St. Lucie Plant EPU Biological Study

Quality Assurance Plan

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TABLE OF CONTENTS

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to establish the Quality Assurance Plan (QAP) for collecting data utilizing gill nets, beach seines, trawls, plankton nets, water quality monitoring equipment, and boat-based observations as required by Florida Power and Light Company's (FPL's) permit modification (NPDES Permit No. FL0002208) for the extended power uprate (EPU) for both Units 1 and 2 at the St. Lucie Plant on Hutchinson Island, St. Lucie County, Florida.

This QAP provides general descriptions of the work to be performed to collect the samples, the standards to be met and the procedures that will be used to ensure that the data are scientifically valid and defensible.

1.2 ORGANIZATION

The organizational chart provided as Figure 1-1 shows the relationships among EAI project participants. Key project roles are filled by those persons responsible for ensuring the collection of valid data, the assessment of data for precision and accuracy, and the person(s) responsible for approving and accepting final products and deliverables.

The responsibilities of these persons are described below.

The ***Project Manager (PM)*** will supervise the assigned project personnel to ensure compliance with QAP procedures and project goals. The PM responsibilities include:

- Providing oversight for sampling design, selection of station sites, and adherence to project objectives;
- Reviewing and approving the QAP, SOP and other materials developed to support the project;
- Coordinating with contractors, reviewers, and others to ensure technical quality and contract adherence;
- Coordinating project assignments in establishing priorities and scheduling;
- Ensuring project completion within established budgets and time schedules;
- Providing technical supervision to project personnel;
- Implementing corrective actions and providing managerial supervision to staff;

- Preparing and/or reviewing preparation of project deliverables, including the QAP and SOP developed to support the project; and
- Liaison with EPA and other agencies for interaction with the project team, technical reviewers, and others to ensure technical quality requirements are met in accordance with project objectives.

The ***Quality Assurance (QA) Officer*** will be responsible for reviewing and approving the QAP and SOP. Additional QA Officer responsibilities include the following:

- Reviewing and evaluating field procedures;
- Conducting external performance and system audits of the procedures;
- Monitoring quality control activities to assure conformance;
- Performing one internal technical system audit;
- Performing a field audit of each sampling team;
- Ensuring the timely processing and analyzing of field samples;
- Ensuring sorting staff and ichthyoplankton taxonomists follow QA procedures outlined in the QAP and SOP;

The ***Quality Control (QC) Officer*** (typically the Field Team Leader), is responsible for performing evaluations to ensure that QC is maintained throughout the sampling process, analysis procedures in the laboratory and during subsequent documentation of results. The QC Officer will:

- Monitoring field activities during sampling events;
- Perform QC evaluations to ensure compliance with QAP standards;
- Interact with the field sampling team and others to ensure technical quality requirements are met in accordance with project design objectives;
- Verify work completed and provide written documentation of QC reviews;
- Oversee ichthyoplankton sorting rechecks;
- Provide peer review oversight on the content of the work products;
- Ensure compliance with EPA/FDEP reporting requirements.

The ***Field Team Leader*** (who also typically serves as the QC Officer), will direct the work of the field sampling team, including collection, preservation of samples and completion of field sampling records. The field sampling team will include scientific staff with specialization and technical competence in field sampling activities to effectively and efficiently perform the required tasks in

accordance with the QAP and SOP. Custody procedures required ensuring the integrity of the samples and the maintenance of proper sample identification during handling will be followed. The field sampling team is responsible for:

- Receiving and inspecting the sample containers to be taken into the field;
- Ensuring equipment calibration;
- Ensuring all items on the field sampling checklist are functional and taken into the field for each sampling event;
- Maintaining field log notebooks;
- Identification of trawl, gill net, and beach seine specimens;
- Assigning tracking numbers to each sample;
- Completing and signing appropriate field records;
- Contacting the FFWCC Law Enforcement Dispatch Center 24 hours prior to sampling as required by EAI's Special Activity License Number SAL-11-0071A-SR.

The ***Ichthyoplankton Taxonomists*** will:

- Identify ichthyoplankton specimens to the lowest practical taxon;
- Follow sample processing procedures to ensure the integrity of the samples (with respect to prevention of loss and maintenance of proper sample identification during handling);
- Verify the completeness and accuracy of sample tracking documentation;
- Maintain the integrity of the samples in their custody;
- Complete and sign laboratory records.

Fish and Shellfish Taxonomists will:

- Identify specimens that could not be readily identified in the field to the lowest practical taxon using published literature or the assistance of experts;
- Follow sample processing procedures to ensure the integrity of the samples (with respect to prevention of loss and maintenance of proper sample identification during handling);
- Verify the completeness and accuracy of sample tracking documentation;
- Maintain the integrity of the samples in their custody;
- Complete and sign laboratory records.

1.3 QUALITY OBJECTIVES AND CRITERIA

Data quality objectives (DQOs) are qualitative and quantitative statements that clarify the intended use of the data, define the type of data needed to support the decision, identify the conditions under which the data should be collected, and specify tolerable limits on the probability of making a decision error due to uncertainty in the data (if applicable). Data users develop DQOs to specify the data quality needed to support specific decisions.

1.3.1 PROJECT QUALITY OBJECTIVES

The quality of an environmental monitoring program can be evaluated in three steps: (1) establishing scientific assessment quality objectives, (2) evaluating program design to determine if the objectives can be met, and (3) establishing assessment and measurement quality objectives that can be used to evaluate the appropriateness of the methods being used in the program. The quality of a particular dataset is a measure of the types and amount of error associated with the data. Sources of error or uncertainty in statistical inference are commonly grouped into two categories:

1. *Sampling error:* The difference between sample values and true population values from unknown biases. Sampling error includes natural variability (spatial heterogeneity and temporal variability in population abundance and distribution) not specifically accounted for in a design (for design-based inference) and variability associated with model parameters or incorrect model specification (for model-based inference).
2. *Measurement error:* The difference between sample values and true population values associated with the measurement process. Measurement error includes bias and imprecision associated with sampling methodology; specification of the sampling unit; sample handling, storage, preservation, and identification; instrumentation; and the like.

The data requirements encompass aspects of both laboratory taxonomic analysis and database management to reduce sources of errors and uncertainty in the use of the data. Data required for each project are listed in Table 1-1.

Water temperature, dissolved oxygen, pH, salinity, and conductivity are monitored in association with each gillnet and trawl/bongo sample. Water temperature is monitored for each beach seine sample and turtle survey.

Methods and procedures described in this document are intended to reduce the magnitude of measurement error sources and the frequency of error occurrence. The relevant quality objectives are related to sample handling and to making measurements of required parameters onsite.

Project quality objectives include the following:

- Use of standardized, repeatable data and sample collection procedures;
- Use of site maps, GPS coordinates and photographs to document the actual sampling locations to ensure correct locations are sampled and for future reference purposes;
- Use of experienced scientists to perform the data and sample collection and taxonomic analyses;
- Calibration of meters for flow rate, pH, temperature, dissolved oxygen, conductivity and salinity to known standards in accordance with the manufacturer's specifications;
- Use of QC protocols and analyses.

1.3.2 MEASUREMENT PERFORMANCE CRITERIA

Measurement performance criteria are quantitative statistics used to interpret the degree of acceptability of the data to the user. These criteria, also known as Data Quality Indicators (DQIs) include the following:

- Precision,
- Accuracy,
- Representativeness,
- Completeness, and
- Comparability.

DQIs that cannot be expressed in terms of accuracy, precision, or completeness will be reported by fully describing the specified method. Measurement performance criteria for various parameters are presented in Table 1-2.

1.4 DOCUMENTATION AND RECORDS

Thorough documentation of all field sample collection and handling activities is necessary for proper processing in the laboratory and, ultimately, for the interpretation of study results. Field sample collection and handling will be documented in writing using the following forms and labels:

- A waterproof field log notebook for general observations and notes at each station;

- A Data Sheet for each sample (gill netting, beach seines, trawls, ichthyoplankton sampling, turtle surveys) (Appendix A);
- An in-jar Sample Identification Label that accompanies and identifies each sample sent to the laboratory for identification (Appendix B);
- An EAI external Sample Identification Label that accompanies and identifies each sample jar (Appendix B);
- A Chain-of-Custody Record form to provide additional tracking information and request specific analyses for each sample sent to outside sources (Appendix B).

A Sample Identification Label (to be placed on the sample bottle/container) (Appendix B) will be completed with specific information to accompany each sample throughout the chain of custody. The label will document the Sample Identification Number (SIN) (consisting of date, sampling area, transect or point, and type of sampling). All entries will be made in indelible ink and will coincide with sample information on the appropriate sample Data Sheet (Appendix A).

Proper chain-of-custody procedures are necessary for tracking sample possession from the EAI laboratory to the confirmation laboratory for samples sent for identification verification. Chain-of-Custody Record forms (Appendix B) will accompany each shipment of samples documenting sample identity (coinciding with information on the Sample Identification Label and field log) and laboratory receipt date and time. All Chain-of-Custody Record entries will be made in ink. A copy of EAI's Special Activity License Number SAL-11-0071A-SR will also accompany each shipment of samples. Samples will be delivered to the appropriate laboratory when problematic species are unidentifiable by EAI taxonomists. The laboratories will retain copies of all shipping airbills. Specifications (to be identified by the PM) will be followed for retention of field samples by the receiving location.

The PM is responsible for ensuring the completeness and retention of data, correspondence, plans, and revisions that may be required for the preparation of reports and supporting documentation during the project. Examples of the type of information to manage include:

- Any reports and documents prepared;
- Contract and work assignment information;
- Project QAP;
- Field datasheets;
- Sorting and taxonomy datasheets;
- Results of technical reviews, data quality assessments, and audits;

- Relevant communications (memoranda; internal notes; telephone conversation records; letters; meeting minutes; and written correspondence among the project team personnel, subcontractors, suppliers, or others);
- Maps, photographs, and drawings;
- Studies, reports, documents, and newspaper articles pertaining to the project;
- Special data compilations; and
- Spreadsheet data files (hardcopy and on CD or DVD).

The Field Team Leader will ensure data on field data sheets are entered into the database. Data compilations and formal reports will be maintained at EAI. Reports will include a summary of the types of data collected, sampling dates, and any problems or anomalies observed during sample collection, as directed by the PM.

If any change(s) in this QAP are required during the study, a memorandum will be sent to each person on the distribution list describing the change(s), following approval by the appropriate persons. The memorandums will be attached to the QAP. All written records relevant to the sampling and processing of samples will be maintained at EAI. Unless other arrangements are made, records will be maintained for a minimum of 2 years following project completion.

1.5 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

This QAP and other supporting materials will be distributed to all participants. All field, laboratory, and data analytical personnel have training and/or extensive experience in performing all duties that are their responsibility. Prior to the initial sampling event, a training session will be held to:

- Review the QAP and other materials,
- Check that all equipment and sampling gear are ready,
- Discuss and demonstrate the sampling method(s) to be used,
- Provide site orientations for the site sampling teams, and
- Review health and safety gear and procedures.

The training session will consist of a discussion of procedures and study-specific paperwork, as well as a field demonstration of equipment components, assembly and operation. Each field sampling team will consist of at least two people. In addition, a QC Officer will ensure strict adherence to the project protocols by conducting field audits (i.e., a field audit of each field sampling team during each

of its first sampling events to assess compliance with the QAP and SOPs) and a second audit midway through the first sampling season.

2.0 SAMPLING METHODS

This section describes the procedures that will be used to collect site information, water quality data, ichthyoplankton samples, fish and shellfish samples, and other data to support compliance with FPL's NPDES permit modification.

Site characteristics will be recorded on field data sheets and in the field log notebook. Samples will be collected at the designated sampling points and transects within the 3 study areas every other month. Gill netting, beach seines, and turtle surveys will be conducted during daylight hours. Trawl and ichthyoplankton sampling (500 μm mesh plankton net) will be conducted at night.

2.1 STANDARD OPERATING PROCEDURES

Standard Operating Procedures (SOP) will be followed for all sampling. A list of equipment and expendable supplies needed in the field for each type of sampling is provided in the SOP for each type of sampling. All primary and back up meters will be calibrated prior to leaving the lab for a sampling event and upon return to the lab after the sampling event. Backup gear will be calibrated and taken into the field for all sampling events. Should any primary equipment fail during sampling, back up gear will be used to complete the sampling event. An equipment failure report will be made by the Field Team Leader upon return to the lab. Malfunctioning equipment will be repaired or replaced as needed. Should the backup equipment fail, the Field Team Leader must determine whether additional backup equipment or samples can be obtained quickly to continue the sampling effort. The Field Team Leader should try to contact either the PM, or QA Officer to notify them of the situation and possible corrective actions. If it is not possible to obtain their approval, the Field Team Leader should proceed based on best professional judgment. Any deviations from the planned sampling procedures must be recorded in the field log notebook and on any pertinent forms.

2.2 SAMPLE HANDLING AND CUSTODY

Samples will be transferred to suitable containers, labeled internally and externally and properly stored until the end of the sampling event. External labels will be marked with the SIN consisting of date, sampling area, transect or point, and type of sampling. This number will also be recorded on the internal label and field data sheet. After completion of sample collection for each sampling event, the samples to be returned to the laboratory for identification will be preserved in a 5-10 percent formalin solution. Alternately, samples may be placed on ice and frozen for lab confirmations of

identifications. Samples sent for outside verification will be preserved and transferred to the receiving analytical laboratories using Chain-of-Custody Record forms. The Chain-of-Custody Record form (Appendix B) acts as a record of the sample shipment and a catalog of the contents of each shipment (coinciding with information on the field record). All Chain-of-Custody Record form entries will be made in black ink and will include:

- Sampler's name;
- Project name and number;
- Page number (e.g., 1 of 1);
- Collection date;
- Sample Identification Number;
- Number of containers;
- Preservation protocol;
- Type of analysis required;
- Laboratory recipient signature; and
- Laboratory receipt date and time.

No erasures will be made on the Chain-of-Custody Record forms. If an incorrect entry is made, the information will be crossed out with a single strike mark, which is initialed and dated. All portions of the Chain-of-Custody Record will be filled out completely and any additional issues or comments will be added in the space provided. The appropriate sample identification label (to be placed on and in the sample bottle/container) will be completed to accompany each sample throughout the chain of custody. The label will document the SIN (including date, sampling area, transect or point, and type of sampling), sampling personnel initials, preservation technique, and the number of jars per SIN (e.g., 1 of 1). Immediately following the packing of each shipping container (sample jar crate complete with preserved, labeled samples sealed associated chain-of-custody records, and EAI's Special Activity License Number SAL-11-0071A-SR), the shipping container will be secured with packaging tape.

