

Southeast Coast Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure 2.2.10

Fixed-Station Discrete Water-Quality Data Entry, Processing, and QA/QC—Version 1.0

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Summary

This standard operating procedure (SOP) describes the step-by-step procedures for entering, processing and QA/QC of data resulting from samples collected during a fixed-station site visit. Water samples are submitted for analysis by a contracted laboratory and the Southeast Coast Network (SECN) receives results 60–90 days following submission. This SOP is for users who already have access to the SECN Estuarine Water-Quality Database (EWQD).

Revision Log

Revision Date	Author	Changes Made	Reason for Change	New Version #

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Fixed-Station Activities and Workflow Summary

An overview of fixed-station monitoring activities and workflow are presented in Figure 1. SOPs are presented left to right in the general order of operations for each activity. This SOP (2.2.10) pertains to the Data Processing and QA/QC activity.

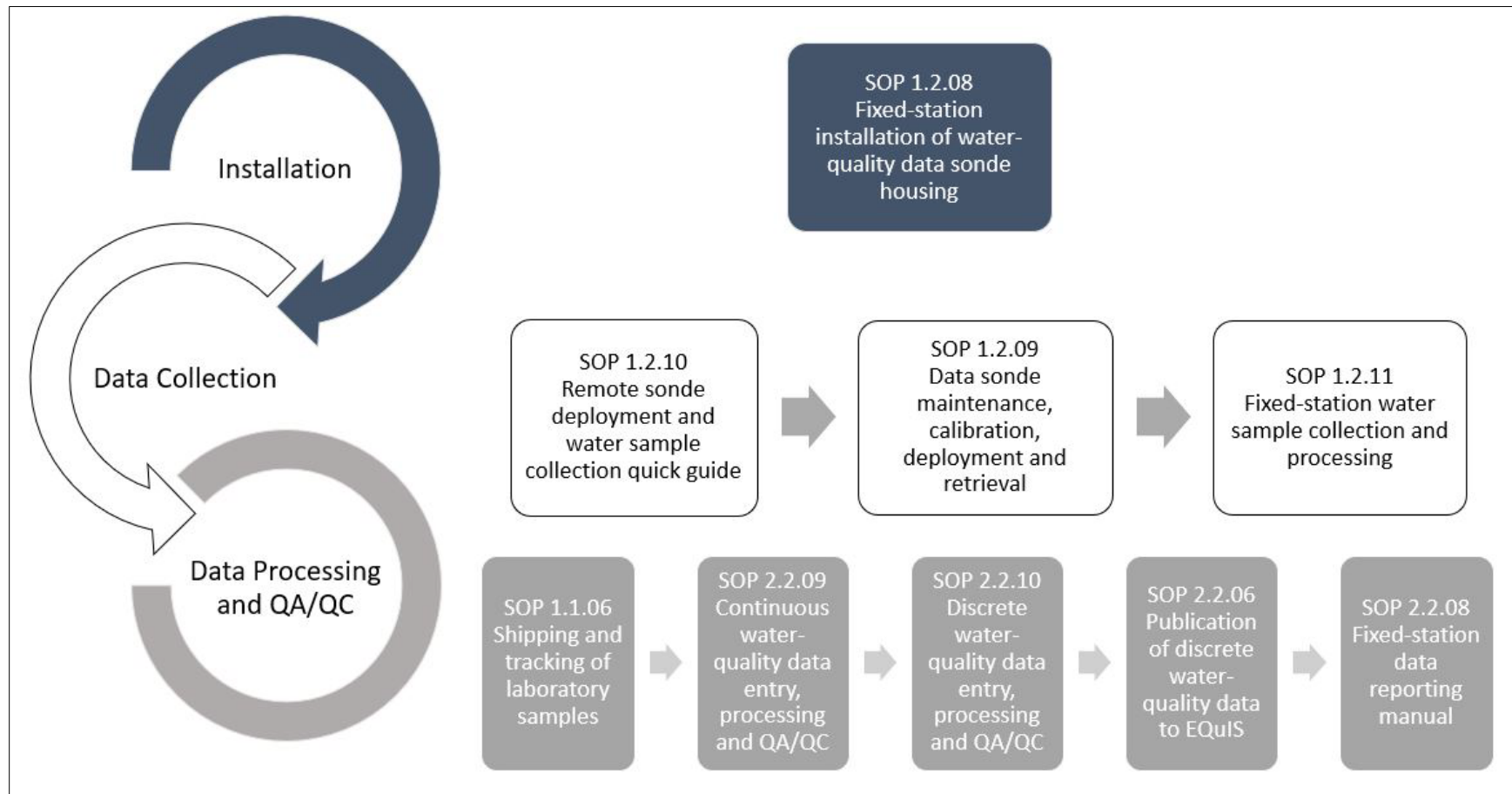


Figure 1. Fixed-station activities and workflow. SOPs are presented left to right in the general order of operations for each activity.

Required Software, Access, and Materials

- Access to the NPS Network
- Access to the SECN Estuarine Water-Quality Monitoring Database (EWQD), consisting of a Microsoft Access front-end and SQL backend. For access contact SECN Data Manager Wendy Wright (wendy_wright@nps.gov).
- Access to the NPS Power BI Report Server – Estuarine Water-quality Reports ([Estuarine Water Quality - Power BI Report Server](#))
- Microsoft Excel
- Populated field forms: SECN Water Sample Collection Form (v2.3 or newer)
- Laboratory analysis results in comma delimited format (.csv)

Overview and Workflow

Fixed-station site visits involve observations of water clarity using a Secchi disk and the collection of water samples to determine concentrations of nutrients and chlorophyll *a*. See SOP 1.2.11 *Fixed-Station Water Sample Collection and Processing*—Version 2.0 (McCay and Starkey 2022) for sampling procedures.

This SOP outlines the procedures necessary to enter, process and perform quality control measures on data recorded on the paper Water Sample Collection Form (Appendix A) and data resulting from laboratory analysis of water samples. Figure 2 shows the general fixed-station discrete data entry and processing workflow. The SECN Estuarine Water-Quality Monitoring Database (EWQD) procedures shown in white boxes are discussed below.

