FT 1700. Field Measurement of Light Penetration (SECCHI Depth and Transparency)

Use in conjunction with:

- FT 1000 General Field Testing and Measurement
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FD 1000 Documentation Procedures

1. EQUIPMENT AND SUPPLIES

1.1. Boat and Supplies: a boat may be required, and the following supplies must be available:

- Fuel supply (primary and auxiliary)
- Spare parts kit
- Life preservers (USCG approved)
- First aid kit (including emergency phone numbers of local hospitals and family contacts for each member of the sampling team)
- Spare oars
- Nautical charts with sampling/testing site locations

1.2. Field Instruments:

- Secchi disk attached to chain or rope marked at 0.1-meter or 1.0-foot intervals
- LI-COR Photometer (quantum radiometer spherical sensor and meter) or equivalent instrument (underwater sensor)
- Lowering frame for photometer sensor
- Pyranometer sensor or equivalent instrument (terrestrial sensor)
- Mounting and leveling fixture for the pyranometer sensor
- Sensor selector

1.3. Recordkeeping and Documentation Supplies:

- Field notebook (w/ waterproof paper is recommended) or forms
- Indelible pens

FT 1710. PHOTOMETERS/RADIOMETERS

1. CALIBRATION AND USE: This SOP addresses certain instruments. If using other equivalent instrumentation, follow the manufacturer's instructions on the use and calibration of such equipment.

1.1. Assembly

1.1.1. LI-COR Photometer: the LI-COR Quantum/Radiometer/Photometer is used to measure light over two different wavelength ranges: photosynthetically active radiation

(400-700 nm), and solar irradiance (400-1100 nm). The instrument measures light in units of microeinsteins per meter squared per second ($\mu E/m^2/s$). The unit consists of a battery-powered transistorized meter, a pyranometer sensor, an underwater quantum sensor, a sensor selector, cables, and a lowering frame for the underwater sensor.

1.1.2. Lowering Frame Assembly

1.1.2.1. Attach a 5-10 pound weight to the base of the lowering frame.

1.1.2.2. Attach the secchi disk to the threaded bolt.

1.1.2.3. Follow the manufacturer's instructions and attach the sensor to the base.

1.1.2.4. Place a small amount of stopcock grease on the O-ring built into the base of the sensor.

1.1.2.5. If using the LI-COR, align the yellow dot on the cable with the yellow mark on the sensor and lightly push the cable connector onto the sensor. Then attach the cable screw-on connector.

1.1.2.6. Adjust the secchi disk so that the top of the disk corresponds to the top of the sensor bulb.

1.1.3. Meter Assembly

1.1.3.1. Attach the patch cable to the meter input and output connectors as specified in the manufacturer's manual.

1.1.3.2. Assemble the pyranometer sensor by attaching the sensor to the leveling base using the attachment screw.

1.1.3.3. Assemble and attach the pyranometer calconnector (small black bar jack labeled pyranometer sensor) per manufacturer's instructions. If using a LI-COR, the serial number on the calconnector (5608) must match the serial number of the pyranometer serial numbers.

1.1.3.4. Attach the quantum sensor calconnector to the BNC cable (cable extending from the underwater sensor) and plug into the instrument sensor port (follow manufacturer's instructions for connection and assembly). The serial number on the calconnector (373) must match the serial number of the quantum sensor.

1.1.4. Battery Check: check the condition of the battery before taking measurements and replace it, if necessary.

1.2. Calibration

1.2.1. Meter Zero Adjustment

1.2.1.1. After the unit is assembled place the meter face up on a level surface and turn the FUNCTION switch to the OFF position.

1.2.1.2. Allow the instrument to remain in the off position for at least one minute, and then determine if the needle on the meter scale is on zero.

1.2.1.3. Adjust the needle to zero by turning the mechanical ZERO screw on the front of the meter.

1.2.2. The manufacturer calibrates both the quantum and pyranometer sensor. The accuracy of this calibration is +/- 5%. Further calibration is not possible.

1.3. Measuring Light Penetration in Samples

1.3.1. Once assembled, carefully lower the unit without putting the weight of the frame assembly on the cable.

1.3.2. If the measurement is taken from an anchored boat, deploy the sensor on the side of the boat with the least shade.