2.3 ANALYTICAL METHODS

Ichthyoplankton samples will be delivered to the EAI laboratory for processing, sorting, enumeration, and taxonomic identification. Laboratory processing will involve the removal of eggs and larvae from detritus and other material found in each sample, and identifying and counting all eggs and larvae to the lowest practical taxon. Processing will be conducted by experienced laboratory

technicians and taxonomists according to the approved SOP, Laboratory Sorting/Specimen Identification.

Training, experience, and possession of proper laboratory equipment and taxonomic literature are crucial factors affecting the quality of taxonomic identification activities. EAI taxonomists will follow the approved EAI SOP and consult the appropriate published taxonomic literature. Ichthyoplankton will be identified to the lowest practical taxon (typically genus or species) using the most pertinent taxonomic literature.

In addition to the published taxonomic literature, a reference collection may be used for taxonomic verification or developed as part of the project. A reference collection is defined as a set of biological specimens, each representing some taxonomic level and not necessarily limited to specific projects or activities. Specimens whose identification is uncertain may be sent to taxonomic experts familiar with the group in question for confirmation. Specimens damaged beyond recognition (i.e., by natural causes or by the sampling process) will be enumerated and documented as "unidentifiable". The true data of a biological project such as this are the actual specimens collected in a survey for that project. Following determination of density (i.e., number of eggs/larvae per volume of water sampled) and taxonomic identification, these specimens should be maintained in a voucher collection for at least 2 years after project completion. If there are questions regarding the accuracy of taxonomic identifications used in calculations and reporting, referral to the voucher collection should be an initial step taken in error reduction.

2.3.1 FIELD IDENTIFICATION OF FISHES AND SHELLFISH

Specimens will be identified in the field to the lowest level that is practical. When specimens collected cannot be identified to a minimum of generic level in the field, they will be preserved and returned to the lab for further laboratory identification. These specimens will be noted on the Field Data Sheet. Some juveniles, or hybrids, are not distinguishable below the generic level in the field and will be left at that level [e.g., *Eucinostomus* less than 40 millimeters (mm) TL]. Field guides will be taken on all field trips, as well as a written summary of field characters that are useful in separating more problematic species (e.g., Gerreidae). Under no circumstances will species that are prohibited or that have special protections (endangered or threatened status) be intentionally collected.

2.4 QUALITY CONTROL

Data quality is addressed by consistent performance of procedures documented in the SOP, the training and experience of project staff and documentation of project activities. The QAP and other supporting materials will be distributed to all sampling personnel. A training session will be held prior to commencement of sampling. Training will include a classroom session and a practical field session and will be mandatory for all field staff. A Field Team Leader or QC Officer will ensure that samples are taken according to the established protocols. The QC Officer and the Field Team Leaders will ensure that all field notebook entries, forms, checklists, and measurements are recorded and completed correctly during each sampling event. QC checks will be completed for all field data sheets, and the name of QC personnel and date of QC check will be entered on the bottom of each Field Data Sheet. Staff performance will be monitored throughout the sampling and analysis phases to ensure adherence to project protocols.

DQOs are described in this QAP and Table 1-2 specifies the precision requirements for project parameters. QC activities include field audits at each sampling location, laboratory sorting checks, and laboratory taxonomic QC.

2.4.1 PRECISION

Precision is a measure of the nearness of two values and can be used as an indicator of internal consistency of methodology. It is demonstrated by the degree of mutual agreement between individual measurements or enumerated values of the same property of a sample, usually under demonstrated similar conditions. Precision of ichthyoplankton measures (i.e., number of eggs and larvae present in a sample) is estimated by a comparison of results between multiple sorters of the same sample. Ten percent of ichthyoplankton samples will be resorted by a second trained sorter and the results compared. Precision is calculated as Relative Percent Difference (RPD) as follows:

$$RPD = \left|C_1 - C_2\right| / \left[(C_1 + C_2) / 2\right] X\ 100\%$$

Where: C_1 and C_2 are the two values (e.g., sorting/counting results of technician 1 and technician 2). The precision of laboratory sorting (i.e., measurement error due to analytical error) is measured by checking the sorted samples discard, removing and counting missed specimens, and calculating sorting efficiency.

Taxonomic precision is calculated from the re-identification process (i.e., taxonomic confirmation or disagreement) conducted by two, independent taxonomists. The percent taxonomic difference (PTD) is calculated as:

$$PTD = 1 - \left[N_1 / N\right] X\ 100\%$$

Where: N is the total number of eggs or larvae, and N1 is the number of taxonomic "agreements."

Taxonomic precision using PTD will be determined by having unusual or problematic species re-identified by a second taxonomist.

Physicochemical measurements of sampled waters will also be collected, and the precision of their measurements (as detailed in Table 1-2) will be determined.

2.4.2 ACCURACY

Accuracy is defined as the degree of agreement between an observed value and an accepted reference or true value.

The field team will be trained in proper uses and calibration for all instrumentation used. Manufacturer's calibration procedures will be followed. For in-field measurements of temperature, dissolved oxygen, pH, salinity and conductivity, procedures for determining precision include the following:

- ***Temperature sensor:*** The precision of temperature sensors used in this project will be checked using a NIST-traceable standard thermometer.
- ***DO sensor:*** The accuracy of DO sensors and methods used in this project will follow the EAI SOP for instrument calibration. The YSI 85 and Hach/Hydrolab Quanta meters have a saturation chamber which creates a 100% water saturated air environment for calibration. The meter is temperature compensated and a prompt for manually entering ambient altitude during calibration adjusts for sea level measurements.
- ***pH sensor:*** The accuracy of pH sensors used in this project will be checked using pH 4, 7, and 10 certified buffer solutions.

- ***Salinity/Conductivity sensor:*** The accuracy of the conductivity sensor used in this project will be checked using certified conductivity standard solutions. The conductivity sensor is calibrated using both 10 mS/cm and 50 mS/cm certified conductivity standard solutions which bracket the anticipated conductivity range.

2.4.3 REPRESENTATIVENESS

Data representativeness is defined as the degree to which data actually represent a characteristic of a population, parameter, variations at a sampling point, a process condition, or an environmental condition. It therefore addresses the natural variability or the spatial and temporal heterogeneity of a population. The location of the sampling points and the number of samples collected from each sampling station during each sampling event will be examined to ensure that representative sample collection from each station occurs.

2.4.4 COMPARABILITY

Two data sets are considered to be comparable when there is confidence that the two sets can be considered equivalent with respect to the measurement of a specific variable or group of variables. Comparability is dependent on the proper design of the sampling program and on adherence to accepted sampling techniques, SOP, and QA guidelines. Comparability of data is ensured by similarity in sampling methods, parameter measurement protocols, as well as by uniform training and experience of field sampling and laboratory personnel. All field personnel conducting sampling will have adequate training and appropriate experience.

2.4.5 COMPLETENESS

Completeness is defined as the percentage of measurements made that are judged to be valid according to specific criteria and entered into the data management system. To achieve this objective, every effort is made to avoid accidental or inadvertent sample or data loss. Accidents during sample transport or lab activities that cause the loss of the original samples will result in irreparable loss of data. Lack of data entry into the database will reduce the ability to perform analyses, integrate results, and prepare reports. Field personnel will assign a set of continuous identifiers to a batch of samples. Samples will be stored and transported in unbreakable (plastic) containers and final sample processing will occur in a controlled environment within the laboratory. The assignment of a set of continuous (serial) laboratory numbers to a batch of samples makes it less likely that a technician or taxonomist will overlook samples when preparing them for processing and identification. The

laboratory serial (or log) numbers also make it easy during the data compilation stage to recognize that some samples have not been analyzed.

Percent completeness (*% C*) for measurement parameters can be defined as follows:

$$\%C=[V/T] \times 100$$

Where: *V* = the number of measurements judged valid and *T* = the total number of measurements.

For this project, sampling will be considered complete when no less than 90 percent of the samples collected during a particular sampling event are judged valid.

2.5 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, MAINTENANCE, AND CALIBRATION

Periodic regular inspection of equipment and instruments is needed to ensure the satisfactory performance of the systems. Equipment to be used during the sampling event is listed in the appropriate SOP. Before any piece of sampling or measurement equipment is taken into the field, it will be determined to be appropriate for the task to be performed, that all necessary parts of the equipment are intact, and the equipment is in working order. In addition, the equipment will be visually inspected before its use by the field sampling team. Broken equipment will be labeled "DO NOT USE" and returned to the office to receive necessary repairs or for disposal. Backup field equipment will be available during all field activities in the event of equipment failure. The objective of preventive maintenance is to ensure the availability and satisfactory performance of the equipment. All field measurement instruments will receive preventive maintenance in accordance with the manufacturer's specifications.

Calibration of water quality instruments used for in-field measurements of temperature, dissolved oxygen, pH, salinity and conductivity will be checked before each sampling event using certified standard solutions. Calibrations will be recorded on instrument calibration forms, FDEP Form FD 9000-8 or equivalent (Appendix C). Individual sensors will be considered to be operating correctly if the instrument readings are within the range of their respective precision values as provided by the instrument manufacturer (Appendix C, Table 1-2). If the values are not within the specified range for an individual sensor, the sensor will be cleaned and recalibrated. If these two values are still not within the specified range following cleaning and recalibration, the sensor will be replaced. All field

equipment will be inspected, maintained, and calibrated as described in the maintenance and calibration portion of the EAI SOP.

2.6 DATA MANAGEMENT

Samples will be documented and tracked by means of Field Data Sheets, Sample Identification Labels, and Chain-of-Custody Record forms. The Field Team Leaders will be responsible for completing these forms, which the QC Officer will review for correctness and completeness. EAI will maintain copies of these forms in the project files. If there is any indication that requirements for sample integrity or data quality have not been met, the QA Officer will be notified immediately (with an accompanying explanation of the problems encountered).

Field sampling data will be compiled and stochastically analyzed. Information obtained from analyses will be used to calculate the density and types of organisms removed from the source water body due to the sampling type. All field and laboratory data will be entered into a project database. EAI will store all computer files associated with the project in a project subdirectory (subject to regular system backups) and will copy the files to archival media and retain for two years after project completion (unless otherwise directed).

2.7 HANDLING OF STATE OR FEDERALLY LISTED SPECIES

Although the probability of an encounter with endangered or threatened species in regular sampling is low, every precaution will be taken to ensure that should this occur, the animals will be released unharmed. Data (i.e., length, weight, photograph) will be collected on any individuals of listed species and recorded as part of the regular sampling process. Because of the small size of the gear employed (gill nets, seines, plankton nets and otter trawls), short duration of tow times, lack of mechanical advantage or winches on otter trawls, and avoidance of sampling in federally managed areas, any potential impacts to endangered or threatened species will be minimized. Any individuals caught will be immediately released after the information on the capture is recorded. Proper handling techniques and reporting requirements will be utilized. For example, if sea turtles are captured, standard federal procedures on resuscitation will be followed or the animal will be considered a stranding and handled appropriately with the FFWCC authorities. Similarly, any impacts to other State or Federally listed species will be minimized by quick release (e.g., gulf sturgeon). It is possible that eggs or larvae of listed species may be captured as part of the planktonic sampling, and these

organisms will be unavoidably removed from the system. Data collected will potentially provide additional information that will aid in the management of listed species populations.

3.0 ASSESSMENT AND OVERSIGHT

3.1 ASSESSMENT AND RESPONSE ACTIONS

The QA program includes technical system audits, with independent checks of the data obtained from sampling, analysis, and data gathering activities. The essential steps in the QA program are as follows:

- Identify and define the problem;
- Assign responsibility for investigating the problem;
- Investigate and determine the cause of the problem;
- Assign and accept responsibility for implementing appropriate corrective action;
- Establish the effectiveness of and implement the corrective action; and
- Verify that the corrective action has eliminated the problem.

Many of the technical problems that might occur can be solved immediately by the staff members involved (i.e., modifying the technical approach, repairing instrumentation that is not functioning properly, or correcting errors or deficiencies in documentation). Immediate corrective actions form part of normal operating procedures and are noted in records for the project. Problems not solved this way require more formalized, long-term corrective action. If quality problems that require attention are identified, EAI will determine whether attaining acceptable quality requires either short- or long-term actions. If a failure in an analytical system occurs (e.g., performance requirements are not met), the QC Officer will be responsible for corrective action and will immediately inform the PM or QA Officer, as appropriate. Subsequent steps taken will depend on the nature and significance of the problem. The PM has primary responsibility for monitoring the activities of this project and identifying or confirming any quality problems. The QA Officer will initiate the corrective action required, document the nature of the problem (using a form such as that shown in Figure 3-2), and ensure that the recommended corrective action is carried out. The QA Officer has the authority to stop work on the project if problems affecting data quality that will require extensive effort to resolve are identified. The PM will be notified of major corrective actions and stop work orders.

Data review and validation services provide a method for determining the usability and limitations of data and provide a standardized data quality assessment. All field record forms and Chain-of-Custody Record forms will be reviewed by the QA Officer for completeness, correctness and adherence to QA requirements. Data quality will be assessed by comparing entered data to original data or by comparing results with the measurement performance criteria.

4.0 DATA VALIDATION AND USABILITY

4.1 VERIFICATION AND VALIDATION METHODS

All entries in the field data sheets, field log notebook, and Chain-of-Custody Record form will be reviewed by the Field Team Leader (assisted by the QA Officer, as needed) for completeness and correctness. Any discrepancies in the records will be reconciled with the appropriate associated field personnel and will be reported to the PM. EAI will be responsible for reviewing data entries and transmittals for completeness and adherence to QA requirements. Data quality will be assessed by verifying entered data to original data or by comparing results with the measurement performance criteria to determine whether to accept, reject, or qualify the data. The submission of samples to outside biological laboratories will include Chain-of-Custody Record forms, documenting sampling time and date. This information will be checked by the laboratories.

4.2 RECONCILIATION WITH USER REQUIREMENTS

As soon as possible following completion of the sample collection and analyses, precision, accuracy, and completeness measures will be assessed by EAI and compared with the criteria. This assessment will represent the final determination of whether the data collected are of the correct type, quantity, and quality to support their intended use for this project. Any problems encountered in meeting the performance criteria (or uncertainties and limitations in the use of the data) will be discussed with the PM and will be reconciled, if possible. All biological data will undergo an assessment to determine their suitability for meeting project objectives. Measurements of physicochemical and biological parameters obtained during the field sampling and laboratory analyses will be compared to the requirements to ensure the number of samples obtained and their quality have met the project goal. A preliminary data review will be conducted, and appropriate statistical tests will be performed (as determined and directed by the PM) for summarizing and analyzing the data. The summary and analysis will include an identification of the key underlying assumptions for the statistical procedures to be valid, verification of the assumptions of the statistical test, and conclusions drawn from the data (USEPA, 1998).

