STORET v2.0 Business Rules

United States Environmental
Protection Agency

Office of Wetlands, Oceans and
Watersheds

August 31, 2005

SAIC®
An Employee-Owned Company

SDC-EPA-STORET-017
August 31, 2005

STORET V2.0
BUSINESS RULES

CONTRACT NO. 68-W-99-002
TASK ORDER NO. 014

Prepared for:

United States Environmental Protection Agency
Office of Wetlands, Oceans and Watersheds
Assessment and Watershed Protection Division
401 M Street SW
Washington, DC 20460

Task Order Project Officer:

Robert King

Prepared by:

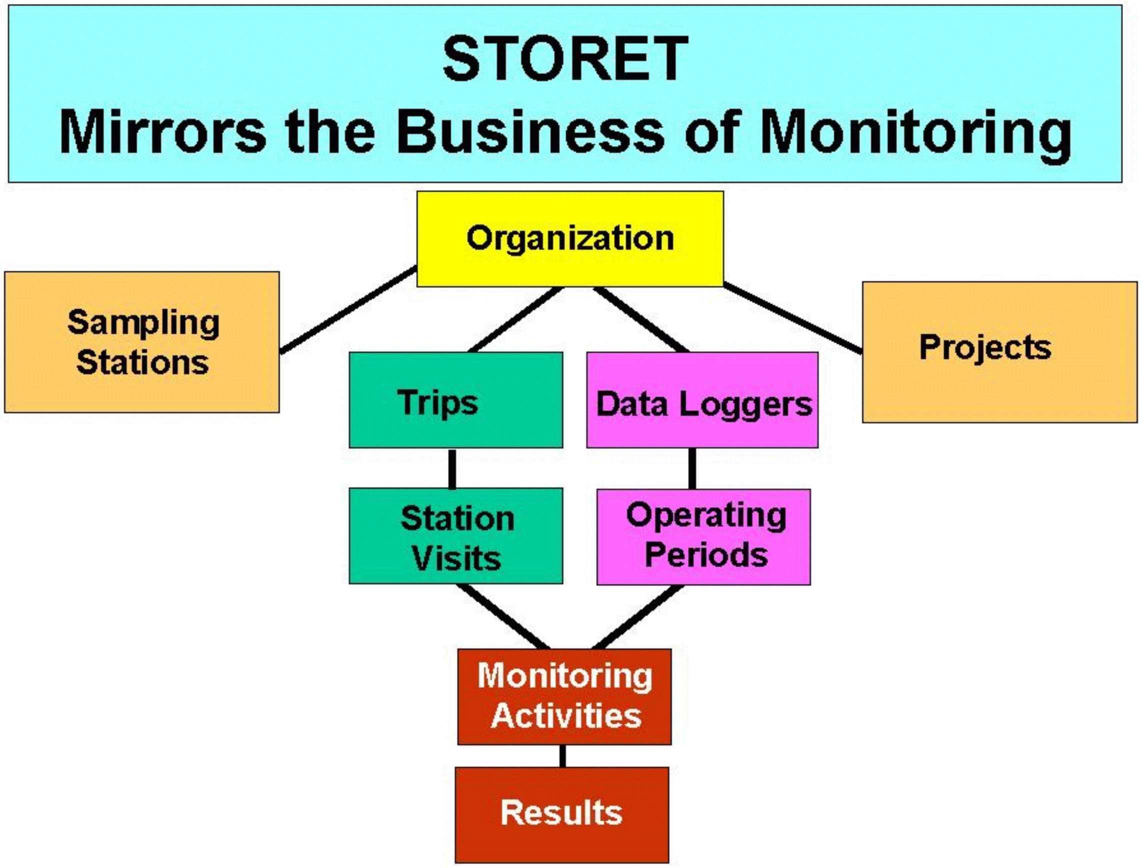
Systems Development Center
Science Applications International Corporation
6565 Arlington Boulevard
Falls Church, VA 22042

CONTENTS

INTRODUCTION

General: This document explores the business rules which control and support the STOrage and RETreival (STORET) system. A business rule is a re-usable piece of business logic that cannot be reduced without losing business meaning. Clearly stated business rules define business needs/objectives, business activities, and the associated interaction between them.

This document is divided into sections which describe each STORET business area, and provide associated business rules. The diagrams in each section show data and process flow followed by a list of data relationships; they are not meant to be entity relationship diagrams. The remainder of this introduction will provide an overview of the water quality monitoring business supported by STORET. The diagram below is a high level representation of the STORET database.



Organization: Organizations carry out Trips to visit Stations/Sites to conduct Monitoring Activities (in support of Projects) which generate Results.

Each copy of STORET may contain many Organizations. Each Organization is at the top of its own data and information pyramid, which includes not only its own description, but the descriptions of its Projects, Stations, Trips, Station Visits, Monitoring Activities, and associated Results.

Organizations also own metadata, or data describing their data. Organizations create lists of Cooperating Organizations and Personnel with whom they work. Organizations have the ability to customize the database to reflect their preferences or usual practices associated with their monitoring activities. The Organization may create a list of the Field and Laboratory Analytical Procedures, or Methods it requires in its monitoring activities to generate Results, or lists and descriptions of sampling equipment, field preservation techniques, or sample collection protocols it commonly uses during these activities.