1.3.3. Take readings just above the surface (AIR on record sheet), just below the surface (SURFACE on record sheet), and at one-foot depth increments.

1.3.4. Read both the underwater quantum sensor and the on-deck pyranometer at each depth (including SURFACE and AIR). Pyranometer readings are used to determine if there are any changes in the incident light due to changes in cloud cover. Any such changes must be factored out when light extinction coefficients are calculated.

1.3.5. Use the range setting function to properly scale the readings.

1.3.6. Begin raising the sensor when the light intensity measured by the quantum sensor drops to less than 1% of the incident light (or once the meter reaches the bottom), and repeat each measurement at the previous depth locations.

1.3.7. Once the surface light measurements have been repeated, lower the unit to determine the secchi depth. Alternatively, follow FT 1720 for secchi depth measurement.

2. PREVENTIVE MAINTENANCE: Refer to FT 1000, section 3.

3. DOCUMENTATION

3.1. Field Instrument Calibration Documentation: Document acceptable calibration (meter zero adjustment) for each instrument unit and field test or analysis, linking this record with affected sample measurements.

3.1.1. Retain vendor certifications of all factory-calibrated instrumentation.

3.1.2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit used.

3.1.2.1. Record manufacturer name, model number and identifying number such as a serial number for each instrument unit.

3.1.3. Record the time and date of all initial calibrations.

3.1.4. Record the instrument reading (value in appropriate measurement units) of all calibrations.

3.1.5. Record the name of the analyst(s) performing the calibration.

3.1.6. Retain manufacturers' instrument specifications.

3.1.7. Document whether successful initial calibration occurred.

3.1.8. Document any corrective actions taken to correct instrument performance according to records requirements of FD 3000.

3.1.8.1. Document date and time of any corrective action.

3.1.8.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.

3.1.9. Describe or cite the specific calibration or verification procedure performed (DEP SOP or internal SOP).

3.2. Record all field-testing measurement data, to include the following:

- Project name
- Date and time of measurement or test (including time zone, if applicable)
- Source and location of the measurement or test sample (e.g., monitoring well identification number, outfall number, station number or other description)
- Latitude and longitude of sampling source location (if required)
- Analyte or parameter measured
- Measurement or test sample value
- Reporting units
- Initials or name of analyst performing the measurement
- Unique identification of the specific instrument unit(s) used for the test(s)
- Estimated percent cloud cover
- Secchi Depth
- Total Depth

FT 1720. MEASUREMENT OF SECCHI DEPTH

1. INTRODUCTION: This SOP applies when the Secchi depth is the only parameter being measured; i.e., the other light penetration measurements are not included in the scope of the project. In such occasions, the only equipment from this SOP that is needed in the field is the secchi disk (see FT 1700, section 1.2).

2. PROCEDURE

2.1. Remove sunglasses. If using a boat, conduct the measurements over the shaded side of the boat or with the sun to the observers back.

2.2. Clip the calibrated chain or rope to the Secchi disk. Make sure the chain is attached so that depth is determined from the upper surface of the disk.

2.3. Slowly lower the secchi disk in the water, visually observe the disk sectors, and record the depth at which the disk disappears. If it is visible to the lake or stream bottom, check the appropriate box in the field sheet.

2.4. Lower the disk beyond the point recorded in section 2.3 above. Slowly raise the disk and record the depth at which it reappears. The Secchi depth is the average of the two readings.

2.5. Note any conditions that might affect the accuracy of the measurement in the field sheet. If the disappearance depth is < 1.0 m, determine the depth to the nearest 0.05 m by marking the chain at the nearest depth marker and measuring the remaining length with a tape measurer.

3. DOCUMENTATION: See FT 1000, section 4 for additional details

3.1. Record all field-testing measurement data, to include the following:

- Project name
- Date and time of measurement or test (including time zone, if applicable)
- Source and location of the measurement or test sample (e.g., monitoring well identification number, outfall number, station number or other description)
- Latitude and longitude of sampling source location (if required)
- Analyte or parameter measured
- Measurement or test sample value
- Reporting units
- Initials or name of analyst performing the measurement