5.0 REFERENCES

U.S. Environmental Protection Agency (USEPA). 1998. *Guidance for Data Quality Assessment: Practical Methods for Data Analysis, EPA QA/G-9, QA97 Version*. EPA/600/R-96/084. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

6.0 ACRONYMN DEFINITIONS

CD – Compact disc

DO – Dissolved oxygen

DQI – Data Quality Initiative

DQO – Data Quality Objective

DVD – Digital video disc

EPA – Environmental Protection Agency

FDEP – Florida Department of Environmental Protection

FFWCC – Florida Fish and Wildlife Conservation Commission

mS – milliSiemens

NIST – National Institute of Standards and Technology

PM – Project manager

PTD – Percent taxonomic difference

QA – Quality assurance

QAP – Quality Assurance Plan

QC – Quality control

RPD – Relative percent difference

SE – Sorting efficiency

TL – Total length

SOP – Standard Operating Procedures

Table 1-1. ENVIRONMENTAL DATA TO BE COLLECTED DURING PSL UPRATE BIOLOGICAL MONITORING PLAN OF STUDY

DATA TYPE	MEASUREMENT ENDPOINT(S) OR UNITS
Physiochemical Parameters	
Photo documentation	Visual record of sampling site characteristics and unusual conditions
GPS location	Coordinates of sampling sites (degrees, minutes, thousandths of minutes)
Temperature	Degrees Centigrade (°C)
Dissolved oxygen	Milligrams per liter (mg/L)
pH	pH Unit
Specific conductivity	milliSiemens per centimeter (mS/cm)
Salinity	Parts per thousand (ppt)
Biological Parameters (as necessary)	
Fish egg density	Eggs per cubic meter (eggs/m^3)
Larval fish/shellfish density	Larvae/m^3
Fish/shellfish – trawl	Number of individuals per square meter of bottom trawled (#/m^2)
Fish/shellfish – gill net	Number of individuals per 30 minute set (#/30 min)
Fish/shellfish – beach seine	Number of individuals per seine (#/seine)

Table 1-2. MEASUREMENT PERFORMANCE CRITERIA FOR ST. LUCIE PLANT MONITORING

MEASUREMENT PARAMETER	PRECISION	ACCURACY	COMPLETENESS (%)
Field Water Quality Measurements			
Temperature	±0.15°C	NA[1]	≥ 90
pH	±0.2 units	NA[1]	≥ 90
Dissolved Oxygen	±0.2 mg/L	+ 10%	≥ 90
Salinity	+0.01 pp	+ 15%	≥ 90
Conductivity	±0.001 mS/cm	+ 15%	≥ 90
Ichthyoplankton Measurements			
Egg Density	RPD[2] ≤ 10%	95% calculation efficiency	≥ 95
Larval Density	RPD ≤ 10%	95% calculation efficiency	≥ 95
Larval Taxonomy	RPD <15%	95% calculation efficiency Literature confirmation[3]	≥ 95
Fish and Shellfish Measurements			
Fish and Shellfish Lengths	+/- 1 mm	NA[1]	> 95
Fish and Shellfish Taxonomy	PTD[4]< 15%	Confirmation in lab with taxonomic keys and independent verification	> 95

[1] NA=Not applicable; Analytical truth is unknown for these field measures (i.e., there is no analytical standard).
[2] RPD = Relative percent difference.
[3] Analytical truth based on taxonomic literature.
[4]PTD = Percent taxonomic difference.

Figure 1-1
EAI ORGANIZATION CHART FOR ST. LUCIE PROJECT

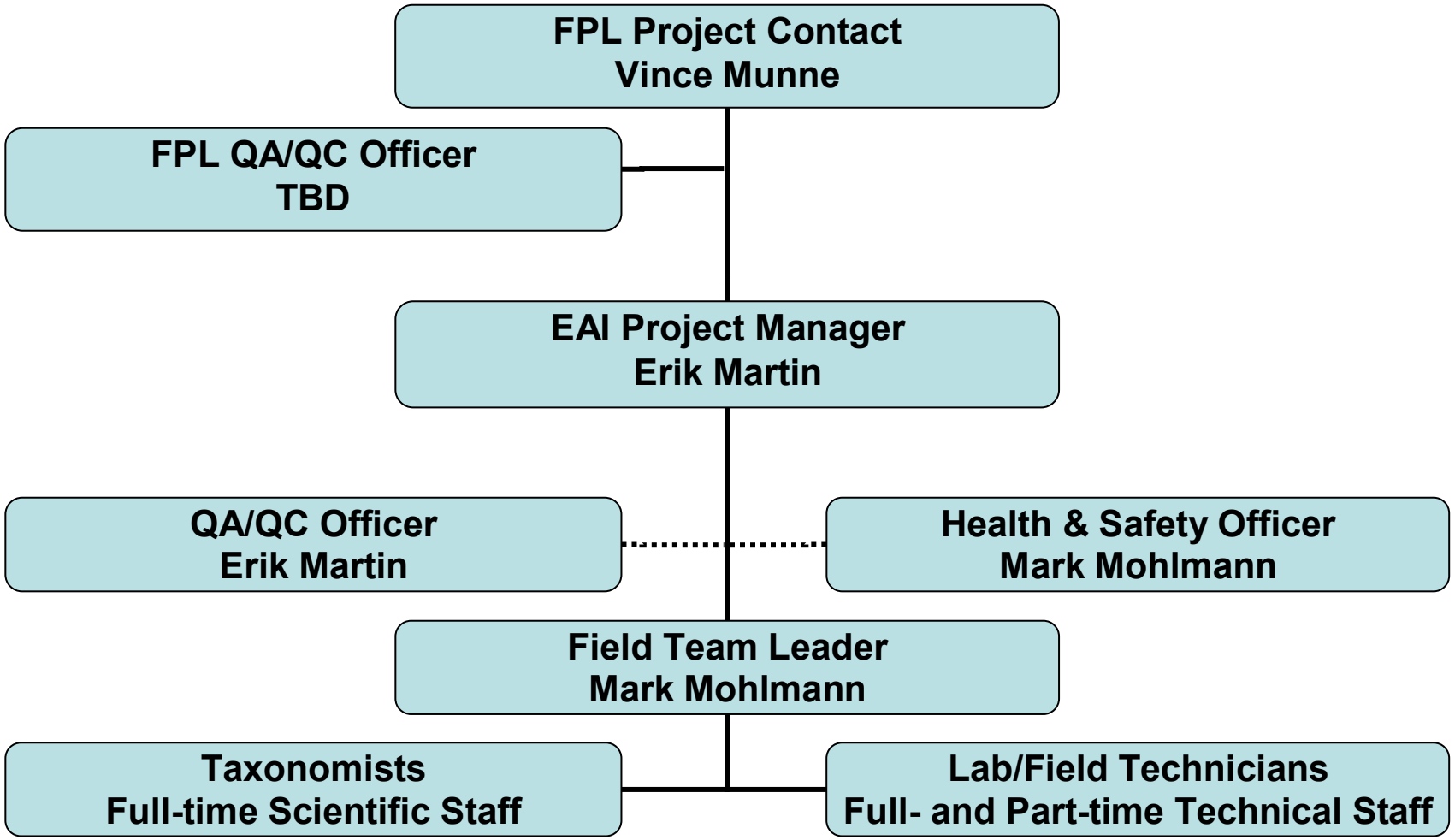

Figure 3-1
Corrective Action Request and Response Verification

Project:	Project Manager:
Description of Problem Encountered:	
Potential Effect(s) on Data Quality:	
Name of Person Reporting Problem:	QA/QC Officer
Date Reported:	
Recommended Action:	
Action Taken:	
Date Action Completed:	

VERIFICATION OF CORRECTIVE ACTION

Corrective Action Has Effectively Resolved Problem: Yes ☐ No ☐

QA/QC Officer: _____ _____
Signature Date

Project Manager: _____ _____
Signature Date

ST. LUCIE PLANT EPU BIOLOGICAL STUDY
QUALITY ASSURANCE PLAN

APPENDIX A
FIELD DATA SHEETS

St. Lucie Plant 1 and 2 Uprate Project: Base Field Data Sheet - Beach Seine

Sample Identification Number: 072811 - SL1 - a - BS

Date (MMDDYY) | Area | Transect | Type

Area: **SL1-** Northern Area - Between Central Area and Ft. Pierce Inlet
SL2- Central Area - In the vicinity of the FPL St. Lucie Plant
SL3- Southern Area - Between Central Area and St. Lucie Inlet

Point: **a -** North; **b -** Middle; **c -** South

Type **GN -** Gill Net; **TR -** Trawl; **IP -** Ichthyoplankton; **BS -** Beach Seine; **ST -** Sea Turtle Survey

Sampling Date/Time

Date: 07/28/2011
Time Arrive:
Time Depart:
Time on Station:

Personnel

FTL: Mark Mohlmann
Crew: Matt Goff
Crew: Carrie Goethel
Crew: Jen Sanders
Crew:
Crew:
Crew:
Crew:

Environmental Data

Current Direction	Current Speed	Tide (Circle one)	Sea Conditions	Air Temp (°C)	Wind Dir	Wind Spd (mph)	Sky Conditions (Circle one)	Precip (Circle one)	Notes on Environmental Data
		High Ebb Low Flood					Clear Partly Cloudy Mostly Cloudy Overcast	Yes No	

Site Data

Position	Latitude (°N)	Longitude (°W)
Start		
End		

Water Temperature (°C)

Beach Seine Data

Time Net Deployed	Time Net Beached	Seine Time	Distance to 4' Depth	Estimated Surf Height (ft)	Estimated Water Visibility (ft)	Notes on Net Set

Notes:

Recorded By: _____ Data Entered By: _____ Date: _____ Data Verified By: _____ Date: _____

St. Lucie Plant 1 and 2 Uprate Project: Base Field Data Sheet - Ichthyoplankton

Sample Identification Number: 072811 - SL1 - a - IP

Date (MMDDYY) | Area | Transect | Type

Area: **SL1-** Northern Area - Between Central Area and Ft. Pierce Inlet
SL2- Central Area - In the vicinity of the FPL St. Lucie Plant
SL3- Southern Area - Between Central Area and St. Lucie Inlet

Point: **a -** Nearshore; **b -** Middle; **c -** Offshore

Type **GN -** Gill Net; **TR -** Trawl; **IP -** Ichthyoplankton; **BS -** Beach Seine; **ST -** Sea Turtle Survey

Sampling Date/Time

Date: 07/28/2011
Time Arrive:
Time Depart:
Time on Station:

Personnel

FTL: Mark Mohlmann
Crew: Matt Goff
Crew: Carrie Goethel
Crew:

Sampling Vessel

(Circle one)
25' Parker
Other

Environmental Data

Current Direction	Current Speed	Tide (Circle one)	Sea Conditions	Air Temp (°C)	Wind Dir	Wind Spd (mph)	Sky Conditions (Circle one)	Precip (Circle one)	Notes on Environmental Data
		High Ebb Low Flood					Clear Partly Cloudy Mostly Cloudy Overcast	Yes No	

Site Data

Position	Latitude (°N)	Longitude (°W)	Water Depth (ft)
Start			
End			

Bongo Data

Position	Time	Flowmeter A	Flowmeter B	Notes on Bongo Tow
Start				
End				
Total (End - Start)				

Water Quality Data

Position	Profile	Time (HH:MM)	Depth Taken (m)	Sp. Cond (mS/cm)	Temp (°C)	Salinity (PSU)	pH	DO (mg/L)	Read By (Initials)	Notes on Water Quality Data	Meter Used (Circle one)
North	Surface										Hach-A Hach-B YSI
	Mid-Depth										
	Bottom										
Middle	Surface										Hach-A Hach-B YSI
	Mid-Depth										
	Bottom										
South	Surface										Hach-A Hach-B YSI
	Mid-Depth										
	Bottom										

Recorded By: _____ Data Entered By: _____ Date: _____ Data Verified By: _____ Date: _____

St. Lucie Plant 1 and 2 Uprate Project: Base Field Data Sheet - Gill Netting

Sample Identification Number: 072811 - SL1 - a - GN

Date (MMDDYY) | Area | Transect | Type

Area: **SL1-** Northern Area - Between Central Area and Ft. Pierce Inlet
SL2- Central Area - In the vicinity of the FPL St. Lucie Plant
SL3- Southern Area - Between Central Area and St. Lucie Inlet

Point: **a -** Nearshore; **b -** Middle; **c -** Offshore

Type **GN -** Gill Net; **TR -** Trawl; **IP -** Ichthyoplankton; **BS -** Beach Seine; **ST -** Sea Turtle Survey

Sampling Date/Time

Date: 07/28/2011
Time Arrive:
Time Depart:
Time on Station:

Personnel

FTL: Mark Mohlmann
Crew: Matt Goff
Crew: Carrie Goethel
Crew:

Sampling Vessel

(Circle one)
25' Parker
Other _____

Environmental Data

Current Direction	Current Speed	Tide (Circle one)	Sea Conditions	Air Temp (°C)	Wind Dir	Wind Spd (mph)	Sky Conditions (Circle one)	Precip (Circle one)	Notes on Environmental Data
		High Ebb Low Flood					Clear Partly Cloudy Mostly Cloudy Overcast	Yes No	

Site Data

Position	Latitude (°N)	Longitude (°W)	Water Depth (ft)
Start			
End			

Gill Net Data

Time Net Set	Time Net Retrieved	Total Soak Time	Notes on Net Set

Water Quality Data

Position	Profile	Time (HH:MM)	Depth Taken (m)	Sp. Cond (mS/cm)	Temp (°C)	Salinity (PSU)	pH	DO (mg/L)	Read By (Initials)	Notes on Water Quality Data	Meter Used (Circle one)
West (near-shore)	Surface										Hach-A Hach-B YSI
	Mid-Depth										
	Bottom										
Middle	Surface										Hach-A Hach-B YSI
	Mid-Depth										
	Bottom										
East (offshore)	Surface										Hach-A Hach-B YSI
	Mid-Depth										
	Bottom										

Recorded By: _____ Data Entered By: _____ Date: _____ Data Verified By: _____ Date: _____

St. Lucie Plant 1 and 2 Uprate Project: Base Field Data Sheet - Sea Turtle Survey

Sample Identification Number: **072811 - SL1 - ST**

Date (MMDDYY) Area Type

Area: **SL1-** Northern Area - Between Central Area and Ft. Pierce Inlet
SL2- Central Area - In the vicinity of the FPL St. Lucie Plant
SL3- Southern Area - Between Central Area and St. Lucie Inlet

Date: _____ **Personnel** FTL: _____ Crew: _____

Crew: _____ Crew: _____

Sampling Vessel: _____

Environmental Data

Current Direction	Current Speed	Tide (Circle one)	Sea Conditions	Air Temp (°C)	Wind Dir	Wind Spd (mph)	Sky Conditions (Circle one)	Precip (Circle one)	Notes on Environmental Data
		High Ebb Low Flood					Clear Partly Cloudy Mostly Cloudy Overcast	Yes No	