The ability to customize the database gives the Organization the ability to accurately document not only the sampling result, but the entire process leading to the result; such as:

C Why the monitoring was performed.

C When, where, how, by whom, and with what equipment the sample was collected.

C How the sample was preserved and transported.

C What sample preparation and analytical methods were employed by the laboratory to generate the results.

Stations: Stations/Sites may be created without limit by an Organization. The STORET system promotes the view that a typical Station may be either a point or a study area. If you are describing a study area, note that in addition to a Station's latitude/longitude Point of Record, any number of additional latitude/longitude pairs may be stored with the station, and may be designated to describe its boundary (i.e., Boundary Points to create a polygon) or to describe specific spots within the study area where activities may be conducted (i.e., Sampling Points). In addition, each Station may include the description of any permanent sampling grid (i.e., Grid Origin) or sampling transect line (i.e., Transect Origin, and unlimited Transect Sampling Points). For facility sites, additional location data may be entered for the individual end-of-pipe locations. For well sites, a field of individual wells may be described.

STATIONS MUST BE LINKED TO PROJECTS IF DATA ARE TO BE STORED. This link is a "many-to-many" type, which means that any one Station may be linked to many Projects, and any one Project may be linked to many Stations.

Location is very important to the Environmental Protection Agency (EPA). All monitoring activities must be associated with a Latitude/Longitude location so that samples, field measurements, and observations can be linked to the location they represent.

Stations/Sites may participate in external reference schemes, and may carry identifiers from these schemes. For example, a site in STORET might have a National Pollutant Discharge Elimination System (NPDES) number, and also be assigned a code to represent it within a state regulatory program. In addition, any site which contributes data to a project may be assigned a project-specific identifier to assist project staff in easily identifying it.

Projects: Monitoring activities are organized by Project. The Organization may describe an unlimited number of Projects. Project descriptions are kept in summary form in the STORET database. STORET also has the ability to store a lengthy document providing the Project Description as a single file in Portable Document Format (PDF), Joint Photographic Experts Graphic (JPEG/JPG), Bitmap (BMP), Graphic Interchange Format (GIF), or Text (TXT) format directly in support of the Project. The Project description must include a list of Stations that will be used by the Project. STORET also supports Probability Surveys with an ability to assign a series of probability survey specific attributes to each Station which is assigned to the Survey. Monitoring Activities and their analytical results will be linked directly to all the Projects they support. Projects may in turn be linked to Programs.

Trips & Station Visits: Trips and Station Visits are the high level activities conducted in support of a project. Data collected in the field are associated with specific Station Visits. In STORET, data generated by portable automated data logging devices can be recorded at the Station Visit during which the activity occurs.

Trip descriptions include the names of the Projects to be supported, Station Visits, descriptions of high level Quality Control (QC) samples (e.g., Trip Blanks, Field Spikes), and site and sample level QC samples which are linked directly to their corresponding individual samples.

Each Station Visit becomes an opportunity to conduct field measurements, record observations about the site and the environment during the visit, and to collect samples. STORET provides for the storage of a digital picture (e.g., bitmap) for each Station Visit conducted during the Trip. Individual Stations may be visited more than once during a Trip, and monitoring activities may occur repeatedly during each Visit.

Monitoring Activities & Results: Monitoring Activities performed during a Station Visit are of two basic types:

Samples:

Samples involve the removal of some material to a remote location (e.g. Lab) for analysis, and are described according to the medium sampled, and sample intent. Methods and equipment used to collect samples are fully described, through association to methods and equipment created by the Organization.

Measurements and Observations:

Information gathered in the field through the process of measuring or observing the environment during a Station Visit may be recorded in STORET. These data may include physical conditions of the station itself, status of any equipment permanently located at the station, biological habitat assessments, weather observations, and simple field-determined physical or chemical data.

STORET will accept descriptions of the sample collection process which embody the complete spectrum of water monitoring and sampling of the biological community. For large area samples, such as trawls, details such as the latitude/longitude of Start and End points, time fished, speed over bottom, gear deployment depth, and bottom conditions under the trawl may be recorded.

Samples can be created from other samples by compositing, splitting, or sub-sampling. Each new sample may be linked to its parent(s), so that it can be geo-referenced and traced back to all the events which might influence its results.

There are three types of results in STORET:

- Value: The result of a procedure or direct measurement or observation (e.g., 50 ml/l, 28 deg C, 12 counted).

- Choice List: A selection from a “choice list” for a given Characteristic (e.g., Sex = “Male”, Stream Condition = “Flood Stage”). The result is picked from a list provided by the system for each Characteristic.

- Free Text: A fully textual result. For Characteristics such as “General Observation” the textual result is entered by the user.

Each Result in STORET can be supported with a digital picture (e.g., JPG, BMP). These pictures can supplement result data in innumerable ways such as the physical condition of a catch or environment. How you enter results, and the rules which are applied, depend on the medium sampled, sampling intent, and the kind of characteristic being measured.