It is important to note that a Water Sample Collection form must be entered in the database BEFORE attempting to enter results from the lab. In other words, the lab result is ‘attached’ to the sample event. **If the Water Sample Collection form is ever deleted after lab results are attached, work with the SECN data manager to ensure that the lab results are not orphaned in the backend.**

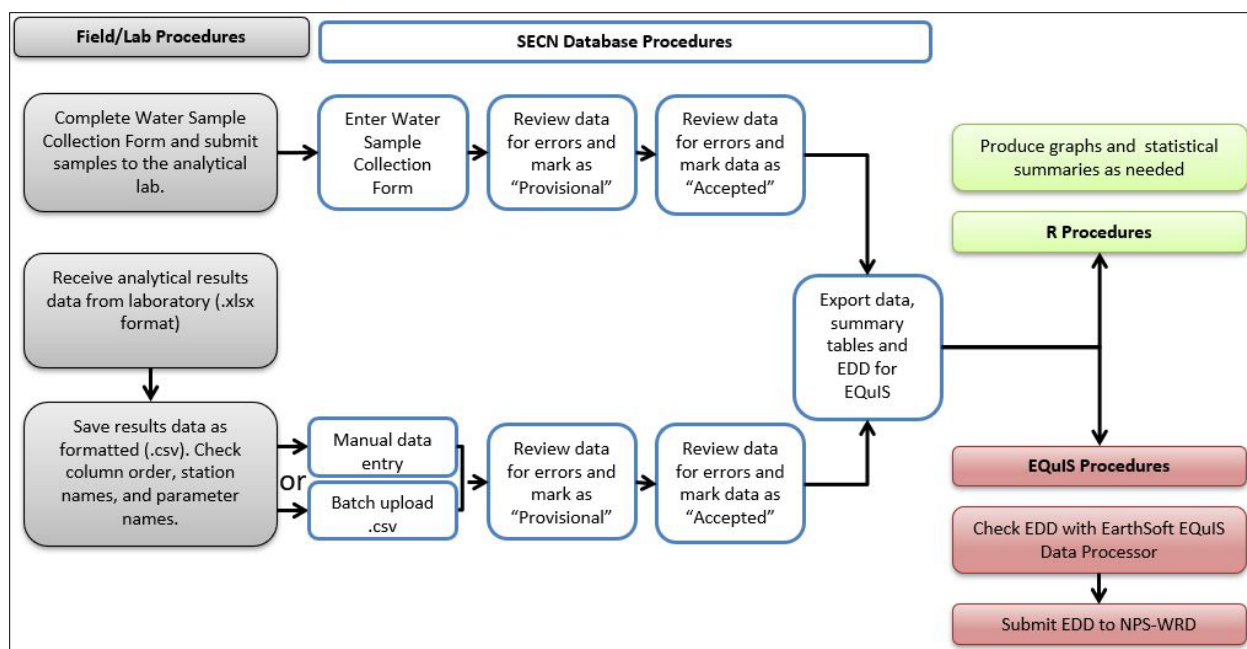


Figure 2. General fixed-station discrete data entry and processing workflow. Arrows represent the flow of data and information between steps and across data systems.

SECN Estuarine Water-Quality Monitoring Database

The Southeast Coast Network (SECN) Estuarine Water-Quality Monitoring Database (EWQD) consists of an SQL Server back-end database and a Microsoft Access front-end user interface. Both applications can be accessed by multiple users simultaneously. The data entry component is designed for the manual entry of associated data sheets (water sample collection form) and lab data (e.g., nutrient and chlorophyll *a* results and associated QA/QC sample data). The application component includes subsequent data analysis and data reporting required for both internal and external use. More details about the database can be found in *SOP 2.2.07 Estuarine Water-Quality Monitoring Data Management and Database Technical Documentation—Version 2.0* (Wright et al. 2022).

Lookup Management

Prior to entry of data for water sample collection, review the paper form and lab results to determine if there is anything that needs to be added to the lookup tables in the database. The most common addition for fixed-station discrete water sampling is new personnel (i.e., protocol users). Less common additions or changes to the lookup tables are discussed separately below. If no additions are necessary, skip directly to data entry.

Add Personnel or Cooperators

1. Open the EWQD front end
2. From the Main Menu select “Lookup Manager” (Figure 3)

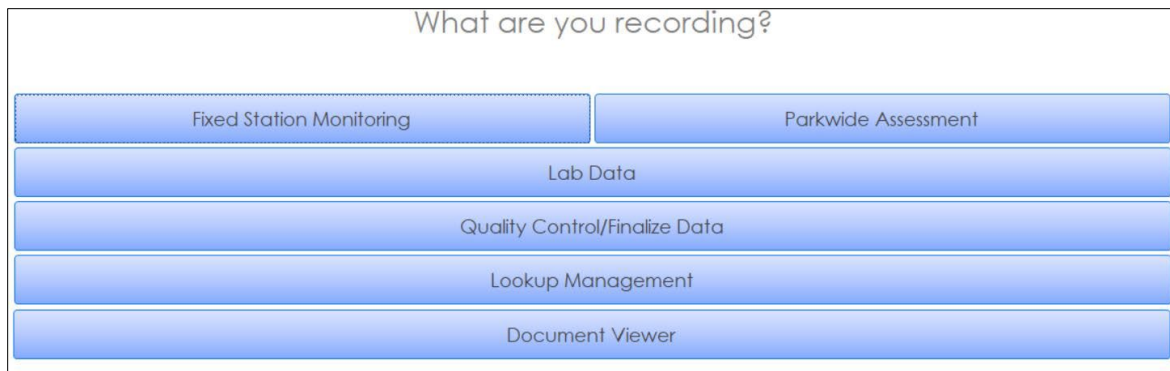


Figure 3. Estuarine Water-Quality Monitoring Database Main Menu.

3. From the “Select a table” drop down, select “dbo_ProtocolUser” (Figure 4)

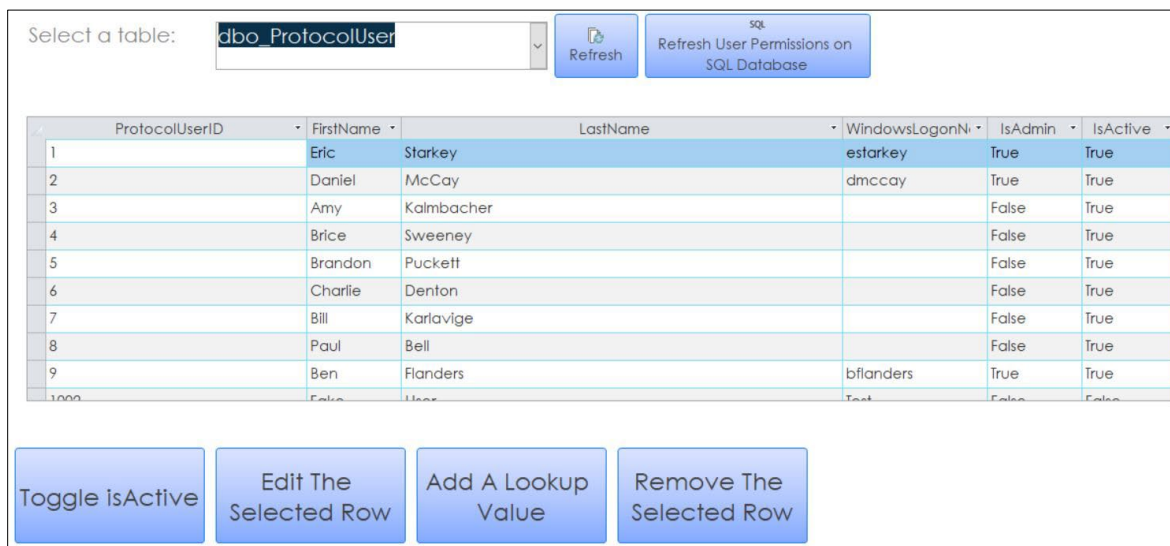


Figure 4. Estuarine Water-Quality Monitoring Database Lookup Manager with the dbo_ProtocolUser table selected.