Site Data

	Pass #1			Pass #2				
Position	**Time**	**Latitude (°N)**	**Longitude (°W)**	**Time**	**Latitude (°N)**	**Longitude (°W)**	**Water Temperature (°C)**	**Underwater Visiblity (ft)**
Start								
End								

Sea Turtle Data

Turtle #	Time	Pass # (1 or 2)	Species	Size (cm)	Surf or Subm	Waypoint	East or West	Distance and Angle
1							E W	
2							E W	
3							E W	
4							E W	
5							E W	
6							E W	
7							E W	
8							E W	
9							E W	
10							E W	

Notes:

Recorded By: _____ Data Entered By: _____ Date: _____ Data Verified By: _____ Date: _____

Species: CC=loggerhead, CM=green turtle, EI=hawksbill, LK=Kemp's ridley, DC=leatherback; Surf=surfaced, Subm=submerged

St. Lucie Plant 1 and 2 Uprate Project: Base Field Data Sheet - Trawl

Sample Identification Number: 072811 - SL1 - a - TR

Date (MMDDYY) | Area | Transect | Type

Area: **SL1-** Northern Area - Between Central Area and Ft. Pierce Inlet
SL2- Central Area - In the vicinity of the FPL St. Lucie Plant
SL3- Southern Area - Between Central Area and St. Lucie Inlet

Point: **a -** Nearshore; **b -** Middle; **c -** Offshore

Type **GN -** Gill Net; **TR -** Trawl; **IP -** Ichthyoplankton; **BS -** Beach Seine; **ST -** Sea Turtle Survey

Sampling Date/Time

Date: 07/28/2011
Time Arrive:
Time Depart:
Time on Station:

Personnel

FTL: Mark Mohlmann
Crew: Matt Goff
Crew: Carrie Goethel
Crew:

Sampling Vessel

(Circle one)
25' Parker
Other _____

Environmental Data

☐ Use Bongo Data - Sample ID No.:_____

Current Direction	Current Speed	Tide (Circle one)	Sea Conditions	Air Temp (°C)	Wind Dir	Wind Spd (mph)	Sky Conditions (Circle one)	Precip (Circle one)	Notes on Environmental Data
		High Ebb Low Flood					Clear Partly Cloudy Mostly Cloudy Overcast	Yes No	

Site Data

☐ Use Bongo Data - Sample ID No.:_____

Position	Latitude (°N)	Longitude (°W)	Water Depth (ft)
Start			
End			

Trawl Data

☐ Use Bongo Data - Sample ID No.:_____

Position	Time	Flowmeter A	Flowmeter B	Notes on Trawl
Start				
End				
Total (End - Start)				

Water Quality Data

☐ Use Bongo Data - Sample ID No.:_____

Position	Profile	Time (HH:MM)	Depth Taken (m)	Sp. Cond (mS/cm)	Temp (°C)	Salinity (PSU)	pH	DO (mg/L)	Read By (Initials)	Notes on Water Quality Data	Meter Used (Circle one)
North	Surface										Hach-A Hach-B YSI
	Mid-Depth										
	Bottom										
Middle	Surface										Hach-A Hach-B YSI
	Mid-Depth										
	Bottom										
South	Surface										Hach-A Hach-B YSI
	Mid-Depth										
	Bottom										

Recorded By: _____ Data Entered By: _____ Date: _____ Data Verified By: _____ Date: _____

Ecological Associates, Inc. - St. Lucie Plant Uprate - Ichthyoplankton Laboratory Bench Sheet

Project: **St. Lucie**	Sample ID:	Due Date:

Primary Taxonomist	ID Date	Total ID Time	% Taxonomic Agreement:	Notes:
QC Taxonomist	QC Date	Total QC Time		

					Number per Life Stage				
FAMILY/ TAXA	GENUS SPECIES	VIAL NO.	REF (Y/N)	ADD. SPLIT X (Multiplier)	Eggs	YSL	PL	Juv	NOTES

Data Entered By: _____ Date: _____

Data Verified By: _____ Date: _____

St. Lucie Units 1 and 2 Uprate Project

Beach Seine Field Data Sheet

Sample Identification Number: 072811 -SL1- a - BS

Date (MMDDYY) Area Point Type

Date: 7/28/11 **Time: ________**

Taxa	Tally	Number Collected	Number Retained	Notes

Notes:

Field Data Recorded by: _______ Data Entered By: __________ Date: __________ Data Verified By: _________ Date: __________

ST. LUCIE PLANT EPU BIOLOGICAL STUDY
QUALITY ASSURANCE PLAN

APPENDIX B
SAMPLE IDENTIFICATION LABEL AND CHAIN-OF-CUSTODY FORM

TAXONOMIC CHAIN-OF-CUSTODY RECORD

Ecological Associates, Inc
PO Box 405
Jensen Beach, FL 34958
(772) 334-3729 fax (772) 334-4925

Sample Origination:	**Alternate Origination:**	**Receiving Laboratory:**
Ecological Associates, Inc 1458 NE Sunview Terrace Jensen Beach, FL 34957 (772) 334-3729	Name:	Name:
	Address:	Address:
	City, State, Zip:	City, State, Zip:
	Phone:	Phone:

Project Name:	Shipping Method:	Laboratory Contact Name:
Project Number:	Tracking Number:	Laboratory Contact Phone (if different from above):
EAI Contact Name	EAI Contact Phone:	Laboratory Contact Email:

Sample Conditions/ Remarks:

Preservative:
- ☐ Formalin
- ☐ Ethanol
- ☐ Other _____

Collection Date (mm/dd/yy)	**Sample Number** / **Taxon** (if known)	**Vial Number**	**Collection Date** (mm/dd/yy)	**Sample Number** / **Taxon** (if known)	**Vial Number**	**Collection Date** (mm/dd/yy)	**Sample Number** / **Taxon** (if known)	**Vial Number**

RELINQUISHED BY: (SIGNATURE AND AFFILIATION):	Date:	Time:	RECEIVED BY: (SIGNATURE AND AFFILIATION):	Date:	Time:
RELINQUISHED BY: (SIGNATURE AND AFFILIATION):	Date:	Time:	RECEIVED BY: (SIGNATURE AND AFFILIATION):	Date:	Time:
RELINQUISHED BY: (SIGNATURE AND AFFILIATION):	Date:	Time:	RECEIVED BY: (SIGNATURE AND AFFILIATION):	Date:	Time:

Date Printed:8/12/2011
File:St. Lucie QAP Appendix B EAI Taxonomic Chain-of-Custody, Final

SAMPLE IDENTIFICATION LABEL
(EXAMPLES)

External Label

Facility Code: **ST** Collection Date:**7/28/11**

Sample Type: **IP** Collection Time: _____

Area**: 1** Period: **Night** Σ Flow Reading : _____

Sample ID No.: **072811 - SL1 - A - IP**
(Date - Area - Transect - Type)

Field Team Leader: **M. Mohlmann**

Jar No. **1** of **1**

Internal Label

Sample ID #: **072811 – SL1 – A – IP**
(Event Date - Area - Transect - Type)

Date: **7/28/11** Time: _____**(Night)**

Initials: _____ **Σ** Flow Reading: _____

ST. LUCIE PLANT EPU BIOLOGICAL STUDY
QUALITY ASSURANCE PLAN

APPENDIX C
PROJECT SOP

ST. LUCIE PLANT EPU BIOLOGICAL STUDY STANDARD OPERATING PROCEDURES (SOP)

Prepared By

Ecological Associates Inc.

Post Office Box 405

Jensen Beach, Florida 34958

August 2011

TABLE OF CONTENTS

ST. LUCIE PLANT EPU BIOLOGICAL STUDY
STANDARD OPERATING PROCEDURES (SOP)

1.0 Introduction

This document describes the methods, procedures, and protocols to be used by staff of Ecological Associates, Inc. (EAI) in support of Florida Power and Light Company's (FPL's) trawl, plankton, gill net, beach seine, and sea turtle study at the St. Lucie Plant. Activities governed under this Standard Operating Procedures (SOP) include sample collection, sample processing, taxonomic identification of specimens, and collection of physicochemical data.

Larval, juvenile, and adult fish and shellfish sampling will be conducted within three general areas adjacent to the St. Lucie Plant: one site parallel to the discharge structure and two reference sites. One of these will be located approximately midway between the discharge site and the Ft. Pierce Inlet and the other midway between the discharge site and the St. Lucie Inlet. Data will be collected bi-monthly, during both day and night periods, as described in this SOP. Data analyses will examine trends in species composition, abundance, and biomass, as well as diurnal and seasonal variation.

Sampling in the area of the St. Lucie Plant will be conducted using trawls, bongo nets, gill nets, and beach seines. A 16-foot otter trawl and a 100-foot beach seine will be used to collect juvenile and adult fish and shellfish, and ichthyoplankton and shellfish larvae will be collected using paired 0.5 mm-mesh bongo nets. In addition, a 600-foot gill net will be used to collect juvenile and adult fish.

Questions on sampling techniques, staffing, schedules, health and safety issues, and/or Quality Assurance/Quality Control (QA/QC) related to sampling at the St. Lucie Plant should be directed to one of the following individuals:

- Mark Mohlmann, EAI Field Operations Manager Office: (772) 334-3729
  Cell: (772) 349-2135

- Erik Martin, EAI Project Manager Office: (772) 334-3729
  Cell: (772) 380-3371

2.0 Health and Safety

2.1 Health and Safety Plan (HASP)

2.1.1 All employees will read and be familiar with the St. Lucie HASP.

2.1.2 An approved copy of the HASP will be kept with the field team during all sampling activities.

2.1.3 Appropriate safety gear will be worn and utilized for all field activities in accordance with the HASP and any additional measures mandated by FPL.

3.0 Mobilization

3.1 Prior to Day of Field Sampling

3.1.1 Confirm vehicle and staff availability for scheduled sampling date.

3.1.2 At least 48 hours prior to a sampling event, notify FPL Contact of impending field activities by email. The FPL Contact will notify the appropriate personnel at the plant and will notify EAI of any operating conditions or plant activities that may affect sampling.

FPL Contact:

Vince Munne
Work: (772) 467-7453
Cell: (772) 263-2847

3.1.3 Ensure that FPL acknowledges sampling schedule (arrival date & time) prior to departing for the field.

3.1.4 At least 24 hours prior to the date of departure:

3.1.5 Contact the Florida Fish and Wildlife Conservation Commission (FWC) and advise them of the scheduled sampling activities, as per EAI's Special Activity License.

3.1.5.1 FWC – Martin and St. Lucie Counties :

(561) 625-5128 (Phone)

3.1.6 Assemble equipment and supplies using applicable Equipment and Supplies Checklists (Appendix A) and ensure that all needed gear is in proper operating condition.

3.1.7 Review Health and Safety Plan (HASP) and ensure that all requisite safety gear is included with equipment and supplies.

3.1.8 Calibrate field instrumentation (Appendix B).

3.2 Day of Field Sampling

3.2.1 Review sampling protocols prior to initiating field activities.

3.2.2 Conduct a Safety and Environmental Tailboard meeting at the site prior to sampling to address any safety and environmental conditions the field team may encounter (refer to HASP).

4.0 Water Quality

4.1 Calibration and Parameters

4.1.1 All meters taken into the field will be calibrated at the EAI office prior to and following data collection in accordance with EAI's Quality Manual and QAP for the St. Lucie project.

4.1.2 A suite of standard water quality parameters, including temperature, pH, conductivity, salinity, and dissolved oxygen, will be taken at three equally spaced stations along each transect during gill net, trawl and plankton sampling. Bottom, mid-depth and sub-surface readings will be recorded at each station.

5.0 Trawl and Plankton Sampling – Preparation and Methods

5.1 Mobilize

5.1.1 Use Equipment and Supplies Checklist to assemble and ready trawl field gear (Appendix A).

5.1.2 Provide a Float Plan to EAI's Field Operations Manager.

5.1.3 Prepare flow meters.

5.1.3.1 Sea Gear meters

5.1.3.1.1 Adjust dial to zero.

5.1.3.2 General Oceanics meters

5.1.3.2.1 Complete the following within 24 hours prior to net deployment at the first sampling location to ensure accurate readings.

5.1.3.2.1.1 Remove the screw at rear of the flow meter.

5.1.3.2.1.2 Hold nose of meter down.

5.1.3.2.1.3 Inject tap water with a syringe or squirt bottle into meter chamber until full.

5.1.3.2.1.4 Replace screw.

5.1.4 Prepare plankton sample containers.

5.1.4.1 Affix exterior sample labels on sample containers. Tape interior labels to container lids.

5.1.4.2 Fill sample containers with 90-100 ml formaldehyde (which will yield approximately 10% formalin when mixed with salt water) and 6.3 g hexamethylenetetramine (used as buffer). Place in carrying container.

5.1.5 Load gear aboard vessel.

5.2 Embarkation

5.2.1 Conduct a safety briefing prior to launching or loading gear on vessel.

5.2.1.1 Ensure all personnel are wearing Personal Flotation Devices (PFDs) and closed-toed, non-skid footwear at all times when working on or around water.

5.2.1.2 Maintain boat log indicating persons on trip, destination, and times of departure and return.

5.2.2 Depart for the sampling area being cognizant of manatee speed zone restrictions.

5.2.2.1 Maintain vigilance for the presence of manatees in the study area, particularly during winter months. Suspend sampling operations if manatees are likely to be impacted and immediately contact the Field Operations Manager. Sampling may be resumed once manatees leave the area.

5.3 Vessel

5.3.1 Launch the boat, being cautious to follow the HASP for the St. Lucie Plant.

5.3.1.1 Abort sampling activities if the Field Team Leader determines that conditions are unsafe or will not permit the safe collection of representative samples (e.g., threatening weather, rough sea conditions, unusual water body conditions, etc.).

6.0 Sampling Location and Frequency

6.1 Location

6.1.1 During each sampling event, trawl and plankton samples will be collected (concurrently if possible) at the discharge site and two adjacent sites.

6.2 Sampling Commencement and Frequency

6.2.1 Sampling will be conducted bi-monthly for a total of 6 sampling events per year (Table 1).

6.2.1.1 Trawl Sampling

6.2.1.1.1 Trawl sampling will be conducted during the nighttime period for each sampling station.

Nighttime sampling will not commence until at least one hour after sunset.

6.2.1.1.2 A total of 54 trawl samples will be collected per year (9 samples per sampling event X 6 sampling events; Table 1).

6.2.1.2 Plankton Sampling

6.2.1.2.1 Plankton sampling will be conducted during the nighttime period for each sampling station. Nighttime sampling will not commence until at least one hour after sunset.

6.2.1.2.2 A total of 36 plankton samples will be collected per year (6 samples per sampling event X 6 sampling events; Table 1).