Each result is attached to a monitoring activity. If the activity was the collection of a water sample, the results are qualified by all the methods used to collect, handle, store, and process that sample. The results may be further qualified by the identity of the lab performing the analytical work, and equipment and methods used in this process. Statistical information concerning confidence intervals may be supplied, and for results which are not quantified, detection status and quantitation status may be stored. Results which are counts or percentages may be qualified by the range of some size or weight variable which they represent.

Biological results are handled in different ways. For a “catch”, the biota may be grouped and regrouped repeatedly for counting, weighing, or measuring. For example, one grouping might be by taxon, and the counts recorded for purposes of computing taxonomic diversity and richness. Another grouping might be a user-defined histogram or class frequency table of fish lengths within a species, and yet another might be to record counts and weights of only adults or gravid females, or any other category the analyst might need.

Data Loggers and Operating Periods: Devices carrying a probe array which take readings and log data are supported by STORET. Two general methodologies to record data via these devices may be utilized.

Portable Data Loggers - Portable Data Loggers may be carried from Station to Station. Multiple readings for each probe in the array may be taken at each station and captured as a “Data Line”. Each data line may be given an identifier such as a depth interval. Portable Data Loggers are otherwise identical to other types of field measurements.

Automated Data Loggers - Up to now, all results were tied to a Monitoring Activity which in turn were tied to a Station Visit, which was tied to a Trip, which was conducted in support of one or more Projects. In the Fixed Automated Data Recording results area the user creates and describes Fixed Automated Data Logger Installations. Each Installation must take place at a Station described by the Organization. Each Installation may have one to many Operating Periods. Each Operating Period may vary in length. An Operating Period must be assigned to at least one Project. A set of results is generated by the automatic interrogation of an array of probes at a user specified preset interval. Interrogation timing and the composition of the probe array may vary from Operating Period to Operating Period at any one Installation. Alternatively, the results for an entire Operating Period may be stored in a single electronic file (e.g., PDF, TXT).

1.0 ORGANIZATION SUMMARY

1.1 Description

Organization: An Organization is a federal, state, local, academic, commercial, or other group or individual wanting to store ambient water quality or biological monitoring data in STORET. Each copy of STORET (i.e., STORET database) may contain many Organizations. Each Organization describes itself and its monitoring operations by providing information in several specific areas of the system (e.g., Addresses, Programs, Cooperating Organizations, Personnel Information, Roles in Organization, Preferences and Defaults, Stations, Projects/Surveys).

Addresses: An Organization may provide up to three Physical Addresses (i.e., Located at, Mailing, and Shipping) and an unlimited number of Electronic Addresses (e.g., phone numbers, fax numbers, e-mail addresses).

Programs: A Program is an Organization defined theme uniting one to many Projects/Surveys. Program components are Name and Description.

Cooperating Organizations: A Cooperating Organization is an entity of special interest to the Organization such that, it may be associated with the Organizations monitoring operations. Cooperating Organizations receive a Name, Point of Contact, and the complete array of Physical and Electronic Addresses.

Personnel Information: Personnel Information contains identifying information about individuals of importance to the Organizations' business of monitoring. First Name, Last Name, Affiliation, and the complete array of Electronic Addresses are available for each person.

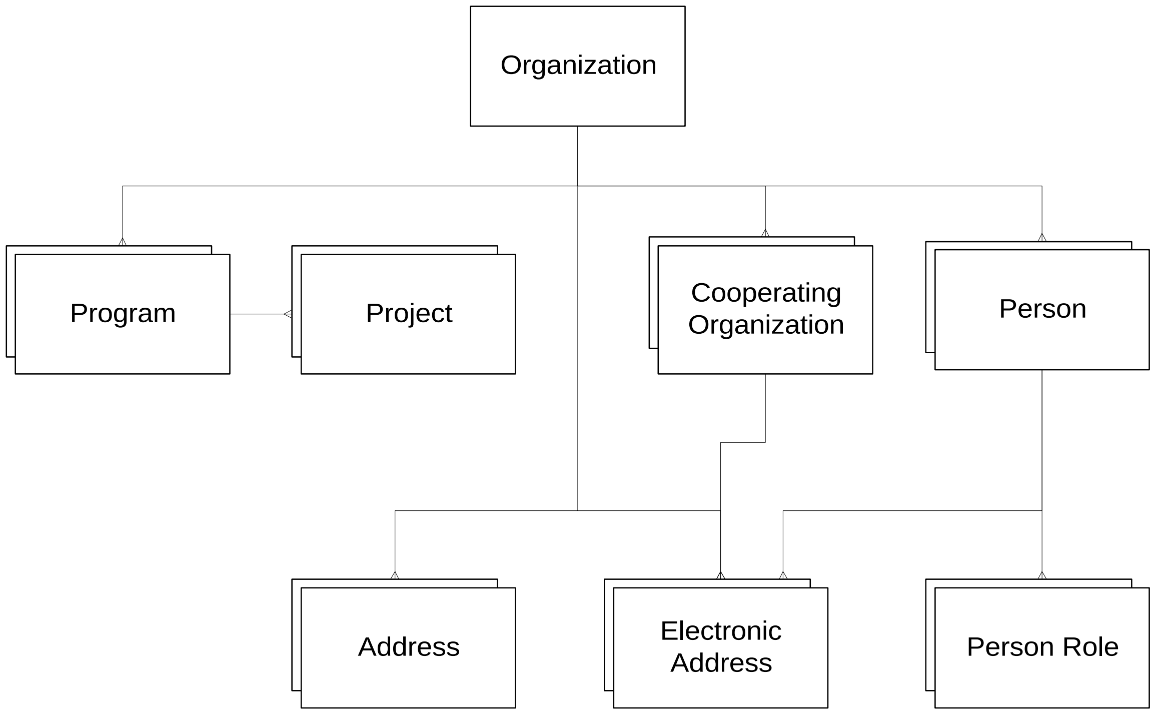
Roles in Organization: Individuals listed above may have Organization Roles assigned to them. Roles such as "Data Administrator" and "Limnologist" convey information about the personnel engaged by the Organization for the operation of environmental monitoring. These individuals may be associated directly with Projects and Monitoring Activities.

