td>subsurface sampling device</td>
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<tr>
<td>chl - opaque sample bottle (1/stn.)</td>
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<tr>
<td>chl - filter holders w/ filters</td>
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<td>chl</td>
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<tr>
<td>chl - extra filters</td>
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<td>chl - 60mL syringe</td>
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<td>chl - forceps</td>
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<td>chl - blotting paper</td>
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<td>chl - aluminum foil</td>
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<td>chl</td>
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<td>chl - airtight container</td>
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<td>chl - cooler with ice</td>
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<td>chl</td>
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<td>chl - water for blank</td>
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</table>
## Verification Readings

*Within 2 days of field day*

<table>
<thead>
<tr>
<th>Before</th>
<th>After</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>GPS of reference station</td>
</tr>
</tbody>
</table>

BEFORE = day before or morning of field day; AFTER = afternoon of or day after field day

<table>
<thead>
<tr>
<th>Depth (do while in the field)</th>
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</thead>
<tbody>
<tr>
<td>Salinity (0 ppt)</td>
</tr>
<tr>
<td>Salinity Standard, ________ ppt</td>
</tr>
<tr>
<td>sonde only - Dissolved Oxygen (100% saturation)</td>
</tr>
<tr>
<td>Turbidity (0 NTU)</td>
</tr>
</tbody>
</table>

### Notes on Weather Conditions

- High air temperature (can get from online weather report)
- Low air temperature (can get from online weather report)
- Cloud cover (%)
- Precipitation state (mist, drizzle, rain, heavy rain, etc.)
- Wind at embayment (not open sea) - measure or use Beaufort Scale

### FIELD NOTES (note anything which may affect the data)

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<thead>
<tr>
<th>Date</th>
<th>Daily Precipitation (inches)</th>
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<tbody>
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<tr>
<td>Embayment Name</td>
<td>GPS units (circle one):</td>
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<td>----------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td></td>
<td>dec. deg (40.772240°)</td>
</tr>
<tr>
<td></td>
<td>degree minutes (40° 46.334’)</td>
</tr>
<tr>
<td></td>
<td>degree min. sec. (40° 46’ 20.06”)</td>
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<table>
<thead>
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<th>Sample Date</th>
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<tbody>
<tr>
<td>People</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Station ID |          |          |
| Time       |          |          |

| Station Depth (m) |          |          |
| GPS N           |          |          |
| GPS W           |          |          |

<table>
<thead>
<tr>
<th>bottom (0.5 m off bottom)</th>
<th>mid-depth (if total depth &gt; 10m)</th>
<th>surface (0.5m below surface)</th>
<th>bottom (0.5 m off bottom)</th>
<th>mid-depth (if total depth &gt; 10m)</th>
<th>surface (0.5m below surface)</th>
<th>bottom (0.5 m off bottom)</th>
<th>mid-depth (if total depth &gt; 10m)</th>
<th>surface (0.5m below surface)</th>
</tr>
</thead>
</table>

| Sample Depth (m) |          |          |
| Temperature (°C) |          |          |
| Salinity (ppt)   |          |          |
| Dissolved Oxygen (%) |          |          |
| Dissolved Oxygen (mg/L) |          |          |
| Fluroescence (RFU) |          |          |
| Chlorophyll a (ug/L) |          |          |
| Turbidity (NTU)   | Turbidity / Salinity bottle ID (if needed) | Turbidity / Salinity bottle ID (if needed) | Turbidity / Salinity bottle ID (if needed) |

Enter additional field notes on back of sheet.  
If using a different method than usual, make a note!  

At 1 station per embayment, do a second profile (usually at last station).  
If total depth < 1.5m, do only mid-depth.  

Chlorophyll Reference Check in Bucket (do once per day per embayment)  
Sonde reading  

|------|------|-----------|-------------|-----|----|-----------|-------------|----|------|

Data entry person ___________  
Person checking data entry ___________
<table>
<thead>
<tr>
<th>Station ID</th>
<th>Time</th>
<th>Barometric Pressure</th>
<th>Barometric Pressure</th>
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<table>
<thead>
<tr>
<th>Station Depth (m)</th>
<th>GPS N</th>
<th>GPS W</th>
</tr>
</thead>
</table>

**reminders:** mg/L = ppm
If total depth < 1.5m, do only mid-depth.

<table>
<thead>
<tr>
<th>Sample Depth (m)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
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</thead>
</table>

Salinity Bottle ID (date, site, stn, depth; e.g. 5/9/17 LNE-1B)

<table>
<thead>
<tr>
<th>Salinity (ppt)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Secchi Depth (do 3 times)</th>
<th>cast 1</th>
<th>cast 2</th>
<th>cast 3</th>
<th>cast 1</th>
<th>cast 2</th>
<th>cast 3</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Chlorophyll</th>
<th>Rep 1</th>
<th>Rep 2</th>
<th>Rep 1</th>
<th>Rep 2</th>
<th>Rep 1</th>
<th>Rep 2</th>
</tr>
</thead>
</table>

Volume Filtered (mL)
Filter ID (date, site, stn, rep "a" or "b"; e.g. 5/9/17 LNE-
LaMotte Winkler DO Bottle ID - 1
DO (mg/L) - 1

LaMotte Winkler DO Bottle ID - 2
DO (mg/L) - 2

LaMotte Winkler DO Bottle ID - 3
DO (mg/L) - 3

LaMotte Winkler DO Bottle ID - 4
DO (mg/L) - 4

Enter additional field notes on back of sheet.

*If using a different method than usual, make a note!*

**At 1 station per embayment, do a second profile (usually last station)**

Data entry person __________ person checking data entry __________
<table>
<thead>
<tr>
<th>Station ID</th>
<th>Time</th>
<th>Barometric Pressure</th>
<th>Barometric Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**reminders: mg/L = ppm**

If total depth < 1.5m, do only mid-depth.

<table>
<thead>
<tr>
<th>Sample Depth (m)</th>
<th>bottom (B)</th>
<th>mid-depth (M)</th>
<th>surface (S)</th>
<th>bottom (B)</th>
<th>mid-depth (M)</th>
<th>surface (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.5 m off bottom)</td>
<td>(if total depth &gt; 10m)</td>
<td>(0.5 m below surface)</td>
<td>(0.5 m off bottom)</td>
<td>(if total depth &gt; 10m)</td>
<td>(0.5 m below surface)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Salinity / Turbidity Bottle ID</th>
<th>Salinity (ppt)</th>
<th>Turbidity (NTU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(date, site, stn, depth; e.g. 5/9/17 LNE-1B)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chlorophyll</th>
<th>Rep 1</th>
<th>Rep 2</th>
<th>Rep 1</th>
<th>Rep 2</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Volume Filtered (mL)</th>
<th>Filter ID (date, site, stn, rep &quot;a&quot; or &quot;b&quot;; e.g. 5/9/17 LNE-1a)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LaMotte Winkler DO Bottle ID</th>
<th>DO (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottle ID - 1</td>
<td>DO (mg/L) - 1</td>
</tr>
<tr>
<td>Bottle ID - 2</td>
<td>DO (mg/L) - 2</td>
</tr>
<tr>
<td>Bottle ID - 3</td>
<td>DO (mg/L) - 3</td>
</tr>
<tr>
<td>Bottle ID - 4</td>
<td>DO (mg/L) - 4</td>
</tr>
</tbody>
</table>

Enter additional field notes on back of sheet. If using a different method than usual, make a note!

At 1 station per embayment, do a second profile (usually last station)

data entry person _____________  person checking data entry ______________