6.2.1.3 Gill Net Sampling

6.2.1.3.1 Gill net sampling will be conducted during the daytime period for each sampling station. Daytime sampling will not commence until at least one hour after sunrise.

6.2.1.3.2 A total of 54 gill net samples will be collected per year (9 samples per sampling event X 6 sampling events; Table 1).

6.2.1.4 Beach Seine Sampling

6.2.1.4.1 Beach seine sampling will be conducted during the daytime period for each sampling station. Daytime sampling will not commence until at least one hour after sunrise.

6.2.1.4.2 A total of 54 beach seine samples will be collected per year (9 samples per sampling event X 6 sampling events; Table 1).

6.2.1.5 Sea Turtle Survey

6.2.1.5.1 Sea turtle utilization surveys will be conducted during the daytime period for each sampling station. Daytime sampling will not commence until at least one hour after sunrise.

6.2.1.5.2 A total of 36 sea turtle surveys will be conducted per year (2 passes along each of 3 transects per sampling event X 6 sampling events; Table 1).

7.0 Field Data Collection

7.1 Ancillary Data

7.1.1 Upon arrival at the station, record weather conditions, sea state, and water depth on the Bongo Field Data Sheet for nighttime sampling or the Gill Net Field Data Sheet for daytime sampling. If bongo and trawl sampling are being conducted concurrently, check the appropriate box on the Trawl Field Data Sheet verifying that the trawl and bongos were sampled concurrently, and the above conditions can be used for both.

7.1.2 Collect water quality data at three equally spaced stations along each transect during the sampling event.

7.1.2.1 After arriving on station, turn on water quality meter and allow adequate time to warm up.

7.1.2.2 At all stations, measurements will be taken at bottom, mid, and surface depths.

7.1.2.3 Measure temperature, pH, dissolved oxygen, conductivity, and salinity with Hach/Hydrolab Quanta or equivalent backup meter.

7.1.2.4 Record results on Bongo Field Data Sheet for nighttime sampling and the Gill Net Field Data Sheet for daytime sampling. If bongo and trawl sampling are being conducted concurrently, check the appropriate box on the

Trawl Field Data Sheet indicating the set of water quality measurements on the Bongo Field Data Sheet applies to the trawl data.

8.0 Trawl Sampling: Location and Methods

8.1 Sample Collection: Location

8.1.1 Conduct sampling along three sampling transects per site.

8.1.2 Towing will be conducted parallel to shore.

8.1.3 Use 16-foot otter trawl.

8.1.4 Conduct each tow for 15 minutes. If excessive debris loads are encountered or weather conditions dictate, tow times may be reduced or location may be adjusted at the discretion of the Field Team Leader.

8.1.4.1 Conduct one bottom trawl at each station at night.

8.1.5 Operate at slow speed (2.0 – 3.0 knots). Ensure that the tow line has the proper scope to keep the net on the bottom and out of the direct prop wash.

8.1.5.1 Use 60’ bridle line attached to additional 50’ line secured to the trawl doors for a total line length of 110’ for trawl stations in water up to 20’ in depth. Add additional line depending on water depth to achieve a 5:1 to 7:1 scope.

8.2 Sample Collection: Methods

8.2.1 Prepare the trawl for deployment. Attach trawl harness with pulley to the transom u-bolts. Attach the trawl bridle to the trawl doors and trawl harness to 50’ auxiliary line. Tie off the cod end of the net and ensure that the net and lines are not twisted and trawl will deploy correctly.

8.2.2 Attach float line to cod end.

8.2.3 If trawl is not being conducted concurrently with bongo tow, record the initial flow meter reading on the Field Data Sheet and

prepare for deployment. Ensure that the flow meter propeller does not turn prior to deployment.

8.2.3.1 Attach one end of the flow meter bridle to a small depressor and the other end of the bridle to the davit tow line. Adjust the bridal and tow line as necessary so the flow meter is deployed at mid depth.

8.2.4 Position the boat parallel to shore at one end of the station transect and motor forward maintaining an appropriate speed to deploy the net (just at or above idle). Ensure that all personnel are clear of any lines and are positioned outside of the bridle and harness.

8.2.5 Deploy the net by tossing the cod end off the stern and to the side of the motor ensuring that net, lines, and tickler chain clear the prop. Swing the doors over the transom of the boat and briefly hold in place when deployed 10-15' to allow the doors to spread. Continue to deploy the trawl by guiding the bridle, tow line, and harness over the stern clear of the prop.

8.2.6 When the net is fully deployed (tow line becomes taut), immediately deploy the flow meter (if not conducting bongo tow concurrently) from the davit and ensure that it is properly oriented and facing into the current. Immediately activate timer. Record time of deployment and GPS start point on Field Data Sheet.

8.2.7 Pull net at approximately 2.5 (2.0 – 3.0) knots in a relatively straight line and at constant depth parallel to shore or slightly angling away from shore.

8.2.7.1 If the trawl snags within the first seven minutes of the tow, or if it is determined that the trawl has not fished properly, discard the contents of the trawl overboard and repeat the tow after addressing the cause of the problem.

8.2.8 At the end of the tow take the boat out of gear and immediately retrieve flow meter and record reading. If the trawl is conducted

concurrent with the bongo tow and the flowmeter readings are within 10% of each other, record the average of the two bongo flow meter readings on the Trawl Field Data Sheet. Record the end time and end GPS waypoint on the Field Data Sheet. If the difference between the two flowmeter readings are greater than 10%, the reading closest to the projected reading will be used. Haul in the trawl tow line and harness over the starboard side of the boat, maintaining tension on the lines. As the boat nears the net, it may be necessary to move forward along the gunwale to keep the net oriented on the starboard side or bump in and out of gear to avoid drifting back over the net.

8.2.8.1 Bring the doors along side of the boat, clear of the prop. Pull the doors over the side and into the boat, and shake net to concentrate catch into cod end.

8.2.9 Untie and empty cod end into primary live well.

8.2.9.1 Carefully examine net liner and body of the net and remove any entangled organisms.

8.2.9.2 Retie cod end in preparation for subsequent sampling.

8.3 Sample Processing

8.3.1 Wear work gloves or rubber gloves when processing samples to avoid injury.

8.3.2 Carefully sift through debris in primary live well; transfer specimens to bins within the secondary live well by species groups for identification and measurement.

8.3.3 Use a small dip net to capture individual specimens or lift specimen bins onto measuring board for processing.

8.3.3.1 Process live specimens first and return them to the water as quickly as possible. Only discard dead specimens if wind and current conditions will not cause specimens to drift into an unsampled station area. Otherwise wait until the trawl tows have been completed before discarding.

8.3.4 Sort, identify, enumerate, and weigh fish and shellfish contained in the sample, as described in 8.4 - 8.7.

8.3.5 Monitor the condition of organisms caught; record and quantify specimens that appear to have been dead or injured prior to being caught in the trawl (e.g., rotten/decomposed specimens, fish with glazed/hazy eyes, etc.). Badly damaged specimens can be noted by placing a "D" in the Retained block on the data sheet.

8.4 Field Collection

8.4.1 Sort, identify and enumerate all fish and shellfish contained in the sample. Identify specimens to the lowest practicable taxon. Scientific names will be verified using the Integrated Taxonomic Information System (www.itis.gov) and common names will follow AFS Special Publication 29, Sixth Edition (2004). Field guides (e.g., EAI Field Identification Tools, 2008; Robins et al., 1986) will be available during collection. A checklist of previously collected species and common identification characters will be developed over the life of the project and available for reference.

8.4.2 Additionally, measure standard and total length of a subset of 25 individuals of each Representative Important Species (RIS) (Table 2) from each station. Obtain a batch weight of the representative specimens. Record these data on the Fish and Shellfish Length and Weight Data Sheet. If more than 25 individuals are present, enter the total number of all remaining specimens on the Data Sheet.

8.4.3 If samples contain excessively large numbers of individuals, a random split may be used to obtain a representative sub-sample that can be analyzed within a one-hour period. Large and/or uncommon specimens should be removed, measured, and recorded prior to splitting to minimize diversity loss.

8.4.4 Specimens retained for QA/QC purposes or representative specimens that cannot be identified to the species level should be placed in plastic containers spiked with formalin. Insert a waterproof internal label with the date, sample period, and sample number; store for subsequent off-site identification and curation.

8.4.5 Following identification return all specimens (except those retained for subsequent identification or QA/QC) to the water.

8.4.6 Ensure that all required information has been entered on the Field Data Sheet prior to leaving the sampling area.

8.5 Measurements

8.5.1 Measure total length (TL; maximum length from anterior-most part of head or jaws to the posterior-most edge of the caudal fin) and standard length (SL; maximum length from anterior-most part of head or jaws to the hypural plate) of all bony fishes.

8.5.2 Measure disk width of rays.

8.5.3 Measure carapace width (CW) of portunid crabs.

8.5.4 Measure post-ocular carapace length (CL) of Penaeid shrimp and lobster.

8.5.5 Measure carapace width of horseshoe crabs.

8.5.6 Measure mantle length of cephalopods (octopi and squid).

8.5.7 Count Xanthid crabs, non-Penaeid shrimps, and any other non-commercial decapod crustaceans contained in the sample. No carapace measurements are required for these taxa.

8.6 Ensure that all required information has been entered on the Field Data Sheet prior to leaving the site.

8.7 Laboratory Follow-up

8.7.1 Specimens retained for QA purposes will be preserved in 10-percent formalin solution. For fish greater than 150 mm, either an incision about 30 mm in length will be made along the abdominal cavity on the right side to allow preservative to enter,

or a syringe will be used to inject formalin directly into the dorsal muscles of the specimen to ensure penetration of preservative into the tissues.

8.7.2 Organisms that cannot be readily identified in the laboratory will be preserved and sent to a recognized expert for taxonomic identification or verification. A list of experts, appropriate to the taxon in question and approved by the Project Manager, will be maintained at the EAI laboratory.

8.7.3 A reference collection of all species collected during the project will be maintained and archived at the EAI laboratory.

9.0 Ichthyo- and Meroplankton Sampling: Location and Methods

9.1 Sample Collection: Location

9.1.1 During each sampling event, ichthyoplankton samples will be collected at two shore-parallel transects per site.

9.1.2 Conduct one bongo net tow at each station at night.

9.1.3 Use 20-cm diameter paired bongo nets fitted with 0.5-mm mesh nets.

9.1.4 Tow for 15 minutes, unless debris load or other conditions require shorter tow times. If towed concurrent with the trawl and a snag occurs, a bongo sample will be considered complete after a minimum of 8 minutes of tow time.

9.1.5 Operate boat at slow speed (2.0 – 3.0 knots).

9.1.6 Tow nets just below the surface.

9.2 Sample Collection: Methods

9.2.1 Prepare the bongo net for deployment.

9.2.1.1 Assure that the flow meters are filled with water. Position the flow meters within the mouth of each side of the bongo frame using the attachment rods.

9.2.1.2 Attach the bongo frame cable to the davit pulley. Ensure that cod-ends are securely connected to both nets.

9.2.1.3 Attach the depressor to the other end of the bongo frame cable.

9.2.1.4 Attach tag line and float to bongo frame.

9.2.1.5 Immediately prior to deployment, record flow meter serial numbers and the initial meter readings of each flow meter on the Field Data Sheet. Ensure that the flow meter propellers do not turn prior to deployment.

9.2.2 Record all pertinent data on Field Data Sheet (weather, tidal stage, water depth, etc.). If trawl and bongo sampling will occur concurrently, check the appropriate box on the Trawl Field Data Sheet to verify that the above conditions and flow meter readings can be used for both operations.

9.2.3 Position the boat parallel to shore at one end of the station transect and motor forward maintaining an appropriate speed to deploy the bongo nets (just at or above idle). Ensure that all personnel are clear of any lines.

9.2.4 Hoist bongo nets into air, high enough to clear gunwale, by pulling davit line through cam-cleat. Place cod ends and tag line into water. Swing davit arm 90° out from boat. Release davit line from cam-cleat and slowly lower bongo nets into the water to proper sampling depth. As soon as the bongo net is completely beneath the surface of the water, activate timer. Record time of deployment on Field Data Sheet.

9.2.5 Maintain a constant speed of approximately 2.0 – 3.0 knots.

9.2.6 Direct the boat in a straight line while watching to assure the net does not wash under the boat and contact the prop.

9.2.7 Pull the nets for 15 minutes unless algae or other debris in the water column prevent the nets from fishing effectively for that length of time. If tows are less than 8 minutes, pull nets for 5

minutes and composite three tows for the equivalent of a 15-minute tow if conditions permit.

9.2.7.1 Constantly monitor bongo net while deployed to ensure it fishes at the proper depth. Make slight adjustments to the amount of line deployed to maintain a constant position in the water column.

9.2.8 If the net collects large amounts of debris, retrieve the net, discard sample, rinse net, record new flow meter readings, and re-deploy. Record new start time and meter reading on Field Data Sheet.

9.2.9 At the end of each tow, retrieve net and deactivate timer. Record time of retrieval, tow time in minutes, and final meter reading for each flow meter on Field Data Sheet. Record the final meter reading of each flow meter on the Field Data Sheet.

9.3 Sample Preservation

9.3.1 Elevate bongo frames on davit and thoroughly but gently rinse down contents of nets from the outside using source water. Once all of the net contents have been rinsed into the cod-end, tip the cod-end to drain excess water. Use a squeeze bottle filled with filtered source water to rinse sample from cod-end mesh.

9.3.2 Carefully remove cod-end and place in secondary containment to avoid spillage. Remove large debris such as sticks and leaves, and rinse any organisms adhering to this material back into the cod-end. Use squeeze bottle to rinse all contents of cod-end into sample container(s) spiked with preservative. Gloves and protective eyewear should be worn while handling preservative.

9.3.2.1 The volume of the drained sample material should not exceed 35% of the sample container for each of the two cod-ends. Fill remaining volume of sample container with filtered seawater (filtered through 0.5-mm mesh) being careful not to overflow. Use a second prepared sample

container should sample volume exceed the capacity of a single container, note use of multiple containers on the external labels and on the data sheets.

9.3.3 Fill in sample information on interior and exterior sample labels using pencil or water-proof ink. Place interior label with sample identification number inside jar and tightly secure lid.

9.3.4 If more than one jar is required per sample, labels should indicate jar number (e.g., 1 of 2, 2 of 2, etc.). Contents of multiple-jar samples will be composited in the laboratory for analysis.

9.3.5 Place sample containers securely in carrying case.

9.3.6 Double-check Field Data Sheets to ensure all relevant data has been filled in.

10.0 Gill Net Sampling: Location and Methods

10.1 Sample Collection: Location

10.1.1 During each sampling event, gill net samples will be collected at three transects perpendicular to shore per site.