Project/Survey: A Project/Survey is a plan for monitoring the environment. A Project/Survey may consist of several descriptive areas:

- Project Description.
- Voucher Specimen Collections.
- Stations on Project.
- Station Roles on Project.
- Programs for Project.
- Cooperation Organizations associated with Project.

- Citations supporting the Project.
- Project Data Summary.
- Document/Graphic supporting the Project Description.

1.2 Functional Diagram



- An Organization may have up to three Physical Addresses.
- An Organization may have one or more Electronic Addresses.
- An Organization may have one or more Programs.
- An Organization may describe one to many Projects.
- A Program may unite one or more Projects.
- An Organization may have one or more Cooperating Organizations.
- A Cooperating Organization may have up to three Physical Addresses.
- A Cooperating Organization may have one or more Electronic Addresses.
- An Organization may have one or more Persons.
- A Person may have one or more Electronic Addresses.
- A Person may have one or more Person Roles assigned.

1.3 Business Rules

1.3.1 Organization

- The system maintains one or more Organizations.
- Users may only change an existing Organization.
- Only the Central Administrator may add or delete Organizations.
- The user must select an Organization before any Organization maintenance functions (e.g., Organization Preferences, Personnel, Projects, Stations, Field Activities, Results) can be performed.
- The user must have modify access to the Organization to make any additions or changes associated with it.
- The list of Organizations is sorted by Organization ID.
- Mandatory fields:
    - Name - The name of the Organization.
    - Type - The type of Organization (e.g., US Government/Local).
- Optional fields:
    - Superfund Site ID - A code assigned by an EPA Superfund Program to identify the site when the Organization ID is used to identify a Superfund site.
    - Description - Additional text describing the Organization.
    - Parent Organization - When applicable, the name of a higher level Organization within which the Organization exists.
- The Organization ID is read-only. All other fields are modifiable.

1.3.1.1 Physical Addresses (Organization)

- An Organization may have up to three physical Addresses, but each Address must be of a different type.
- Mandatory fields:
    - Address Type - Located at, Shipping, and Mailing.
- Optional fields:
    - Effective Date - Date upon which an Address became (or will become) valid, formatted as MM-DD-YYYY.
    - Line 1 - The first line of the Address, which usually denotes the Organization Name.
    - Line 2 - The second line of the Address. This line usually denotes a Mail Routing Code, Post Office (PO) box number, or suite.
    - Line 3 - The third line of the Address, which usually denotes the street address (including street name and type, house/office number, or sector designation).
    - Line 4 - The fourth line of the Address (e.g., city, state, and zip code).
    - Country - The appropriate country: US (United States), CN (Canada), or MX (Mexico).

- Country code is defaulted to “US”.
- All fields are modifiable.
- The list of Physical Addresses is sorted by Type.

1.3.1.2 Electronic Addresses (Organization)

- An Organization may have one or more Electronic Addresses defined.
- Mandatory fields:
  - Address Type - Commercial Network, Fax, Internet, Phone, and Other.
  - Number - The text or codes that are used to specify an Electronic Address for a company or individual.
- Optional field:
  - Comments - Any text that further clarifies the Electronic Address Type.
- All fields are modifiable.
- The list of Electronic Addresses is sorted by Type.

1.3.2 Programs

- An Organization may have one or more Programs defined.
- The list of available Programs is divided into national and organizational.
- The user may not add, change, or delete national Programs.
- The user may add, change, or delete organizational Programs.
- Mandatory fields:
  - Name - The name of the Program. It must be unique within the Organization.
- Optional Fields:
  - Description - Any text that describes the Program.
- The list of Programs is sorted by Program Name.
- All fields are modifiable.

1.3.3 Program Project Assignment

- A Program may have one or more Projects assigned.
- Both national and organizational Programs may have Program Project Assignments.
- Program Project Assignments may be deleted.

1.3.4 Cooperating Organizations

- An Organization may have one or more Cooperating Organizations defined.
- The user may add, change, or delete Cooperating Organizations.
- The list of Cooperating Organizations is sorted by Name.

- Mandatory fields:
    - Name - The name of the Cooperating Organization. It must be unique within the Organization.
- Optional Fields:
    - Point of Contact - The name of the point of contact at the Cooperating Organization. This person should understand the nature of the relationship between the data owning Organization and the Cooperating Organization.
- All fields are modifiable.