4. Click “Add a Lookup Value”
5. Fill in the required information in the “Add a Lookup Value” window. Required fields are:
 - a. First Name
 - b. Last Name
 - c. Windows Logon Name (if applicable)
 - d. Is Admin (True or False). Only the protocol lead, hydrological technician and data manager are set to True
 - e. Is Active (True or False)

6. Click “Submit”
7. Click “Refresh” (Figure 4) and ensure that the new protocol user is shown in the table

Other Lookup Table Additions

Less common items may also be added via the Lookup Manager; however, any additions or changes must be cleared by the SECN aquatic ecologist and SECN data manager. Edits to values in these tables should be avoided since changes may have broad implications. Lookup tables related to fixed-station water samples that may require additions include:

dbo_FiltrationMethod

dbo_Laboratory

dbo_Method

dbo_Parameter

dbo_Unit

dbo_WaterSampleType

Water Sample Collection – Data Entry Procedures

Water sample collection data are recorded on paper datasheets (Appendix A) and subsequently entered into the SECN EWQD within a week of a site visit. To begin data entry, open the database and click “Fixed Station Monitoring” on the Main Menu (Figure 3).

Fixed-Station Selection

Create New Station (Initial Setup Required Once)

If the monitoring station does not exist in the “Select an Existing Station” drop-down list (Figure 5):

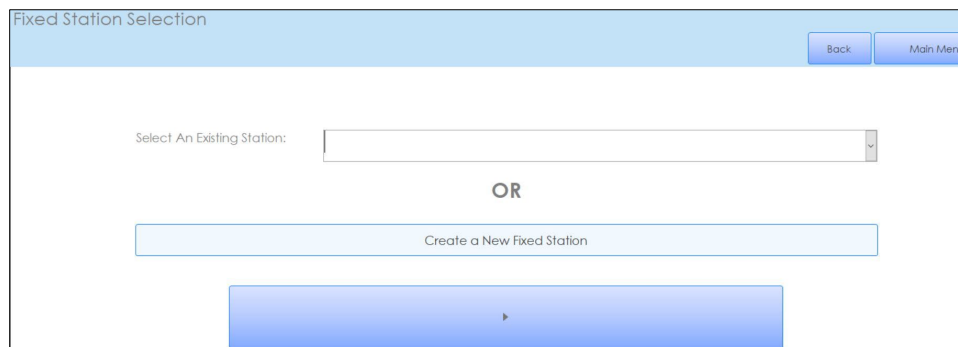


Figure 5. Estuarine Water-Quality Monitoring Database Fixed Station Selection screen.

1. Check the datasheet to make sure that the station name has been recorded correctly. Do not enter new station names for existing monitoring locations already entered in the database.

2. From the “Fixed Station Selection” menu, select “Create a New Fixed Station.”
3. On the “SECN Fixed Station Creation Form” populate all fields and click “Submit” (Figure 6).

SECN Fixed Station Creation Form
STATION FORM v1.1 (04/2017)

Station Name:

Water Body Name: **Staging Area:**

GPS X: Y:
UTM Zone: (17 or 18) Datum (NAD83):

Recorded By: **Notes**

Submit

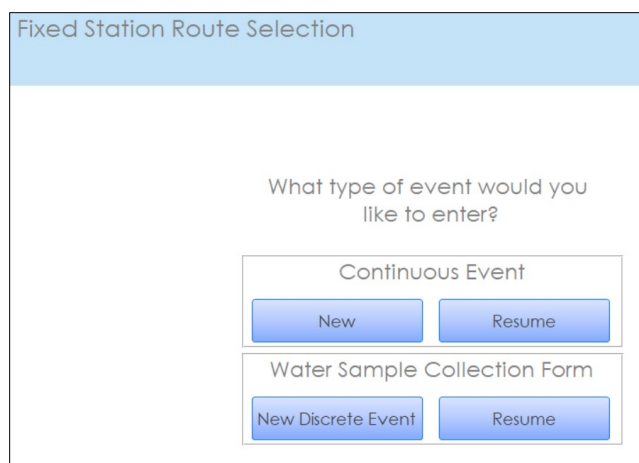
Figure 6. Estuarine Water-Quality Monitoring Database Fixed Station Creation Form.

4. From the “Fixed Station Selection” menu select the new station from the drop-down menu and press the play button ► (Figure 5). After selection, the “Fixed Station Route Selection” screen will appear. Proceed to the steps outlined in the section below (New Discrete Event).

Existing Station (Routine Process)

If the monitoring station already exists in the “Select an Existing Station” drop-down list (Figure 5):

1. From the “Fixed Station Selection” screen, select an existing station from the drop-down menu.
2. Press the play button ► (Figure 5).
3. After selection, the “Fixed Station Route Selection” screen will appear (Figure 7). Proceed to the steps outlined in the section below (New Discrete Event).

The image shows a web application interface titled "Fixed Station Route Selection" in a light blue header bar. Below the header, the text "What type of event would you like to enter?" is centered. There are two main sections for selection. The first section, titled "Continuous Event", contains two blue buttons: "New" and "Resume". The second section, titled "Water Sample Collection Form", contains two blue buttons: "New Discrete Event" and "Resume".

Fixed Station Route Selection

What type of event would you like to enter?

Continuous Event

New Resume

Water Sample Collection Form

New Discrete Event Resume

Figure 7. Estuarine Water-Quality Monitoring Database Fixed Station Route Selection screen.

New Discrete Event

Data from the Water Sample Collection Form will be entered in this step.

1. Click “New Discrete Event” from the Fixed-Station Route Selection screen (Figure 7).
2. Enter the collection date (MM/DD/YYYY).
3. Populate all fields in the database Water Sample Collection Form (Figure 8). Note that all times are in Eastern Standard Time (EST), 24-hour format.

Fixed Station — Water Sample Collection Form

DATASHEET v2.2 (04/2019)

Station Name: **FOPUlaz01**

Back Main Menu

Sample Number: **1**

Water Sample Type: Normal Sample

Filtration Method: Vacuum Collected By: Daniel McCay

Collection Date: 2021-12-01 Salinity: (psu) 22.98

Collection Time: (EST) 08:50:00 Secchi Depth: (m) 0.7

Check if the secchi disk hit the ground before losing visibility ☐

(Samples are to be collected between +3 hours before slack low water)

Low Tide Time: (EST) 11:30:00

Parameters Requested (Please use check boxes to indicate required analyses)

Monthly Analytes: Quarterly Analytes: (February, May, August, November)

TDN ☒ DIN ☒

TDP ☒ DIP ☒

Chl a ☒

Amount Filtered (ml): 200

Filtered By: Daniel McCay

Filtered Date: 2021-12-01

Filtered Time: (EST) 09:05:00

Notes:

Go To Sample:

Delete Current Sample Add Another Water Sample Submit All Samples

Figure 8. Estuarine Water-Quality Monitoring Database Fixed Station Water Sample Collection Form screen.