10.1.2 Conduct three gill net samples at each station during the day.

10.1.3 Use 600-foot in length by 12-foot in depth net comprised of 5 monofilament mesh panels, each 120-foot long.

10.1.4 The gill net will be fully deployed for 30 minutes, unless large numbers of fish are being capture or other conditions are present that require shorter set times.

10.2 Sample Collection: Methods

10.2.1 Prepare the gill net for deployment.

10.2.2 Attach buoy line and weight to each end of the net.

10.2.3 Position the boat perpendicular to shore at one end of the station transect and motor forward maintaining an appropriate speed to deploy the net (just at or above idle). Ensure that all personnel are clear of any lines and the net.

10.2.4 Deploy the net by tossing the end off the stern and to the side of the motor ensuring that net and buoy line clear the prop. Activate the timer when the end of the net is first deployed. Record time of deployment and GPS point on Field Data Sheet. Continue to deploy the net by guiding the net over the stern clear of the prop.

10.2.5 At the end of the 30-minute soak begin to haul in the anchor buoy from the end first deployed. Pull the gill net over the starboard side of the boat, maintaining tension on the lines. As the boat nears the net, it may be necessary to move forward along the gunwale to keep the net oriented on the starboard side or bump in and out of gear to avoid drifting back over the net. Record the end time when the last buoy is retrieved.

10.2.6 Immediately remove any live specimens and place in live well.

10.2.6.1 While two people are retrieving the net, a third person will carefully examine the body of the net as it comes into the boat and remove any entangled organisms.

10.3 Sample Processing

10.3.1 Wear work gloves or rubber gloves when processing specimens to avoid injury.

10.3.2 Transfer specimens to bins within the secondary live well by species groups for identification and measurement.

10.3.3 Use a small dip net to capture individual specimens or lift specimen bins onto measuring board for processing.

10.3.3.1 Process live specimens first and return them to the water as quickly as possible. Only discard dead specimens if wind and current conditions will not cause specimens to drift into an unsampled station area. Otherwise wait until the trawl tows have been completed before discarding.

10.3.4 Sort, identify, enumerate, and weigh fish and shellfish contained in the sample, as described in 10.4-10.7.

10.3.5 Monitor the condition of organisms caught; record and quantify specimens that appear to have been dead or injured prior to being caught in the trawl (e.g., rotten/decomposed specimens, fish with glazed/hazy eyes, etc.). Badly damaged specimens can be noted by placing a "D" in the Retained block on the data sheet.

10.4 Field Collection

10.4.1 Sort, identify and enumerate all fish contained in the sample. Identify specimens to the lowest practicable taxon. Scientific names will be verified using the Integrated Taxonomic Information System (www.itis.gov) and common names will follow AFS Special Publication 29, Sixth Edition (2004). Field guides (e.g., EAI Field Identification Tools, 2008; Robins et al., 1986) will be available during collection. A checklist of previously collected species and common identification characters will be developed over the life of the project and available for reference.

10.4.2 Additionally, measure standard and total length of a subset of 25 individuals of each Representative Important Species (RIS) (Table 2) from each station. Obtain a batch weight of the representative specimens. Record these data on the Fish and Shellfish Length and Weight Data Sheet. If more than 25 individuals are present, enter the total number of all remaining specimens on the Data Sheet.

10.4.3 If samples contain excessively large numbers of individuals, a random split may be used to obtain a representative sub-sample that can be analyzed within a one-hour period. Large and/or uncommon specimens should be removed, measured, and recorded prior to splitting to minimize diversity loss.

10.4.4 Specimens retained for QA/QC purposes or representative specimens that cannot be identified to the species level should be placed in plastic containers spiked with formalin. Insert a

waterproof internal label with the date, sample period, and sample number; store for subsequent off-site identification and curation.

10.4.5 Following identification return all specimens (except those retained for subsequent identification or QA/QC) to the water.

10.4.6 Ensure that all required information has been entered on the Field Data Sheet prior to leaving the sampling area.

10.5 Measurements

10.5.1 Measure total length (TL; maximum length from anterior-most part of head or jaws to the posterior-most edge of the caudal fin) and standard length (SL; maximum length from anterior-most part of head or jaws to the hypural plate) of all bony fishes.

10.5.2 Measure disk width of rays.

10.5.3 Measure carapace width (CW) of portunid crabs.

10.5.4 Measure mantle length of cephalopods (octopi and squid).

10.5.5 Count Xanthid crabs, non-Penaeid shrimps, and any other non-commercial decapod crustaceans contained in the sample. No carapace measurements are required for these taxa.

10.6 Ensure that all required information has been entered on the Field Data Sheet prior to leaving the site.

10.7 Laboratory Follow-up

10.7.1 Specimens retained for QA purposes will be preserved in 10-percent formalin solution. For fish greater than 150 mm, either an incision about 30 mm in length will be made along the abdominal cavity on the right side to allow preservative to enter, or a syringe will be used to inject formalin directly into the dorsal muscles of the specimen to ensure penetration of preservative into the tissues.

10.7.2 Organisms that cannot be readily identified in the laboratory will be preserved and sent to a recognized expert for taxonomic identification or verification. A list of experts, appropriate to the

taxon in question and approved by the Project Manager, will be maintained at the EAI laboratory.

10.7.3 A reference collection of all species collected during the project will be maintained and archived at the EAI laboratory.

11.0 Beach Seine Sampling: Location and Methods

11.1 Sample Collection: Location

11.1.1 During each sampling event, one beach seine sample will be collected at each of three stations per site.

11.1.2 Beach seine samples will be collected during the day.

11.1.3 Use 100-foot in length (125' running length) by 6-foot in depth net with a stretch mesh of one inch.

11.1.4 The beach seine will be fully deployed in 4-foot of water then pulled onto the beach.

11.2 Sample Collection: Methods

11.2.1 Prepare the beach seine for deployment.

11.2.2 Carry the rolled beach seine out to a depth of approximately 4 feet.

11.2.3 Deploy the net parallel to shore ensuring the distance covered is 100 feet from end to end.

11.2.4 Begin to walk towards the beach with the ends of the beach seine perpendicular to shore. Record time of deployment and GPS point of the northern end on Field Data Sheet.

11.2.5 Once the net has reached the shore, record the end time on the Field Data Sheet.

11.2.5.1 Bring the net completely onto shore.

11.2.6 Immediately remove any live specimens and place in sea water filled storage container equipped with an aerator if necessary.

11.2.6.1 Carefully examine the body of the net and remove any entangled organisms.

11.3 Sample Processing

11.3.1 Wear work gloves or rubber gloves when processing specimens to avoid injury.

11.3.2 Use a small dip net to capture individual specimens or lift specimen bins onto measuring board for processing.

11.3.2.1 Process live specimens first and return them to the water as quickly as possible. Only discard dead specimens if wind and current conditions will not cause specimens to drift into an unsampled station area. Otherwise wait until the seine collections have been completed before discarding.

11.3.3 Sort, identify, enumerate, and weigh fish and shellfish contained in the sample, as described in 11.4-11.7.

11.3.4 Monitor the condition of organisms caught; record and quantify specimens that appear to have been dead or injured prior to being caught in the seine (e.g., rotten/decomposed specimens, fish with glazed/hazy eyes, etc.). Badly damaged specimens can be noted by placing a "D" in the Retained block on the data sheet.

11.4 Field Collection

11.4.1 Sort, identify and enumerate all fish contained in the sample. Identify specimens to the lowest practicable taxon. Scientific names will be verified using the Integrated Taxonomic Information System (www.itis.gov) and common names will follow AFS Special Publication 29, Sixth Edition (2004). Field guides (e.g., EAI Field Identification Tools, 2008; Robins et al., 1986) will be available during collection. A checklist of previously collected species and common identification characters will be developed over the life of the project and available for reference.

11.4.2 Additionally, measure standard and total length of a subset of 25 individuals of each Representative Important Species (RIS) (Table 2) from each station. Obtain a batch weight of the

representative specimens. Record these data on the Fish and Shellfish Length and Weight Data Sheet. If more than 25 individuals are present, enter the total number of all remaining specimens on the Data Sheet.

11.4.3 If samples contain excessively large numbers of individuals, a random split may be used to obtain a representative sub-sample that can be analyzed within a one-hour period. Large and/or uncommon specimens should be removed, measured, and recorded prior to splitting to minimize diversity loss.

11.4.4 Specimens retained for QA/QC purposes or representative specimens that cannot be identified to the species level should be placed in plastic containers spiked with formalin. Insert a waterproof internal label with the date, sample period, and sample number; store for subsequent off-site identification and curation.

11.4.5 Following identification return all specimens (except those retained for subsequent identification or QA/QC) to the water.

11.4.6 Ensure that all required information has been entered on the Field Data Sheet prior to leaving the sampling area.

11.5 Measurements

11.5.1 Measure total length (TL; maximum length from anterior-most part of head or jaws to the posterior-most edge of the caudal fin) and standard length (SL; maximum length from anterior-most part of head or jaws to the hypural plate) of all bony fishes.

11.5.2 Measure disk width of rays.

11.5.3 Measure carapace width (CW) of portunid crabs.

11.5.4 Measure post-ocular carapace length (CL) of Penaeid shrimp and lobster.

11.5.5 Measure carapace width of horseshoe crabs.

11.5.6 Measure mantle length of cephalopods (octopi and squid).

11.5.7 Count Xanthid crabs, non-Penaeid shrimps, and any other non-commercial decapod crustaceans contained in the sample. No carapace measurements are required for these taxa.

11.6 Ensure that all required information has been entered on the Field Data Sheet prior to leaving the site.

11.7 Laboratory Follow-up

11.7.1 Specimens retained for QA purposes will be preserved in 10-percent formalin solution. For fish greater than 150 mm, either an incision about 30 mm in length will be made along the abdominal cavity on the right side to allow preservative to enter, or a syringe will be used to inject formalin directly into the dorsal muscles of the specimen to ensure penetration of preservative into the tissues.

11.7.2 Organisms that cannot be readily identified in the laboratory will be preserved and sent to a recognized expert for taxonomic identification or verification. A list of experts, appropriate to the taxon in question and approved by the Project Manager, will be maintained at the EAI laboratory.

11.7.3 A reference collection of all species collected during the project will be maintained and archived at the EAI laboratory.

12.0 Sea Turtle Survey: Location and Methods

12.1 Survey: Location

12.1.1 During each sampling event, sea turtle surveys will be conducted at one transect within each of the three sites.

12.1.2 Conduct surveys during the day.

12.1.2.1 The transect should measure 0.6 miles (1 km).

12.1.2.2 If insufficient habitat exists to allow a continuous transect, two or more smaller transects may be used to provide an equivalent length.

12.1.3 Transverse each transect a minimum of two times during each sampling event with at least a 30 minute separation between the two passes.

12.1.3.1 Operate at slow speed (less than 4.0 knots).

12.2 Survey: Methods

12.2.1 Monitoring days will be selected for optimal viewing capabilities (e.g., sunny with calm seas).

12.2.2 The order in which the three study sites are monitored will be randomly selected prior to each monitoring event.

12.2.3 Standard environmental data (current direction and speed, wind direction and speed, sky conditions, etc.) as well as water temperature and underwater visibility will be recorded on the Field Data Sheet just prior to each pass along each transect.

12.2.4 Two observers will be positioned on an elevated platform.

12.2.5 Record the start time and GPS waypoint on the Field Data Sheet when the boat operator determines that the boat is at the beginning of the transect.

12.2.6 One observer will look to port side and the other to starboard side.

12.2.7 Observers will record and identify to species, when possible, any turtle observed along the transect.

12.2.8 Observers will record the time each turtle was observed, location (GPS waypoint) of the boat at the time of observation, the distance and bearing to the turtle, the size (approximate length) of the turtle, and whether the turtle was at the surface or submerged.

12.2.9 At the end of the transect, record the end time and GPS point on the Field Data Sheet.

13.0 Laboratory Sorting/Specimen Identification

13.1 Plankton Sample Sorting

13.1.1 Until a laboratory technician has been deemed qualified, his/her sorting will be checked by EAI's QA/QC Officer or another qualified technician, as described in the QAP. During this period, prior to storing the sample residue, the QA/QC Officer or designee will inspect the sorting tray(s) of the original sorter, and any missed organisms will be removed, counted and placed into the appropriate sample vials.

13.1.1.1 The total number of missed organisms will be recorded on the Laboratory Bench Sheet and Sorting Efficiency calculated. Additionally, on-going QC checks will be made over the life of the project, as described in the QAP. After all applicable QC checks are completed; the sample residue will be archived.

13.1.2 Obtain a sample from the raw sample storage area of the lab and fill in all requisite information at the top of the Laboratory Bench Sheet. Ensure that the sample is scheduled for processing by comparing the Sample Identification Number (SIN) with the Master Sample Inventory.

13.1.3 Remove and retain in-jar sample label. This will be returned to the sample container with the archived portion of the sample (sample residue). Verify that both the internal and external labels match the SIN in the Master Sample Inventory and record SIN on the Laboratory Bench Sheet.

13.1.4 Latex gloves and eye protection should be used while working with preservative. Under a ventilated fume hood, or in an open-air location, carefully decant the formalin solution from the sample container through a 0.5-mm mesh cone into a secondary container. The waste formalin may be poured down the drain with the water running continuously at least 30 seconds prior to and following the formalin.

13.1.4.1 Gently transfer sample to conical 0.5-mm net with jar type cod end and rinse sample with water for 5 to 10 minutes while suspended in sink. If woody debris, vegetation, or other large detritus are present in the sample, each piece of material may be washed in a larger mesh sieve (e.g., 5-mm) suspended over the 0.5-mm sieve. Following a thorough but gentle rinsing with tap water and examination for organisms, discard any large detritus.

13.1.5 Use a squeeze bottle filled with 70% Ethanol solution to wash contents of the fine mesh conical net and cod end into a 1-L beaker. Inspect the net and cod end to ensure that all organisms have been transferred to the beaker.

13.1.6 Pour the organic material from the beaker into the appropriate sized jar, place the original internal label into the jar and label the lid with the SIN using the appropriate color tape for the St. Lucie Project. Fill the jar with 70% ethanol.

13.1.7 Remove a small amount of the sample material and spread it on a gridded tray. Add enough ethanol solution to cover sample material, and spread material over bottom of tray as evenly as possible. For large samples, it may be necessary to partition the sample among several sorting trays.

13.1.8 Prepare three sample vials filled with 70% ethanol preservative and label each for fish eggs, ichthyoplankton (fish larvae), or meroplankton (shellfish larvae).

13.1.9 Inspect contents of each sorting tray grid under a dissecting scope. Move systematically from one grid to the next carefully searching for target organisms. Staining may be used, as necessary, to help distinguish specimens from debris.

13.1.10 Remove all fish eggs, fish larvae, and targeted meroplankton (refer to list provided by EAI Project Manager) from sorting tray

using soft forceps or pipette, as practical, and place in appropriate labeled specimen vial. Count and record number of organisms on bench sheet.