1.3.4.1 Physical Addresses (Cooperating Organization)

- A Cooperating Organization may have one to three physical Addresses defined but each Address must be of a different type.
- Mandatory fields:
    - Address Type - Located at, Shipping, and Mailing.
- Optional fields:
    - Effective Date - Date upon which an Address became (or will become) valid, formatted as MM-DD-YYYY.
    - Line 1 - The first line of the Address, which usually denotes the Organization Name.
    - Line 2 - The second line of the Address. This line usually denotes a Mail Routing Code, Post Office (PO) box number, or suite.
    - Line 3 - The third line of the Address, which usually denotes the street address (including street name and type, house/office number, or sector designation).
    - Line 4 - The fourth line of the Address (e.g., city, state, and zip code).
    - Country - The appropriate country: US (United States), CN (Canada), or MX (Mexico).
- The list of Physical Addresses is sorted by Type.
- All fields are modifiable.

1.3.4.2 Electronic Addresses (Cooperating Organization)

- A Cooperating Organization may have one or more electronic addresses defined.
- Mandatory fields:
    - Address Type - Commercial Network, Fax, Internet, Phone, and Other.
    - Number - The text or codes that are used to specify an Electronic Address for a company or individual.
- Optional field:
    - Comments - Any text that further clarifies the Electronic Address type.
- The list of Electronic Addresses is sorted by Type.
- All fields are modifiable.

1.3.5 Personnel

- An Organization may have one or more Persons assigned.
- The user may add or change Personnel.
- Only the System Administrator may delete a Person.
- If the Person has one or more of the following assignments it cannot be changed or deleted:
  - Field Activity.
  - QC Sample.
  - Project.
- Mandatory fields:
  - First Name - The person’s first name.
  - Last Name - The person’s last name.
- The First Name/Last Name combination must be unique within a given Organization.
- Optional Fields:
  - Affiliation - Denotes the person’s employer, which may be the data-owning Organization, a Cooperating Organization, or any other organization.
- The list of Persons are sorted by Last Name, First Name.
- Only “active” Persons (where active_indicator_code = “Y”) are included in the available list.
- Personnel may be suspended or made “inactive”. Suspended Personnel have an active_indicator_code = “N” and are not displayed in the list.
- Only the System Administrator may re-activate a suspended Person.

1.3.5.1 Electronic Addresses (Personnel)

- A Person may have multiple occurrences of each type of electronic address (i.e., Commercial Network, Fax, Internet, Phone, or Other).
- The user may add, change, or delete Electronic Addresses associated with a Person.
- Mandatory fields:
  - Address Type - Commercial Network, Fax, Internet, Phone, and Other.
  - Number - The text or codes that are used to specify an Electronic Address for a company or individual.
- Optional field:
  - Comments - Any text that further clarifies the Electronic Address type.
- The list of Electronic Addresses is sorted by Type.
- All fields are modifiable.

1.3.6 Personnel Roles

- A Person may have one or more Personnel Roles assigned.
- The user may assign (add) or unassign (delete) Personnel Role Assignments from the Organization.
- The user may assign one or more Persons to a selected Role at one time.
- The list of Personnel Role Assignments may be sorted by Role or Last Name. By default, the list is sorted by Last Name.

2.0 ORGANIZATION PREFERENCES AND DEFAULTS SUMMARY

2.1 Description

General: Organizational Preferences describe the operational details of the Organization and provide the bulk of the metadata necessary to describe a monitoring activity in STORET, (e.g., sample containers and preservation methods, field and lab analytical procedures, typical groups of monitored substances, laboratories used, sample collection procedures, quality control procedures, field equipment). Using different procedures during the sample gathering and analytical process impact the acquired result; therefore, capturing the procedures, configurations, and profiles being applied is vital for proper review and interpretation of the result. Furthermore, the creation of these preferences can be a time saver during data entry, and allow for more efficient and extensive metadata documentation of monitoring results.

Field/Lab Analytical Procedures: Field/Lab Analytical Procedures provide methodology guidelines used to obtain a Result. The Organization identifies Field/Lab Procedures (i.e., procedures employed either in the field and/or in the lab which generate numeric values for a chemical and/or field measurement) used to yield results. These procedures may be identified in either of two ways:

- The Organization may record a procedure directly in the database, in which case, Procedure ID, Name, Description, Citation ID, Citation, Equipment, Comparable National Procedure fields are available.

- The Organization may adopt procedures supplied by STORET, in which case all fields are filled automatically. These procedures may be performed in the field or in the lab, no distinction is made. These procedures also define the domain of valid values used to qualify environmental Results.

Sample Collection/Creation Procedure: The Organization identifies Sample Collection and Creation Procedures used to collect or create samples. Each procedure is described by a unique Procedure ID, Name, Gear Type, Description Text, and a Citation clarifying this procedure. These Sample Collection Procedures are available for describing Monitoring Activities.