- Before clicking “Submit All Samples”, check to see if there was a QA/QC sample (blank or duplicate) collected at the same station on the same date. If so, proceed to the next step.
- If a QA/QC sample (blank or duplicate) was taken, click “Add Another Water Sample” at the bottom of the screen (Figure 8). An empty form will appear and the “Sample Number” box will change to “2.”
- Populate all fields in the Water Sample Collection form for the QC Blank or QC Duplicate.

7. Use professional judgement to double check that Secchi depth and salinity are within a reasonable range for the site and tidal window. Extreme values will be flagged by the database. When finished with all entries, click “Submit All Samples.”
8. Review your input (Figure 9).

Review your input

Route Summary:

Fixed Water Sample Info:

Sample Count: 2

Normal Sample Count: 1

QC Blank Count: 1

QC Duplicate Count: 0

Next

Figure 9. Estuarine Water-Quality Monitoring Database Fixed Station Water Sample ‘Review Your Input’ screen.

Analytical Laboratory Results—Data Verification Procedures

Laboratory results are received as an electronic Microsoft Excel file from the contracted analytical laboratory and subsequently entered in the SECN EWQD. Prior to data entry, all laboratory results must be reviewed for errors and inconsistencies (pay close attention to site names and sample dates). In some cases, additional information and clarification may be required from the contracted analytical lab. Once the data have passed the initial screening, review the normal and quality control (QC) sample results. Note that when clerical errors have been corrected, all data are entered into the SECN EWQD. Additional application of QC measures to meet data quality objectives may be conducted during data export and reporting (e.g., censoring data below the method detection limit).

Review All Sample Results and QC Codes

Check the laboratory data qualifier codes (QC codes) for any issues that may indicate problems with the handling or processing of the sample (e.g., hold times exceeded, torn filter, foil pouch damaged). Use this check as an opportunity to identify and correct problems with sample handling and processing prior to the next round of sampling. In some cases, staff may need to be retrained on proper handling technique and procedures.

Review QC Blanks and Duplicate Results

Results of quality control blanks and duplicates are reviewed and compared to requirements for acceptable data shown below (modified from British Columbia Ministry of Environment 1998). This initial assessment of blanks and duplicates is used to correct systemic sampling and handling issues that need to be dealt with as soon as they are identified.

- **Field Blanks**—Blanks are designed to detect contamination that contributes to imprecision and bias. Rules of thumb for assessing contamination are (1) not more than 5% of the blanks will exceed the ‘method detection limit’ and (2) blanks will not exceed 10% of the environmental levels (based on existing data for a site) or 10% of the level of interest (e.g., a criterion or objective). These rules of thumb are, in effect, data quality objectives for contamination. If concentrations indicate contamination that contributes to imprecision and bias, staff will be retrained on sampling techniques and procedures.
- **Field Duplicates**—Duplicates provide a rough estimate of the overall precision associated with the field technique and laboratory analysis. When the data values for replicate samples have low variability, then contamination during collection or analysis is unlikely and uncertainty associated with data collection can be ruled out. When the data have high variability, contamination may have occurred during collection/analysis or as a result of environmental conditions that were highly variable.

Precision can be expressed as a relative percent mean difference when duplicates were collected as per the absolute value of the following equation:

$$\frac{\text{data value A} - \text{data value B}}{\frac{(A + B)}{2}} * 100$$

The relative percent mean difference increases rapidly as the analytic value approaches the method detection limit (MDL). Consequently, the use of relative percent mean difference is limited to analytical values that are at least five times the MDL. The following is a ‘rule of thumb’ criterion for precision values (above which the data need to be viewed with caution):

- 25% relative difference for duplicates (i.e., a value exceeding 25% is considered too imprecise)

Analytical Laboratory Results—Data Entry Procedures

Direct Data Entry

While direct data entry is possible for each analyte, the batch upload feature described in the next section is more efficient and prevents transcription errors. For these reasons, consider using batch upload if there are more than 2–3 entries.

1. Open the database and click “Lab Data” on the Main Menu (Figure 3).
2. On the next screen, click on “Water Nutrient Analysis.” The Nutrient Analyte Lab Data Entry screen will appear (Figure 10).

Sample	Collection Date	Sample Type	Laboratory	Analysis Date	Parameter	Result	UnitID	Method Detection	Lower rQu	Method	Comment
Station Name Collection Date Water Sample Type						0.0			0.0000		
SECNreal05 2/5/2016 Normal Sample											
SECNreal05 2/5/2016 QC Blank											
CUISSeac03 12/9/2019 Normal Sample											
CUISSeac03 1/24/2020 Normal Sample											
CUISSeac03 3/3/2020 Normal Sample											
CUISSeac03 3/3/2020 QC Duplicate											
CONGccbr01 6/25/2020 Normal Sample											
CONGccbr01 11/9/2020 Normal Sample											
CONGbann01 6/25/2020 Normal Sample											
CONGbann01 11/9/2020 Normal Sample											
FOPUilaz01 12/10/2019 Normal Sample											
FOPUilaz01 12/10/2019 QC Blank											
FOPUilaz01 1/22/2020 Normal Sample											
FOPUilaz01 3/2/2020 Normal Sample											
CAHAocbr01 12/13/2019 Normal Sample											

Figure 10. Estuarine Water-Quality Monitoring Database Nutrient Analyte Lab Data Entry screen.

3. Select the correct Station Name, Collection Date and Sample Type from the drop-down menu. This list corresponds to data entered from the Water Sample Collection Form. If the correct station name, collection date, and sample type combination is not shown, check to see if the water sample form has been entered and has a data processing level of “Provisional” or “Accepted.”
4. Populate all columns in each row for each analyte (parameter) result. In other words, Total Dissolved Nitrogen (TDN), Total Dissolved Phosphorus (TDP), Dissolved Inorganic

Nitrogen (DIN), Dissolved Inorganic Phosphorus (DIP), and Chlorophyll *a* Active (Chla), will each have a row.

5. Use professional judgement to review each entry for validity and check that it is within a reasonable range for the site, season, and tidal window. Extreme values will be flagged by the database.
6. When all data entry has been completed click “Submit Data.”

Batch Upload Data Entry

The batch upload feature in the SECN EWQD allows for quick entry of results for multiple analytes and stations. When a properly configured file is uploaded this feature increases entry efficiency and prevents transcription errors. This section will address both file configuration and upload procedures.

Formatting the Results File (.xlsx to .csv)

The analytical laboratory returns results to the Southeast Coast Network in a Microsoft Excel file (.xlsx). This file must be formatted and saved as a comma delimited (.csv) file so that it can be uploaded into the database using a lab-specific parser. The steps in this section and template in Appendix B are for results supplied by Chesapeake Biological Laboratory. If a different analytical lab is contracted the parser and template will change.