13.1.11 Prepare internal labels on waterproof paper. Include the SIN and contents (meroplankton, ichthyoplankton, or fish eggs), and insert it into each sample vial. Seal vials with a cap and affix a color-coded label to the top with last 4 digits of SIN and content type.

13.1.12 Record the time that sorting was completed on the Laboratory Bench Sheet and store the sorted samples in designated area of the lab for subsequent taxonomic identification. Place the bench sheet in the Sorted Sample Folder.

13.1.13 Return the sample residue to its original glass jar. Insert the original sample label after adding words "sorted residue" and preserve in 70% ethanol. Place a unique color-coded label on the lid, seal and store in the designated sorted sample storage area.

13.2 Plankton Sample Splitting

13.2.1 Samples containing excessive amounts of debris (algae, ctenophores, etc.) or high numbers of plankton (>250) may be split with a Motodo sample splitter, at the direction of the Laboratory Manager. The Lab Manager will visually inspect the sample and determine if a split is appropriate.

13.2.1.1 Samples that would require an experienced Certified Sorter more than four hours to process will generally be split. However, groups (meroplankton, ichthyoplankton, fish eggs) with less than 250 individuals will be sorted from samples prior to splitting to maintain species diversity.

13.2.2 Decant ethanol from sample. Pour sample into splitting chamber and dilute with sufficient amount of tap water from a wash bottle to ensure an even split.

13.2.3 Gently but thoroughly stir sample, tilt splitter, and carefully pour contents into collection chambers. Check to ensure that water levels in the two collection chambers are equal. If not, combine contents of both chambers into splitting chamber and repeat the process.

13.2.3.1 Carefully and thoroughly rinse chambers after each use and empty wash water into splitting chamber.

13.2.4 Record split.

13.2.5 Remove collection chambers. Place contents of one chamber in gridded sorting tray(s) for processing

13.2.6 Place contents of other chamber into labeled bulk residue container.

13.2.7 Sort for all organisms with <250 individuals before continuing to split. With each successive split, pour the residue from the unused half into the labeled bulk residue container. Record the total number of splits on the Laboratory Bench Sheet.

13.2.7.1 If necessary, make additional splits by pouring contents of one of the collection chambers (a one-half split) back into the splitting chamber and repeat the process, as necessary until desired organism density is obtained. Record each split on the Laboratory Bench Sheet as completed.

13.2.8 The count of individuals for each species in the split sample multiplied by the inverse of the split is the estimated number of organisms in the total sample.

13.3 Plankton Taxonomy

13.3.1 Obtain a bench sheet from the Sorted Sample Folder and locate the corresponding sample vials. Fill in all requisite information (taxonomist name, date and start time) at the top of the Laboratory Bench Sheet.

13.3.2 Remove and retain internal sample label.

13.3.3 Prepare a series of sample vials filled with 70% ethanol.

13.3.4 Pour the contents of the sample bottle into a sorting tray or watch glass.

13.3.5 Identify ichthyoplankton to the lowest practical taxon. Count and record the number of individuals for each taxon by life stage (e.g., egg, yolk-sac larvae, post-yolk-sac larvae, or juvenile) on the Laboratory Bench Sheet.

13.3.6 Identify eggs to the lowest practical taxon or taxon complex.

13.3.7 Scientific names will be verified using the Integrated Taxonomic Information System (www.itis.gov) and common names will follow AFS Special Publication 29, Sixth Edition (2004). .

13.3.8 Identify meroplankton in accordance with the taxonomic level indicated in Table 3.

13.3.9 Specimens damaged beyond recognition will be recorded as unidentified.

13.3.10 In the event that a sample contains an excessive number (>500) of organisms of various life stages, sub-sampling may be conducted using the Motodo sample splitter (see 13.2). The number of splits will be recorded on the Laboratory Bench Sheet, and numbers of organisms contained in the analyzed portion of the sample will be extrapolated to estimate the number in the full sample.

13.3.11 Place each taxon whose identity is questionable in separate vials. Separate all other specimens by lowest practical taxon, and place in corresponding vials.

13.3.12 Prepare labels for each sample vial using pencil or extra fine-tipped waterproof marker. Place the SIN, the scientific name, and initials of the taxonomist making the ID on the label.

13.3.13 Secure the vials/bottles with caps, label the cap with the project color tape, last four digits of the SIN, taxa and vial number, and place in the area designated for sample archival/QC.

13.3.14 Record the date and time the taxonomy was completed on the Laboratory Bench Sheet. If taxonomy is completed for all components, file in the "To Be Input" project folder. If all taxonomic components are not completed, file in the "To Be Identified" folder.

13.3.15 One or more representative individuals of each species will be preserved in 70% ethanol and retained in a reference collection archived at EAI.

13.3.15.1 Individuals will be selected to represent the various sizes and developmental stages of the species contained in the samples. An electronic photographic reference collection will also be maintained.

13.3.15.1.1 If specimens are removed from a sample for the reference collection, a notation will be made on the Laboratory Bench Sheet.

13.3.16 If there is disagreement on the identification of organisms between taxonomists in the laboratory, the organisms will be sent to an outside recognized expert (approved by the Project Manager) for taxonomic identification/confirmation. Alternatively, electronic images of the disputed specimens may be submitted to the expert, alleviating the need for sending specimens through the mail.

14.0 Trawl: Identification of Retained Specimens

14.1 Procedures for Identification and Curation

14.1.1 Return unidentified specimens to the laboratory. Preserved specimens should remain in formalin storage for no less than 5 days.

14.1.2 Decant formalin into Waste Formalin Receptacle. Be sure to wear latex gloves and protective eyewear, and always work in a well-ventilated area.

14.1.2.1 Soak rinsed specimens in water for at least an hour under fume hood to remove excess formalin. Change the water periodically. Keep label with sample.

14.1.3 Ensure that labels containing the SIN and other pertinent field information are included with the specimen.

14.1.4 Using available literature, identify specimens to lowest practical taxon. Generally, problematic specimens will have been identified to family level in the field, and will require further ID in the laboratory to either genus or species level.

14.1.5 Once identifications are complete, obtain the Fish and Shellfish Length and Weight Data Sheet from which the specimen was removed and enter the correct identification.

14.1.6 Weigh the specimen and record on the Length and Weight Data Sheet.

14.1.7 Either preserve the specimen in 70% ethanol and retain for the reference collection or discard as trash.

14.1.7.1 Specimens retained for the reference collection will have an internal label with the sample number, date collected, method of collection, taxon and the initials of the person that identified the specimen(s).

14.1.7.2 An external label will be affixed to the lid of the container with the sample number and taxon.

14.1.8 A reference collection of all species collected during the project will be maintained and archived at the EAI laboratory.

Table 1

Summary of St. Lucie Plant EPU Biological Study Field Sampling Program, St. Lucie County, Florida.

Component	Frequency per Year	Sampling Period	Sampling Points			Total Samples/Sampling Points per Year
			No. Study Sites	No. Samples or Sampling Points per Site	Number of Depths	
Water Quality[1]	6	Day/Night	3	3	3	324
Trawls	6	Night	3	3	1	54
Ichthyoplankton	6	Night	3	2	1	36
Gill Nets	6	Day	3	3	1	54
Beach Seines	6	Day	3	3	1	54
Sea Turtle Transects	6	Day	3	2	1	36

[1] Concurrent with other sampling components.

Table 2

Representative Important Species
Targeted for St. Lucie Plant EPU Biological Study

Common Name	Scientific Name
Atlantic Croaker	*Micropogonias undulatus*
Spot	*Leiostomus xanthurus*
Sand Drum	*Umbrina coroides*
Pigfish	*Orthopristis chrysoptera*
Bluefish	*Pomatomus saltatrix*
Silver Seatrout	*Cynoscion nothus*
Kingfish/Whiting	*Menticirrhus spp.*
Florida Pompano	*Trachinotus carolinus*
Spanish Mackerel	*Scomberomorus maculatus*
Clupeiformes: Anchovies, Herrings, and Sardines	
Leopard Searobin	*Prionotus scitulus*
Green Sea Turtle	*Chelonia mydas*

Table 3

Shellfish Larvae (Meroplankton)
Level of Taxonomy Targeted for St. Lucie Plant EPU Biological Study

Group	Lowest Taxonomic Level Targeted	Taxa Included
Commercial or Recreationally Important Species	**Genus and Species**	*Menippe mercenaria*
		Menippe nodifrons
		Farfantepenaeus duorarum
		Farfantepenaeus aztecus
		Litopenaeus setiferus
		Callinectes sapidus
		Callinectes sp.
		Panulirus argus
		Scyllarides nodifer
		Lolliguncula brevis
		Loligo pealeii
		Emerita talpoida
		Albunea sp.
		Limulus polyphemus
		Lepidopa sp.
Caridean Shrimp	**Infraorder (Caridea)**	*Hippolyte*
		Thor
		Lysmata
		Tozeuma
		Palaemonetes
		Alpheus
		Crangon
		Latreutes
		Processa
Sergestid Shrimp	**Superfamily (Sergestoidea)**	*Acetes*
		Lucifer
Stomatopods	**Order (Stomatopoda)**	*Squilla*
Mud/Ghost Shrimp	**Infraorder (Thalassinidea)**	*Callianassa*
		Upogebia
		Naushonia

Table 3
(Continued)

Group	Lowest Taxonomic Level Targeted	Taxa Included
Hermit Crabs	**Infraorder (Anomura)**	*Clibanarius*
		Pagurus
		Polyonyx
Non-commercial Crabs	**Infraorder (Brachyura)**	*Persephona*
		Libinia
		Cancer
		Ovalipes
		Panopeidae
		Pilumnus
		Sesarma
		Dissodactylus
		Pinnixa
		Pinnotheres
		Ocypode
		Uca
		Zaops
Non-commercial Bivalve Molluscs	**Class (Bivalvia)**	Mytilidae
		Mactridae
		Ostreidae
		Tellinidae
		Arcidae
		Cardiidae

SOP APPENDIX A

EQUIPMENT AND SUPPLIES CHECKLISTS
ST. LUCIE PLANT EPU BIOLOGICAL STUDY

EQUIPMENT AND SUPPLIES CHECKLIST – ST. LUCIE PLANT EPU
TRAWL AND BONGO SAMPLING

Stays on Boat

- [ ] 16' Otter trawl - BACKUP
- [ ] 5 gallon buckets (3)
- [ ] Anchor and line
- [ ] Batteries (AA, AAA, C, D, 9volt)
- [ ] Boat box (Flares, 1st aid kit, air horn, spare parts box, spare fuel-water separator, spark plugs, fuses, breakers, bulbs, plug wrench, PVC pipe parts)
- [ ] Boat soap/brushes
- [ ] Bongo codends + nets - BACKUP
- [ ] Bongo line (100')
- [ ] Bug spray and sunscreen
- [ ] Calipers (2)
- [ ] Eye Protection
- [ ] Field guides and ID aides
- [ ] Filtered seawater bottle
- [ ] Fire extinguisher
- [ ] Fishboards (2)
- [ ] Fish holding containers
- [ ] Fish nets
- [ ] Flowmeter syringe
- [ ] Garden hoses (2) w/ splitter
- [ ] Headlamps (5)
- [ ] Latex gloves (M & L - 2 ea)
- [ ] Life jackets (5)
- [ ] Large & small forceps/ tongs
- [ ] Look box
- [ ] Net repair kit
- [ ] Paper towels (2)
- [ ] Pencils/markers/waterproof pens
- [ ] Raingear
- [ ] Salt-Away
- [ ] Scales + weighing trays
- [ ] Silicone spray (2)
- [ ] Sorting trays (3)
- [ ] Spare boat oil (1) and hydraulic fluid (1)
- [ ] Spare davit rope
- [ ] Spare drain plug for boat
- [ ] Spare flowmeter screws
- [ ] Spare hose washers
- [ ] Spare plastic bags (quart & gallon)
- [ ] Spare pulley
- [ ] Spare shackles
- [ ] Spare washers/nuts
- [ ] Specimen containers (2L-3; 1L-4)
- [ ] Tape (electrical & duct)
- [ ] Throw-line
- [ ] Timers (2)
- [ ] Toolbox and tools
- [ ] Trashbags
- [ ] Trawl flow meter planer - BACKUP
- [ ] Work gloves (5 pair)

EQUIPMENT AND SUPPLIES CHECKLIST – ST. LUCIE PLANT EPU
TRAWL, BONGO, GILL NET SAMPLING, AND SEA TURTLE SURVEYS

Trip Prep

- [ ] FPL Operations Letter
- [ ] FWC Float Plan
- [ ] EAI Float Plan
- [ ] Safety Tailboard Forms
- [ ] Field Data Sheets
- [ ] Sample Labels
- [ ] Prep sample containers
- [ ] Calibrate meters (2)
- [ ] Fill flowmeters with water and replace screws
- [ ] Trailer Chains and Locks

Paperwork Checklist

- [ ] Field Data Sheets (Trawl, IP, Gill Net, Turtle Survey, L/W)
- [ ] Field Log
- [ ] Boat Log
- [ ] SAL
- [ ] HASP & SOP
- [ ] Contact Numbers (FPL, FWC, SeaTow)

Equipment Checklist

- [ ] 16' Otter trawl w/ ropes & doors
- [ ] 600’ Gill Net w/ anchors and buoys
- [ ] Boat GPS/depth finder
- [ ] Boat Keys
- [ ] Bongo frame, nets, codends (505µm)
- [ ] Bongo planer
- [ ] Cell phones
- [ ] Closed-toed shoes
- [ ] Cooler (large & small)
- [ ] Flashlights (Maglites & Q-beams) -2
- [ ] Flow meters (2) and backup (1)
- [ ] Formaldehyde: 1/2 liter bottles (2)
- [ ] Handheld GPS
- [ ] Leftover snacks, condiments and utensils
- [ ] Sample containers - 12 (spiked & labeled)
- [ ] Spare Bongo flowmeter
- [ ] Tap water (gallon)
- [ ] Water quality meters (2) -calibrated

SOP APPENDIX B

CALIBRATION OF FIELD INSTRUMENTATON

ST. LUCIE PLANT EPU BIOLOGICAL STUDY

FIELD INSTRUMENT CALIBRATION

General Information

The day of each sampling event, the Field Team Leader will verify that all equipment is in proper working condition, calibrated, and that batteries are properly charged (see Appendix C: DEP-SOP-001/01 FT 1000). Calibrations performed prior to the collection of the first sample for each event are considered Initial Calibrations and are recorded on the EAI Field Instrument Calibration Log. Final Calibration Checks will be performed upon return to the lab. Initial and Final calibration checks will be performed for all measured variables.