Gear/Equipment Configurations: The Organization identifies Sample Collection Gear Configurations for each Gear Group associated with Sample Collection Procedures described in the previous section. For example, if a user is employing the Gear Group “Net/horizontal Tow” and the Field Sampling Gear “Otter Trawl”, the user would then be able to describe a configuration for the Otter Trawl which consists of a unique Gear Configuration ID, Configuration Name, and detailed Description of the Trawl itself. The Organization may create as many Otter Trawl Configurations as necessary to cover field operations. These Gear Configurations are available for describing Monitoring Activities.

Sample Preservation, Transport, and Storage: The Organization identifies Sample Preservation, Transport and Storage Profiles specific to its monitoring activities. Each profile includes a unique Profile ID, Profile Name, Container Material/Size, Container Color, Temperature Preservation (e.g., on ice, refrigerated, etc.), and Chemical Preservation and Storage Procedure. These Sample Transport and Storage configurations are available for describing Monitoring Activities.

QC Sample Creation Transport & Storage Defaults: The Organization may create QC Sample Profiles specific to its monitoring activities. The profile provides for the creation of unique Profile ID, QC Sample Type, QC Sample Name, Creation Date/Time, Sample Volume, Container Material/Size, Container Color, and Method and Reagents Used in the QC Sample. Details regarding the Handling, Transport, and Storage of the sample may also be included. These QC Sample Profiles are available for describing Trip QC Samples.

Lab Sample Preparation Procedure: This area is similar to the "Field/Lab Analytical Procedures & Equipment" in that an Organization has the ability to create their own Laboratory Sample Preparation Procedures, and/or adopt system provided procedures. The created and adopted procedures are available when describing the laboratory sample preparation associated with a specific result.

Characteristic Groups & Defaults: The Organization may create Groups of Characteristics which are of repeated interest to the organization (e.g., a group of chemicals examined in every water sample, a group of species usually observed and counted during a kick net sample). These Groups may support specific Projects, River/Streams, Stations, or any other business need. Each Characteristic Group carries a unique Group ID, and each Characteristic within a Group may carry a series of defaults; Row ID, Sample Fraction, Value Unit, Value Type, Weight Basis, Statistic Type, Duration, Temperature, Field/Lab Analytical Procedure, Lab Sample Preparation Procedure, and Acceptable Result Range Low/High. These defaults are carried over and applied to the Result values. Using defaults not only reduce the data entry effort, but help promote greater consistency in the stored data. The Characteristics and/or Defaults in each Group may be modified in the Results area to allow greater flexibility in their use.

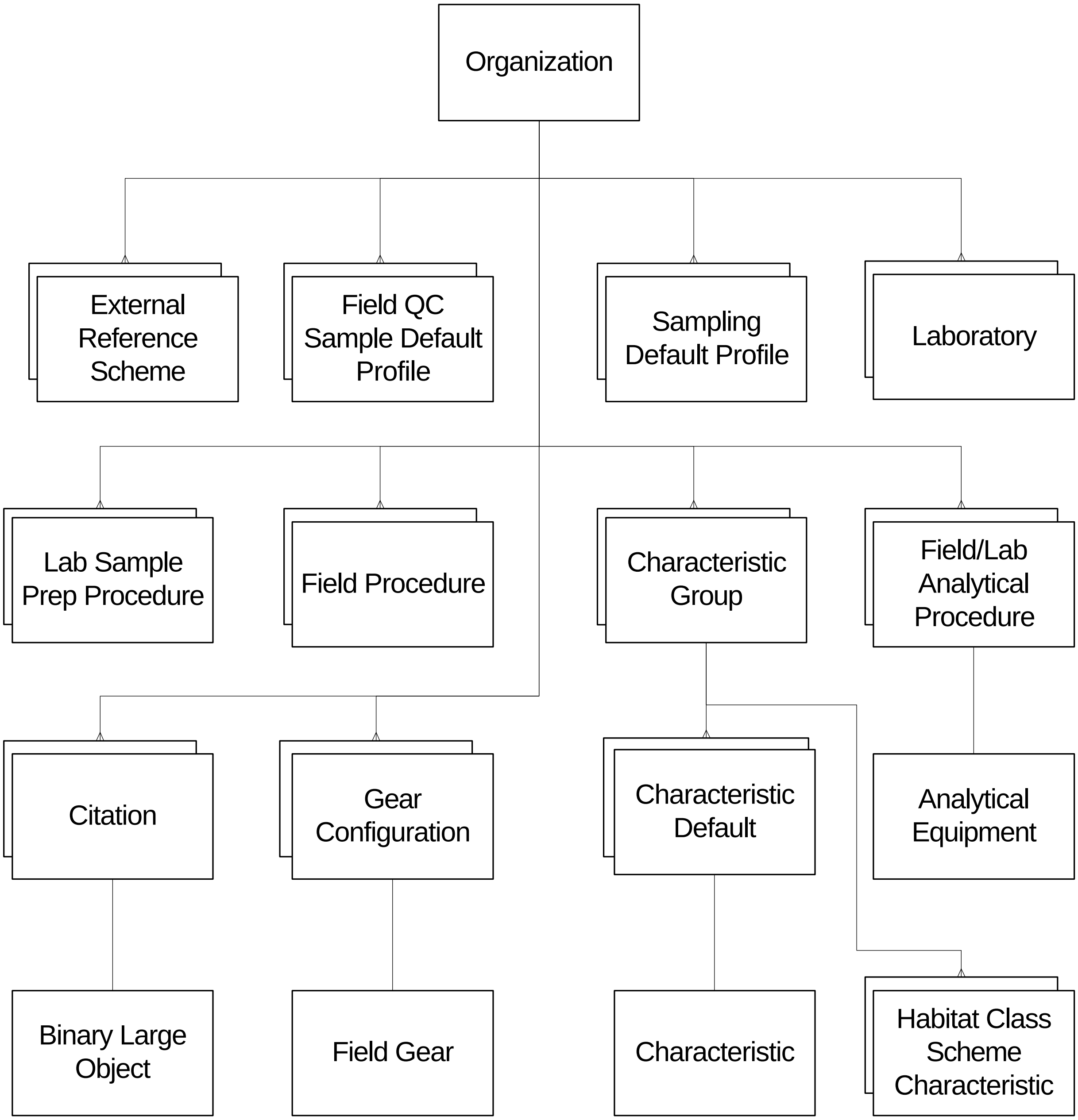
A Characteristic Group may contain the components of a habitat classification system. Such a Group may be composed of either user defined, or system provided characteristics which may be evaluated or scored in the Result area.