1. Open the raw unformatted file in Microsoft Excel (Figure 11). Raw files are stored on the SECN server in the “Raw” folder for a given year (e.g., <S:\Monitoring\EstuarineWaterQuality\FixedStation\Data\Lab Nutrient Data\Chesapeake Biologic\2020\Raw>).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	NUTRIENT ANALYTICAL SERVICES LABORATORY DATA REPORT														
2	Chesapeake Biological Laboratory														
3	146 Williams Street / P.O. Box 38														
4	Tel: 410-328-7252														
5	http://www.umces.edu/nutrient-analytical-services-laboratory														
6	Jerome M. Frank- Laboratory Manager														
7															
8	The following person accepts responsibility for the contents of this report:														
9															
10	Name: Jerome M Frank Signature: JMF Date: 4/25/2020														
11															
12	NELAC Certification #: 12066														
13	Date of Issue: 6/28/2017														
14															
15															
16	Client: NPS														
17	Project ID: Southeast Coast Network Water Quality Monitoring														
18	Reference #:														
19	POC: Starkey														
20	Address:														
21															
22															
23															
24	Sample ID	Sample Date	Received Date	NASL ID	Matrix	Prep Date	Analysis Date	Parameter	<MDL/RL	Result	Unit	MDL/RL	Method	Analyst	Qualifiers/Comments
25	CALO1	11/6/2019	11/13/2019	CALO1	W	11/19/2019	11/19/2019	NH4	LBR	0.013	mg N/L	0.013/0.039	SM4500G	CLH	
26	CALO2	11/6/2019	11/13/2019	CALO2	W	11/19/2019	11/19/2019	NH4	BR	0.014	mg N/L	0.013/0.039	SM4500G	CLH	
27	CALO2 DUP	11/6/2019	11/13/2019	CALO2 DUP	W	11/19/2019	11/19/2019	NH4	BR	0.017	mg N/L	0.013/0.039	SM4500G	CLH	
28	CUIS	11/14/2019	11/19/2019	CUIS 1114	W	11/25/2019	11/25/2019	NH4	BR	0.016	mg N/L	0.013/0.039	SM4500G	CLH	
29	FOPU	11/12/2019	11/19/2019	FOPU 1112	W	11/25/2019	11/25/2019	NH4	BR	0.024	mg N/L	0.013/0.039	SM4500G	CLH	
30	CAHA	11/7/2019	11/25/2019	CAHA 1107	W	12/13/2019	12/13/2019	NH4	LBR	0.013	mg N/L	0.013/0.039	SM4500G	CLH	31
31	CALO1	2/10/2020	2/12/2020	CALO01 0210	W	2/17/2020	2/17/2020	NH4	LBR	0.013	mg N/L	0.013/0.039	SM4500G	CLH	
32	CALO2	2/10/2020	2/12/2020	CALO02 0210	W	2/17/2020	2/17/2020	NH4	LBR	0.013	mg N/L	0.013/0.039	SM4500G	CLH	
33															
34	CALO1	11/6/2019	11/13/2019	CALO1	W	11/19/2019	11/19/2019	NO2	BR	0.0007	mg N/L	0.0007/0.0022	EPA 353.2	CLH	
35	CALO2	11/6/2019	11/13/2019	CALO2	W	11/19/2019	11/19/2019	NO2	BR	0.0008	mg N/L	0.0007/0.0022	EPA 353.2	CLH	
36	CALO2 DUP	11/6/2019	11/13/2019	CALO2 DUP	W	11/19/2019	11/19/2019	NO2	BR	0.0009	mg N/L	0.0007/0.0022	EPA 353.2	CLH	
37	CUIS	11/14/2019	11/19/2019	CUIS 1114	W	11/25/2019	11/25/2019	NO2		0.0022	mg N/L	0.0007/0.0022	EPA 353.2	CLH	
38	FOPU	11/12/2019	11/19/2019	FOPU 1112	W	11/25/2019	11/25/2019	NO2		0.0051	mg N/L	0.0007/0.0022	EPA 353.2	CLH	
39	CAHA	11/7/2019	11/25/2019	CAHA 1107	W	12/13/2019	12/13/2019	NO2	LBR	0.0007	mg N/L	0.0007/0.0022	EPA 353.2	CLH	31
40	CALO1	2/10/2020	2/12/2020	CALO01 0210	W	2/17/2020	2/17/2020	NO2	BR	0.0007	mg N/L	0.0007/0.0022	EPA 353.2	CLH	
41	CALO2	2/10/2020	2/12/2020	CALO02 0210	W	2/17/2020	2/17/2020	NO2	LBR	0.0007	mg N/L	0.0007/0.0022	EPA 353.2	CLH	
42															

Figure 11. Raw lab results report .xlsx screen shot.

2. Go to "File," "Save As."
 - a. Change the file type to comma delimited (.csv).
 - b. Save the file to the Formatted folder on the SECN server (e.g., S:\Monitoring\EstuarineWaterQuality\FixedStation\Data\Lab Nutrient Data\Chesapeake Biologic\2020\Formatted)
3. Do not remove any header metadata (i.e., rows 1:23 in Figure 11).
4. If needed, modify the station names in the Sample ID column so that they match the SECN station naming convention (i.e., PARKcode##) as recorded on the water sample collection form (Appendix A).
5. Stations with QA/QC samples (Blanks and Duplicates) will have the station name followed by BLANK or DUP (e.g., CUISseac03 BLANK, CALOshak01 DUP; Figure 12).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	NUTRIENT ANALYTICAL SERVICES LABORATORY DATA REPORT														
2	Chesapeake Biological Laboratory														
3	146 Williams Street / P.O. Box 38														
4	Tel: 410-326-7252														
5	http://www.umces.edu/nutrient-analytical-services-laboratory														
6	Jerome M. Frank- Laboratory Manager														
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9															
10															
11															
12	NELAC Certification #	12066													
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14															
15															
16	Client:	NPS													
17	Project ID:	Southeast Coast Network Water Quality Monitoring													
18	Reference #:														
19	POC:	Starkey													
20	Address:														
21															
22															
23															
24	Sample ID	Sample Date	Received Date	NASL ID	Matrix	Prep Date	Analysis Date	Parameter	<MDL/RL	Result	Unit	MDL/RL	Method	Analyst	Qualifiers/ Comments
25	CALOm02	12/15/2020	12/17/2020	CALO02	P	1/7/2021	1/8/2021	Chla		1.27 ug/L		0.69/0.69	EPA 445.0, CR		
26	CALOm02	12/15/2020	12/17/2020	CALO2 121	W	12/21/2020	2/4/2021	TDN	BR	0.11 mg/L		0.05/0.15	EPA 353.2 KB		
27	CALOm02	12/15/2020	12/17/2020	CALO2 121	W	12/21/2020	2/4/2021	TDP		0.0116 mg/L		0.0015/0.0	EPA 365.1 KB		
28	CALOm02 BLANK	12/15/2020	12/17/2020	CALO02BLK	P	1/7/2021	1/8/2021	Chla	L/BR	0.69 ug/L		0.69/0.69	EPA 445.0, CR		
29	CALOm02 BLANK	12/15/2020	12/17/2020	CALO BLK 1	W	12/21/2020	2/4/2021	TDN	L	0.05 mg/L		0.05/0.15	EPA 353.2 KB		
30	CALOm02 BLANK	12/15/2020	12/17/2020	CALO BLK 1	W	12/21/2020	2/4/2021	TDP		0.0081 mg/L		0.0015/0.0	EPA 365.1 KB		
31	CALOshak01	12/15/2020	12/17/2020	CALO01	P	1/7/2021	1/8/2021	Chla		3.36 ug/L		0.69/0.69	EPA 445.0, CR		
32	CALOshak01	12/15/2020	12/17/2020	CALO1 121	W	12/21/2020	2/4/2021	TDN		0.19 mg/L		0.05/0.15	EPA 353.2 KB		
33	CALOshak01	12/15/2020	12/17/2020	CALO1 121	W	12/21/2020	2/4/2021	TDP		0.0131 mg/L		0.0015/0.0	EPA 365.1 KB		
34	CUISseac03	9/11/2020	10/7/2020	CUIS911BX	P	10/7/2020	10/8/2020	Chla		11.13 ug/L		0.69/0.69	EPA 445.0, NLK		36
35	CUISseac03	9/11/2020	10/7/2020	CUIS 0911	W	10/14/2020	10/14/2020	NH4		0.041 mg/L		0.009/0.02	SM4500G CLH		31
36	CUISseac03	9/11/2020	10/7/2020	CUIS 0911	W	10/14/2020	10/14/2020	NO2		0.0053 mg/L		0.0007/0.0	EPA 353.2 CLH		31