If an Initial or Final Calibration Check fails to meet acceptance criteria, the instrument will be immediately recalibrated. If the instrument fails a second time, it will be removed from service. In this case, the Field Technician will use the back-up instrument during collection of field data (DEP-SOP-001/01 FT 1000). If a Final Calibration Check fails to meet acceptance criteria, and it is not possible to reanalyze the sample(s), the Field Team Leader will a) report all results between the last acceptable calibration check and the failed calibration check as "estimated" by using the 62-160, F.A.C. qualifier "J"; b) include a narrative description of the problem; and c) shorten the time period between verification checks or replace/repair the instrument, as appropriate.

Specific Procedures

A list of the different field instruments available for use during the St. Lucie Plant EPU Biological Study field sampling program are found in Table 1 along with the corresponding manual that provides detailed manufacturer's instructions for calibrations. An example of an instrument calibration form is given in Figure 1.

Table 1. Calibration Methods for Water Quality Meters

Meter	Parameters Measured	Calibration Reference
Hydrolab Quanta	pH Dissolved Oxygen (DO) Conductivity Salinity Temperature	Hydrolab Quanta Operating Manual February 2002 (Revision C) Hydrolab Corporation
YSI 650 MDS (Display/Logger) & YSI 600QS Sonde	pH DO, Conductivity Salinity Temperature	YSI Environmental Operations Manual January 2006 (Revision C) YSI incorporated
YSI DO200	DO Temperature	YSI DO200 Operations Manual December 2002 (Revision A) YSI incorporated
YSI 85	Conductivity DO Salinity Temperature	YSI 85 Operations Manual November 1998 (Revision E) YSI incorporated
YSI 60	pH Temperature	YSI 60 Operations Manual September 1999 YSI incorporated

Figure 1. Example of an Instrument Calibration Form.

Ecological Associates, Inc.

Field Instrument Continuing Calibration Records for St. Lucie Plant EPU Biological Study

Meter: **Type:** Continuing Verification

DATE (mm/dd/yy)	TIME (hr:min)	PARAMETER	LOCATION	STANDARD EXPIRATION DATE	STANDARD VALUE (expected reading)	INSTRUMENT RESPONSE (actual reading)	PASS or FAIL acceptance criteria?	CORRECTIVE ACTIONS for failed check	INITIALS person calibrating
		DO							
		Sp. Cond			50 mS/cm				
		pH			7.00 SU				
					10.0 SU				

Meter: **Type:** Continuing Verification

DATE (mm/dd/yy)	TIME (hr:min)	PARAMETER	LOCATION	STANDARD EXPIRATION DATE	STANDARD VALUE (expected reading)	INSTRUMENT RESPONSE (actual reading)	PASS or FAIL acceptance criteria?	CORRECTIVE ACTIONS for failed check	INITIALS person calibrating
		DO							
		Sp. Cond			50 mS/cm				
		pH			7.00 SU				
					10.0 SU				

SOP APPENDIX C

DEP-SOP-001/01 FT 1000

GENERAL FIELD TESTING AND MEASUREMENT

FT 1000. GENERAL FIELD TESTING AND MEASUREMENT

Use the following SOPs in conjunction with FT 1000:

- FD 1000 Documentation Procedures
- FM 1000 Field Planning and Mobilization
- FS 1000 General Sampling Procedures
- FT 1100 through FT 3000 Specific Field Testing Procedures

1. INTRODUCTION

1.1. Scope and Applicability: SOPs FT 1100 to FT 3000 outline procedures to conduct field testing measurements and observations. They include the parameters that are measured *in-situ* or in a field-collected sample. Additionally some samples with allowable extended holding times may be collected for laboratory measurement, as described in the specific FT-series SOPs. Included in SOPs FT 1100 to FT 3000 are:

- FT 1100 Field Measurement of Hydrogen Ion Activity (pH)
- FT 1200 Field Measurement of Specific Conductance (Conductivity)
- FT 1300 Field Measurement of Salinity
- FT 1400 Field Measurement of Temperature
- FT 1500 Field Measurement of Dissolved Oxygen (DO)
- FT 1600 Field Measurement of Turbidity
- FT 1700 Field Measurement of Light Penetration (Secchi Depth and Transparency)
- FT 1800 Field Measurement of Water Flow and Velocity
- FT 1900 Continuous Monitoring with Installed Meters
- FT 2000 Field Measurement of Residual Chlorine
- FT 3000 Aquatic Habitat Characterization

1.2. Exclusions: **If proposed for experimental purposes, field-screening procedures employing techniques not addressed in these SOPs** must be submitted to the DEP site or project manager. Such procedures must be addressed for each program or project dealing specifically with the planning and design of sampling events. Data quality objectives for quantitative assessment preclude the use of field-screening procedures for regulatory purposes.

1.3. Expectations and Requirements:

1.3.1. In some cases, specific instruments are identified in the SOP, with detailed instruction provided on their use. If you are using a different instrument from that identified in the SOP, follow the manufacturer's instructions for assembly, operation, and maintenance.

1.3.2. When required, the FT-series SOPs outline the instrument specifications. A field instrument must meet the stated requirements.

1.3.3. The FT-Series SOPs specify the calibration requirements for each method. Although instruments may vary in configuration or operation, the specified calibration requirements must be met.

1.3.3.1. Where applicable to the FT-series SOP, use the minimum number of calibration standards specified.

1.3.3.2. Do not establish the lower limit of the quantitative calibration bracket with "zero" solutions, quality control blanks or reagent dilution water.

1.3.4. Ensure that all equipment is in proper working condition, calibrated, and that batteries are properly charged before using the equipment for field testing measurements.

1.3.5. If reagents or standards are prepared from stock chemicals, they must be analytical reagent grade or better. Some procedures may specify a higher grade or assay of reagent or standard.

1.4. Recommendations for Use of Grab Samples or *in situ* Field Testing Measurements:

1.4.1. Use *in situ* readings where practical for field measurements in surface water and wastewater.

1.4.2. Use *in situ* readings or flow-through containers for field measurements for groundwater stabilization during purging and for other applications where groundwater monitoring measurements are required.

1.4.3. If grab samples are collected for measurement where allowed in the individual FT-series SOP, measure samples within fifteen (15) minutes of collection when immediate analysis is specified per Table FS 1000-4 and FS 1000-5. Otherwise, analyze grab samples within the applicable holding times specified in Table FS 1000-4 and FS 1000-5.

2. MINIMUM CALIBRATION REQUIREMENTS:

2.1. Calibration Definitions: This section outlines the essential calibration concepts that must be applied to each field test. Specific requirements for calibration are addressed in the individual SOPs.

2.1.1. Initial Calibration (IC): The instrument or meter electronics are adjusted (manually or automatically) to a theoretical value (e.g., dissolved oxygen saturation) or a known value of a calibration standard.

2.1.2. Initial Calibration Verification (ICV): The instrument or meter calibration is checked or verified directly following initial calibration by measuring a calibration standard of known value as if it were a sample and comparing the measured result to the calibration acceptance criteria listed in the SOP.

2.1.3. Continuing Calibration Verification (CCV): The instrument or meter calibration is checked or verified by measuring a calibration standard of known value as if it were a sample and comparing the measured result to the calibration acceptance criteria listed in the SOP.

2.1.4. Chronological Calibration Bracket: The interval of time between verifications within which environmental sample measurements must occur. The instrument or meter

is calibrated or verified before and verified after the time of environmental sample measurement(s).

2.1.5. Quantitative Calibration Bracket: The instrument or meter is calibrated or verified at two known values that encompass the range of observed environmental sample measurement(s).

2.1.6. Acceptance Criteria: The numerical limits within which calibration verifications are acceptable.

2.2. Calibration Activities: Specific calibration procedures are given in the individual SOPs.

2.2.1. Chronological Calibration Bracket:

2.2.1.1. Ensure that the field test result is preceded by an acceptable ICV or CCV and followed by an acceptable CCV.

2.2.1.2. Specific requirements for chronological bracketing are addressed in the individual FT-series SOPs.

2.2.2. Quantitative Calibration Bracket:

2.2.2.1. Choose two standards that bracket the range of sample measurements. These standards may be used for initial calibrations or for verifications.

2.2.2.2. Specific requirements for quantitative bracketing are addressed in the individual FT-series SOPs.

2.2.3. Initial Calibration: Calibrate if no initial calibration has been performed or if a calibration verification does not meet acceptance criteria. Do not reuse standards for initial calibrations.

Table FT 1000-1: Field Testing Acceptance Criteria

Parameter	Acceptance Criteria
pH (FT 1100)	**± 0.2 Standard pH Units of buffer or more stringent program criteria**
Specific Conductance (FT 1200)	**± 5% of standard value**
Temperature (FT 1400)	**± 0.2°C of NIST-traceable value (with correction factors) Verification over range of applicable values**
Dissolved Oxygen (FT 1500)	**± 0.3 mg/L of theoretical value (see Table FT 1500-1)**
Turbidity (FT 1600)	**0.1-10 NTU: ± 10% of standard value 11-40 NTU: ± 8% of standard value 41-100 NTU: ± 6.5% of standard value > 100 NTU: ± 5% of standard value**
Total Residual Chlorine (FT 2000)	**0.995 calibration curve correlation coefficient ± 10% of primary standard value ± 10% of secondary standard value Color comparator acceptance criterion: ± 10% of primary standard value**

2.2.4. Initial Calibration Verification:

2.2.4.1. Perform an ICV immediately after calibration. All ICVs must meet the calibration acceptance criteria specified in the applicable FT-series SOP. See Table FT 1000-1 for a list of acceptance criteria for the most common field testing procedures.

2.2.4.2. If an ICV fails to meet acceptance criteria, immediately recalibrate the instrument using the applicable initial calibration procedure or remove it from service.

2.2.5. Continuing Calibration Verification: Perform a CCV at no more than 24-hour intervals from previous verification, except where noted for individual FT-series SOPs.

2.2.5.1. If historically generated data demonstrate that a specific instrument remains stable for longer periods of time, the time interval between calibration verifications may be increased.

2.2.5.2. Base the selected time interval on the shortest interval that the instrument maintains stability. If CCVs consistently fail, shorten the time period between verifications or replace/repair the instrument.

2.2.5.3. All CCVs must meet the calibration acceptance criteria specified in the applicable FT-series SOP. See Table FT 1000-1 for a list of acceptance criteria for the most common field testing procedures.

2.2.5.4. If a CCV fails to meet acceptance criteria perform one or more of the following procedures as necessary:

- Reattempt the CCV again within the chronological bracket time interval without changing the instrument calibration. Do not perform maintenance, repair, or cleaning of the instrument or probe. Probes may be rinsed with analyte-free water or fresh verification standard. The CCV may be reattempted with a fresh aliquot of verification standard.
- Perform the initial calibration, perform an ICV, re-analyze the sample(s), and perform a CCV.
- Report all results between the last acceptable calibration verification and the failed calibration verification as estimated (report the value with a "J"). Include a narrative description of the problem in the field notes.

2.2.5.5. For installed instruments that are deployed for extended periods of time or used for continuous monitoring, see FT 1900.

2.2.5.6. Shorten the time period between verification checks or replace/repair the instrument.

2.2.6. Determining the Values of Secondary Standards: Use only those standards recommended by the manufacturer for a specific instrument. Only use secondary standards for continuing calibration verifications. See the individual FT-series SOPs for specific procedures for use of secondary standards. At documented intervals, determine or verify the values of secondary standards immediately after performing an initial calibration or after verifying the calibration with primary standards. Read each secondary standard as a sample. This result must be within the manufacturer's stated tolerance range and +/- 10% of the stated standard value. If the +/- 10% criterion is not

met, assign this reading as the value of the standard. If the reading is outside the manufacturer's stated tolerance range, discard the secondary standard.

2.2.7. **More frequent calibration verifications may be required for discharge permit compliance measurements or other regulatory requirements.**

3. PREVENTIVE MAINTENANCE: Record all maintenance and repair notes in the maintenance logbook for each meter (see FS 1007). If rental equipment is used, a log is not required. However, the origin (i.e., rental company), rental date, equipment type, model number, and identification number (if applicable) must be entered into the field notes or a rental equipment notebook.

4. DOCUMENTATION

4.1. Standard and Reagent Documentation: Document information about standards and reagents used for calibrations, verifications, and sample measurements.

4.1.1. Note the date of receipt, the expiration date and the date of first use for all standards and reagents.

4.1.1.1. Document acceptable verification of any standard used after its expiration date.

4.1.2. Record the concentration or other value for the standard in the appropriate measurement units.

4.1.2.1. Note vendor catalog number and description for pre-formulated solutions as well as for neat liquids and powdered standards.

4.1.2.2. Retain vendor assay specifications for standards as part of the calibration record.

4.1.3. Record the grade of standard or reagent used.

4.1.4. When formulated in-house, document all calculations used to formulate calibration standards.

4.1.4.1. Record the date of preparation for all in-house formulations.

4.1.5. Describe or cite the procedure(s) used to prepare any standards in-house (DEP SOP or internal SOP).

4.2. Field Instrument Calibration Documentation: Document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements.

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

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

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

4.2.3. Record the time and date of all initial calibrations and all calibration verifications.

4.2.4. Record the instrument reading (value in appropriate measurement units) of all calibration verifications.

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

4.2.6. Document the specific standards used to calibrate or verify the instrument or field test with the following information:

- Type of standard or standard name (e.g., pH buffer)
- Value of standard, including correct units (e.g., pH = 7.0 SU)
- Manufacturer's tolerance range for secondary standards
- Link to information recorded according to section 4.1 above

4.2.7. Retain manufacturers' instrument specifications.

4.2.8. Document whether successful initial calibration occurred.

4.2.9. Document whether each calibration verification passed or failed.

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

4.2.10.1. Document the date and time of any corrective actions.

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

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

4.3. 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)

Appendix FT 1000
Tables, Figures and Forms

Table FT 1000-1 Field Testing Acceptance Criteria

Table FT 1000-1: Field Testing Acceptance Criteria	
Parameter	**Acceptance Criteria**
pH (FT 1100)	**± 0.2 Standard pH Units of buffer or more stringent program criteria**
Specific Conductance (FT 1200)	**± 5% of standard value**
Temperature (FT 1400)	**± 0.2°C of NIST-traceable value (with correction factors) Verification over range of applicable values**
Dissolved Oxygen (FT 1500)	**± 0.3 mg/L of theoretical value (see Table FT 1500-1)**
Turbidity (FT 1600)	**0.1-10 NTU: ± 10% of standard value 11-40 NTU: ± 8% of standard value 41-100 NTU: ± 6.5% of standard value > 100 NTU: ± 5% of standard value**
Total Residual Chlorine (FT 2000)	**0.995 calibration curve correlation coefficient ± 10% of primary standard value ± 10% of secondary standard value Color comparator acceptance criterion: ± 10% of primary standard value**