Laboratory: If an Organization employs analytical laboratories to perform sample analysis during their operations, they can identify laboratories with laboratory addresses. Each Laboratory description contains: a unique Lab ID, Name, and the full complement of Physical and Electronic Addresses. These laboratories are available for assignment to each result.

Citation: The Organization can use Citations to clarify, support, or provide detail for the metadata it provides the database. The Organization identifies Citations, each with the following: unique Citation ID, Title Name, Author Name, Publishing Organization Name, Publishing Year, reference ID, Volume and Page No., and Comment. The document itself can be stored in the database as a PDF file. Storage of the actual citation documents provide a consolidated and readily available repository of documentation supporting the monitoring activities. The STORET system provides some common citations (e.g., ASTM Methods). Organization entered and STORET provided citations can then be assigned to other areas in STORET (e.g., Field/Lab analytical methods, Project descriptions, Habitat Classification Scheme descriptions, Sample Collection/Creation Procedures).

External Reference Scheme: The Organization may identify its sampling stations by additional names or labels (e.g., United Stated Geological Survey (USGS) station label, project specific station label, labels that might identify the station in other databases). This is performed by creating schemes. Each scheme identifies a station naming methodology. Stations may then be given alternative names for each scheme. These additional names/labels work like aliases, allowing the same station to be given alternative names which may be more familiar to individuals of differing interests.

2.2 Functional Diagram



- An Organization must have one or more Field/Lab Analytical Procedures.
- A Field/Lab Analytical Procedure may have one Analytical Equipment.
- An Organization may have one or more Lab Sample Prep Procedures.
- An Organization may have one or more Citations.

- A Citation may have one Binary Large Object.
- An Organization may have one or more Field Procedures.
- An Organization may have one or more Gear Configurations.
- A Gear Configuration may have one Field Gear.
- An Organization may have one or more Sampling Default Profiles.
- An Organization may have one or more Field QC Sample Default Profiles.
- An Organization may have one or more Characteristic Groups.
- A Characteristic Group may have one or more Characteristic Defaults.
- A Characteristic Default may have one Characteristic assigned.
- A Characteristic Group may have one or more Habitat Class Scheme Characteristics.
- An Organization may have one or more Laboratories.
- An Organization may have one or more Citations.
- An Organization may have one or more External Reference Schemes.

2.3 Business Rules

2.3.1 Field/Lab Analytical Procedures

- An Organization may have one or more Organization-defined Field/Lab Analytical Procedures.
- Mandatory fields:
    - Procedure ID - An ID that is unique within the Organization’s list of Analytical Procedures, which includes both created and adopted procedures.
    - Procedure Name - The full title of the Analytical Procedure.
    - Citation - Assign a Citation to the procedure. The list of available Citations includes national Citations as well as those defined for the current Organization.
    - Owner Type Code - Automatically set to “ORG” for Organization-defined procedures. Set to “NAT” for National Field/Lab Analytical Procedures.
    - Source Name - Automatically set to the current Organization’s Name.
    - Source Acronym - Automatically set to the current Organization’s Organization ID.
- Optional fields:
    - Description - A long description that provides further information about the Field/Lab Analytical Procedure.
    - Equipment - Assign equipment that is used with the Analytical Procedure.
    - Comparable National Procedure - Assign a national Analytical Procedure that is similar to the one being defined.
- All fields except the Procedure ID are modifiable.
- Citations are displayed in a concatenated format (i.e., Author Name, Publication Year, Article or Book Title Name, Journal or Publisher Name, Volume and Page Number).
- An Organization may adopt one or more National Field/Lab Analytical Procedures.

- A procedure may be deleted/unadopted; however, this action is disallowed if a Result exists that uses it.
- A procedure may be suspended. A suspended procedure is not available for use.
- Only the System Administrator may re-activate a suspended procedure.
- The list of Analytical Procedures contains the Organizational and National procedures that are used by the Organization, and is sorted by source (Organizational then National), then alphabetically by Procedure ID and Short Name.
- The list of available National Citations is maintained centrally.
- The list of available National Procedures is maintained centrally.
- The list of available Analytical Equipment is maintained centrally.