Figure 12. Formatted lab results .csv screen shot.

6. Remove all rows that have the Parameter CHL-TOTAL and CHL-PHAEO. These are not stored in the database.
7. Change Parameter CHL-ACTIVE to Chla. Use Find and Replace in Excel to make this easier (ctrl + F).

8. Check that all other Parameters are named correctly (i.e., TDN, TDP, NH4, NO2, NO23, PO4).
9. Raw results from the lab are typically sorted by parameter and then sample date. To make it easier to spot missing data or entry issues, use Microsoft Excel to sort the results by Sample ID and then Sample Date (Figure 13).

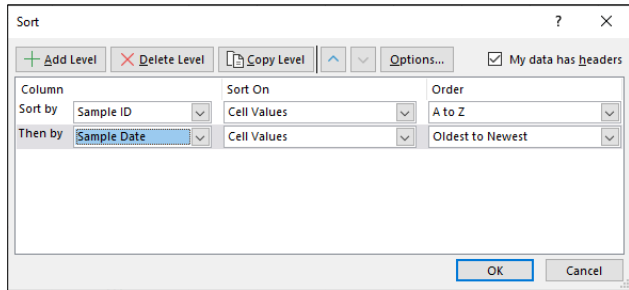


Figure 13. Microsoft Excel Sort window.

- a. In Microsoft Excel, highlight the headers and all data. Start in Row 24 (i.e., the row with column headers).
 - b. Go to “Data.”
 - c. Click “Sort.”
 - d. Populate Sort by: Colum “Sample ID”, Sort On “Cell Values”, Order “A to Z.”
 - e. Click “Add Level.”
 - f. Populate Then by: “Sample Date”, Sort On “Cell Values”, Order “Oldest to Newest.”
 - g. Click “OK.”
10. Double check that all data are in order by sample date and that each station has all corresponding data.
 - a. All sample dates should have data for the following parameters: Chla, TDN, TDP.
 - b. Quarterly sample dates should have data for the following parameters: Chla, NH4, NO2, NO23, PO4, TDN, and TDP.
 11. Remove any blank rows.
 12. Save the file.

Database Input

1. Open the EWQD and click “Lab Data” on the Main Menu (Figure 3).

- On the next screen, click on “Water Nutrient Analysis.” The Nutrient Analyte Lab Data Entry screen will appear (Figure 10).
- Click “Batch Upload” (Figure 10).
- Read and click “OK” in the warning box. “All data on the current sheet will be cleared. Make sure to check data entry results for errors.”
- Select the formatted .csv data file.
- From the Data Scraper Extra Info Popup select the correct analytical lab and click Confirm (Figure 14).

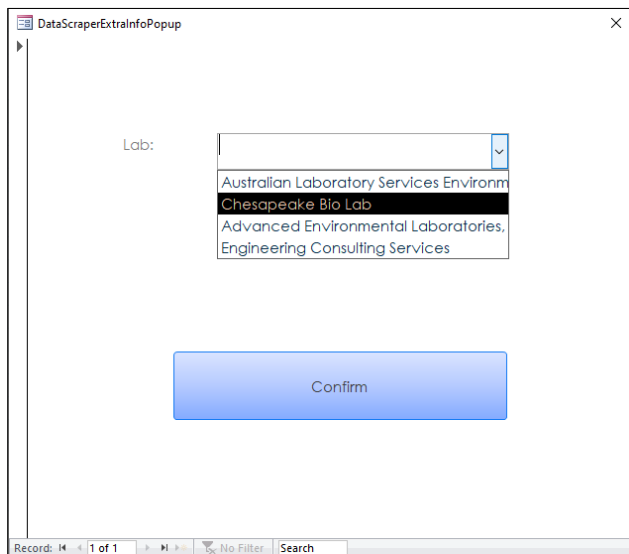


Figure 14. Estuarine Water-Quality Monitoring Database Data Scraper Extra Info Popup screen.

- Depending on the amount of data contained in the .csv, the Water Analyte Lab Data Entry screen may take several minutes to populate with data (Figure 15). If the screen has not populated with data after approximately 10 minutes, contact the SECN data manager for assistance.

Nutrient Analyte Lab Data Entry				Batch Upload						
DATABASE v1.0 [09/2019]										
Sample	Collection Date	Laboratory	Analysis Date	Parameter	Result	UnitID	Method Detection	Lower rQu	Method	Comment
SECNreal05	5/19/2015	Chesapeake Bio Lab	6/11/2015	TDN	0.33	mg/L	0.05	0.1500	EPA 353.2	
SECNreal05	5/19/2015	Chesapeake Bio Lab	6/11/2015	TDP	0.033	mg/L	0.0015	0.0045	EPA 365.1	
SECNreal05	5/19/2015	Chesapeake Bio Lab	6/11/2015	NH4	0.049	mg/L	0.013	0.0390	SM4500G	
SECNreal05	5/19/2015	Chesapeake Bio Lab	6/11/2015	PO4	0.0184	mg/L	0.0034	0.0102	EPA 365.1	
SECNreal05	5/19/2015	Chesapeake Bio Lab	6/11/2015	Chla	8.42	ug/L	0.69	0.6900	EPA 445.0. SA	
SECNreal05	5/19/2015	Chesapeake Bio Lab	6/11/2015	NO2	0.0002	mg/L	0.0007	0.0022	EPA 353.2	
SECNreal05	5/19/2015	Chesapeake Bio Lab	6/11/2015	NO23	0.049	mg/L	0.0007	0.0056	EPA 353.2 C/A	
SECNreal05	7/13/2015	Chesapeake Bio Lab	7/21/2115	TDN	0.34	mg/L	0.05	0.1500	EPA 353.2	
SECNreal05	7/13/2015	Chesapeake Bio Lab	7/21/2115	TDP	0.044	mg/L	0.0015	0.0045	EPA 365.1	
SECNreal05	7/13/2015	Chesapeake Bio Lab	7/21/2115	Chla	13.19	ug/L	0.69	0.6900	EPA 445.0. SA	
SECNreal05	7/13/2015	Chesapeake Bio Lab	7/21/2115	TDN	0.32	mg/L	0.05	0.1500	EPA 353.2	
SECNreal05	7/13/2015	Chesapeake Bio Lab	7/21/2115	TDP	0.043	mg/L	0.0015	0.0045	EPA 365.1	

Figure 15. Estuarine Water-Quality Monitoring Database populated Nutrient Analyte Lab Data Entry screen.

8. Check all entries against the original Microsoft Excel results provided by the lab. Be sure to look for any missing lines, station names, sample dates, parameter names or method detection limits (MDLs). Any missing information may indicate an issue with the formatting of the .csv file. Blanks and duplicate sample ID's may need to be selected manually from the drop down, which appears in each row of the first column of the Nutrient Analyte Lab Data Entry form (Figure 15).
9. Use professional judgement to review each entry for validity and check that it is within a reasonable range for the site, season, and tidal window. Extreme values will be flagged by the database.
10. Click "Submit Data."

Quality Assurance (QA) and Processing

As indicated in Figure 2 (SECN Estuarine Water-Quality Monitoring Database Procedures), all fixed-station discrete data (field forms and lab results) are entered in the database and reviewed several times for quality assurance. This section outlines the procedures for the review of these records.

Data Processing Levels

Data processing levels indicate the level of review that has been applied to a given dataset within the database.

Raw:	Data have been entered but received no further review, or data have been reviewed and found to contain errors that need to be fixed.
Provisional:	The person that performed the data entry has checked all values against the original paper forms and found them to be free of errors. Considered the initial review.
Accepted:	An independent observer has checked all values against the original paper forms and found them to be free of errors. Considered the final review.

Review of Water Sample Collection Forms (QA)

This process is the same for the initial and final review of data.

1. Obtain the original paper datasheets filed in the SECN Athens office.
2. Open the SECN Estuarine Water-Quality Monitoring Database.
3. From the Main Menu, select "Quality Control/Finalize Data" (Figure 3).
4. From the "Quality Control Manager" screen, select the Form Type "DiscreteFixedEvent" of interest (Figure 16).

Quality Control Manager

Back Main Menu

Please Select a Single Processable Data Record:

FormType	Station Name	Date Deployed/Collected (if applicable)	Entered By	Date Entered	Current Data Processing Level	Data Processed By	Data Processing Date
DiscreteFixedEvent	FAKEfake99	2021-04-28	Ben Flanders	2021-05-03	Raw	Ben Flanders	2021-05-03
DiscreteFixedEvent	CUISSec03	2020-11-23	Daniel McCay	2021-05-04	Provisional	Daniel McCay	2021-05-04
DiscreteFixedEvent	CUISSec03	2021-04-12	Daniel McCay	2021-05-04	Provisional	Daniel McCay	2021-05-04
DiscreteFixedEvent	CAHAocbr01	2021-03-17	Daniel McCay	2021-05-05	Provisional	Daniel McCay	2021-05-05
DiscreteFixedEvent	FOPUazz01	2021-04-11	Daniel McCay	2021-05-05	Provisional	Daniel McCay	2021-05-05
DiscreteFixedEvent	CONGborr01	2021-04-11	Daniel McCay	2021-05-05	Raw	Daniel McCay	2021-05-05
DiscreteFixedEvent	CONGcbp01	2021-04-11	Daniel McCay	2021-05-05	Raw	Daniel McCay	2021-05-05
DiscreteFixedEvent	CAHAocbr01	2021-05-11	Daniel McCay	2021-05-26	Provisional	Daniel McCay	2021-05-26
FixedContinuousEvent	TIMUking01	2020-10-14	Daniel McCay	2021-05-04	Provisional	Eric Starkey	2021-05-18
FixedContinuousEvent	FOMAvcfr01	2020-11-10	Daniel McCay	2021-05-04	Provisional	Daniel McCay	2021-05-04
FixedContinuousEvent	FOMAvcfr01	2021-02-01	Daniel McCay	2021-05-04	Provisional	Daniel McCay	2021-05-04
FixedContinuousEvent	TIMUking01	2021-02-25	Daniel McCay	2021-05-04	Provisional	Daniel McCay	2021-05-04

New Processing Level:

RAW
ACCEPTED

Figure 16. Estuarine Water-Quality Monitoring Database Quality Control Manager screen with a Discrete Fixed Event selected.

5. After selecting the event of interest, use the drop-down menu to select the new processing level that will be applied to the data (i.e., Raw, Provisional, or Accepted; Figure 16).
 - a. Raw data can move up to Provisional.
 - b. Provisional data can move up to Accepted or back to Raw.
 - c. Accepted data are considered final and can no longer be moved back to Provisional or Raw. As a result, Accepted records do not appear in the list of forms that can be processed.
6. Click “Continue.”
7. Review all entries against the paper datasheet. In addition, use professional judgement to review each entry for validity and check that it is within a reasonable range for the site.
 - a. If an error is found, it can be corrected but the database will automatically move the record back to the Raw processing level.
 - b. On the water sample form, use the “Go To Sample” drop down to review QC Blanks and QC Duplicates.
 - c. If all data match the paper datasheet, click “Confirm and Apply New Processing Level” (Figure 17).

Fixed Station — Water Sample Collection Form
 DATASHEET v2.2 (04/2019)

Station Name: **CUISseac03**
 Back Main Menu

Sample Number: **1**

Water Sample Type: **Normal Sample**
 Filtration Method: **Vacuum** Collected By: **Daniel McCay**
 Collection Date: **2021-04-12** Salinity: (psu) **26.80**
 Collection Time: (EST) **12:55:00** Secchi Depth: (m) **.50**
 Check if the secchi disk hit the ground before losing visibility ☐
 (Samples are to be collected between +3 hours before slack low water)
 Low Tide Time: (EST) **15:05:00**
 Parameters Requested (Please use check boxes to indicate required analyses)
 Monthly Analytes: Quarterly Analytes: (February, May, August, November)
 TDN ☒ DIN ☒
 TDP ☒ DIP ☒
 Chl a ☒
 Amount Filtered (ml): **1.50**
 Filtered By: **Daniel McCay**
 Filtered Date: **2021-04-12**
 Filtered Time: (EST) **13:10:00**
 Notes: **Tore edges of filter, but center sample circle unharmed.**
 Go To Sample: **1** Delete Current Sample Add Another Water Sample
 Current Processing Level **PROVISIONAL** Previously Processed By: **Daniel McCay**
 New Processing Level **ACCEPTED** Next Form

Figure 17. Estuarine Water-Quality Monitoring Database options to apply a new processing level to a Fixed Discrete Event—Water Sample Form.

8. If water sample collection forms are “deleted” from the database, work with the SECN data manager to ensure that no analytical lab results are “orphaned” in the back end.

Review of Analytical Laboratory Results (QA)

This process is the same for the initial and final review of data.

1. Obtain the original paper datasheets filed in the SECN Athens office.
2. Open the SECN EWQD.
3. From the Main Menu, select “Quality Control/Finalize Data” (Figure 3).

- From the “Quality Control Manager” screen, select the Form Type “FixedStationNutrientLabData” (Figure 18).

FormType	Station Name	Date Deployed/Collected (If applicable)	Entered By	Date Entered	Current Data Processing Level	Data Processed By	Data Processing Date
FixedContinuousEvent	CAHAocbr01	2020-10-22	Daniel McCay	2021-06-01	Provisional	Daniel McCay	2021-06-01
FixedContinuousEvent	CONGcbarr01	2020-11-09	Daniel McCay	2021-06-01	Provisional	Daniel McCay	2021-06-01
FixedContinuousEvent	CONGccbr01	2020-11-09	Daniel McCay	2021-06-01	Provisional	Daniel McCay	2021-06-01
FixedContinuousEvent	CAHAocbr01	2020-12-30	Daniel McCay	2021-06-01	Provisional	Daniel McCay	2021-06-01
FixedSamplingLocation	FAKElake99		Ben Rlanders	2021-04-29	Raw	Ben Rlanders	2021-04-29
FixedStationNutrientLabData					NA		
ParkwideNutrientLabData					NA		
SedimentLabData					NA		

New Processing Level: Processed in subsequent step Continue

Figure 18. Estuarine Water-Quality Monitoring Database Quality Control Manager with “Fixed StationNutrientLabData” Form Type selected.

- After selecting the “FixedStationNutrientLabData” form use the drop-down menu to select “Processed in subsequent step” (Figure 18).
- Click “Continue.”
- The DPL Fixed Nutrient Analyte Selector Screen (Figure 19) will display. Select a fixed nutrient water sample to process its analyte data.

FixedStationName	SampleDate	AcceptedAnalyteCount	UnprocessedAnalyteCount
CUISseac03	11/23/2020	0	3
CALOshak01	12/15/2020	0	3
CALOmidm02	12/15/2020	0	3
CALOmidm02	12/15/2020	0	3

Select Cancel

Figure 19. Estuarine Water-Quality Monitoring Database DPL Fixed Nutrient Analyte Selector screen.

8. Review the data shown in the Nutrient Analyte Lab Data QC spreadsheet (Figure 20) against the original results provided by the lab. In addition, use professional judgement to review each entry for validity and check that it is within a reasonable range for the site.

Nutrient Analyte Lab Data QC				Station/Assessment: CUISeac03		Quick Change New DPLs (first select record(s) below)		RAW		Apply Data Processing Information	
Database v1.0 (07/2019)				Collection Date: 2020-11-23				PROVISIONAL		Back	
				Sample Type: Normal Sample				ACCEPTED		Main Menu	
LaboratoryID	AnalysisDate	Parameter	Result	UnitID	MethodDetectionLimit	LowerQuantificationLimit	MethodID	Comment	Current DPL	New DPL	
Chesapeake Bio Lab	15-Dec-20	Chla	3.4800 micrograms pe		0.49	0.4900	EPA 445.0.51		PROVISIONAL	PROVIS	
Chesapeake Bio Lab	04-Feb-21	TDN	0.3200 milligrams pe		0.05	0.1500	EPA 353.2		PROVIS	DELETE	
Chesapeake Bio Lab	04-Feb-21	TDP	0.0431 milligrams pe		0.0015	0.0045	EPA 365.1		PROVIS	RAW	
									PROVISIONAL		
									ACCEPTED		

Figure 20. Estuarine Water-Quality Monitoring Database Nutrient Analyte Lab Data QC screen.

- a. If an error is found, it can be corrected but the database will automatically move the record back to the Raw processing level.
 - b. If all data match the original lab results, click the New Data Processing Level (DPL) drop-down and select “Provisional” or “Accepted” for each analyte (row; Figure 20). See step d for a shortcut.
 - c. After selecting all the new DPLs click “Apply Data Processing Information” in the upper right (Figure 20).
 - d. Alternately, in place of steps b and c, use the “Quick Change New DPLs” feature (Figure 20).
 - i. Select the records that need to change to a new data processing level.
 - ii. Click “Raw” “Provisional” or “Accepted” and wait until each of the selected lines changes to the new DPL.
 - iii. Click “Apply Data Processing Information.”
9. If this was the initial review of the data (i.e., New DPL = Provisional), alert the secondary reviewer that the data are available for final review (i.e., New DPL = Accepted).
 10. When the final review has been completed, file paper copies of the lab results in the notebook located in the SECN Athens office.

Literature Cited

- British Columbia Ministry of Environment. 1998. Guidelines for Interpreting Water Quality Data. Land Use Task Force Resources Inventory Committee Gov't. Publications Order No. 7680000553. Available at: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/guidlines_for_interpreting_water_quality_data.pdf (last accessed June 2022).
- Wright, W., B. Flanders, and E. N. Starkey. 2022. Estuarine water-quality monitoring data management and database technical documentation—Version 2.0. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—2.2.07. Southeast Coast Network, Athens, Georgia. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2284577> (last accessed June 2022).
- McCay, D., and E. N. Starkey. 2022. Fixed-station water sample collection and processing—Version 2.0. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—1.2.11. Southeast Coast Network, Athens, Georgia. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2284575> (last accessed June 2022).

Figure A-1. Example water sample collection form.

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Appendix B. Batch Upload Template

All metadata are placed before the header row (see Table B-1). The ‘scraping’ of data occurs on a row where ‘SampleID’ occurs in the first column.

All column headers (including optional columns) are included in lab data reports. Values within these columns may be optional.

Table B-1. Nutrient Discrete Fixed-Station Template.

Sample ID	Sample Date	Received Date	NASL ID	Matrix	Prep Date	Analysis Date	Parameter	<MDL/RL	Result	Unit	MDL/RL	Method	Analyst	Comments
The fixed-station name	The date that the water sample event occurred on	(OPTIONAL)	(OPTIONAL)	(OPTIONAL)	(OPTIONAL)	Date	A standard NPS parameter value. (See WQX data dictionary for more information)	(OPTIONAL)	Decimal (10,4)	A standard NPS unit name. (See WQX data dictionary for more information)	Two values separated by a ‘/’ with no space. (Decimal(7,4)/Decimal(7,4))	A standard NPS method name. (See WQX data dictionary for more information)	(OPTIONAL)	(OPTIONAL) with a maximum of 250 characters.