2.3.2 Sample Collection/Creation Procedures

- An Organization may have one or more Sample Collection/Creation Procedures.
- Mandatory fields:
  - ID - An ID that is unique within the Organization's list of Sample Collection/Creation Procedures.
  - Name - The name of the sampling procedure, as listed in the reference document.
- Optional fields:
  - Gear Group Name - You may associate a Sample Collection/Creation Procedure with a type of gear that is usually used to extract or produce the sample.
  - Description Text - Any additional text to describe the Sample Collection/Creation Procedure.
  - Citation - Assign a Citation to the procedure. The list of available Citations includes National Citations as well as those defined for the current Organization.
- If a Sample Collection/Creation Procedure has been used in the description of a monitoring activity, it cannot be deleted.
- The list of available Gear Group Names is maintained centrally.
- Citations are displayed in a concatenated format (i.e., Author Name, Publication Year, Article or Book Title Name, Journal or Publisher Name, Volume and Page Number).
- All fields are modifiable.

2.3.3 Gear Configurations

- An Organization may have one or more Gear Configurations.
- Mandatory fields:
  - Gear Group Name - Select a Gear Group Name (i.e., the name of the type or category of Field Sampling Gear [e.g., Water Sampler]).
  - Field Gear ID/Name - Select from a list of Field Sampling Gear that match the chosen Gear Group Name.

  - ID - An ID that is unique within the Field Gear ID/Name.
  - Name - A name that identifies the Gear Configuration.
- Optional fields:
  - Specifications - A description of how the Gear is configured.
- A single piece of Gear may have many configurations.
- If a Gear Configuration has been used in the description of a monitoring activity, it cannot be deleted.
- Gear Group Name and Field Gear have to be selected before a new Gear Configuration is created.
- The list of available Gear Group Names is maintained centrally.
- The list of available Field Sampling Gear is maintained centrally.

2.3.4 Sampling Default Profiles

- An Organization may have one or more Sample Transport and Storage Profiles or Sampling Default Profiles.
- Mandatory fields:
  - ID - A profile ID that is unique within the Organization's list of Sampling Default Profiles.
  - Name - Enter a name for the profile.
- Optional fields:
  - Container Type - Select a default for the style and material of the container that is used to collect and transport the Sample.
  - Container Color - Select the color of the container used to collect and transport the Sample.
  - Container Size/Unit - A default size and unit of measurement for the container that is used to collect and transport Samples.
  - Temperature Preservation Type - Select a default for the type of temperature based physical preservation.
  - Chemical Preservation and Storage Procedure - Describe the chemical preservation and storage procedures employed by the profile.
- For measures and associated units, both must be provided.
- The list of available Container Types is maintained centrally.
- The list of available Container Colors is maintained centrally.
- The list of available Temperature Preservation Types is maintained centrally.

2.3.5 Field QC Sample Default Profiles

- An Organization may have one or more Field QC Sample Default Profiles.
- Mandatory fields:
  - Name - A profile name that is unique within the Organization's list of Field QC Sample Default Profiles.

  - Type - The type of Field QC sample for which this profile is applicable.
- Optional fields:
  - Container Type - Select a default for the style and material of the container that is used to collect and transport the Sample.
  - Container Color - Select the color of the container used to collect and transport the Sample.
  - Container Size/Unit - A default size and unit of measurement for the container that is used to collect and transport Samples.
  - Methods and Reagents Used - Describe the method and reagents used during the Sample creation process.
  - Handling, Transport and Storage Comments - Describe the handling, transport, and storage of the Sample.
- For measures and associated units, both must be provided.
- The list of available Field QC Sample Types is maintained centrally.
- The list of available Container Types is maintained centrally.
- The list of available Container Colors is maintained centrally.

2.3.6 Lab Sample Preparation Procedures

- An Organization may have one or more Organization-defined Lab Sample Preparation Procedures.
- Mandatory fields:
  - Prep ID - An abbreviated name of the procedure. This field provides a user-defined identification label for the procedure. The ID must be unique within the Organization's list of Sample Preparation Procedures.
  - Name - The full title of the preparation procedure.
  - Citation - Assign a Citation to the procedure. The list of available Citations includes National Citations as well as those defined for the current Organization.
  - Owner Type Code - Automatically set to "ORG" for Organization-defined procedures. Set to "NAT" for National Lab Sample Preparation Procedures.
  - Source Name - Automatically set to the current Organization's Name.
  - Source Acronym - Automatically set to the current Organization's Organization ID.
- All fields except the Prep ID are modifiable.
- Citations are displayed in a concatenated format (i.e., Author Name, Publication Year, Article or Book Title Name, Journal or Publisher Name, Volume and Page Number).
- An Organization may adopt one or more National Lab Sample Preparation Procedures.
- A procedure may be deleted/unadopted; however, this action is disallowed if a Result exists that uses it.

- The list of Lab Sample Preparation Procedures contains the Organizational and National Lab Procedures that are used by the Organization, and is sorted by source (Organizational then National), then alphabetically by Prep ID.
- The list of available National Citations is maintained centrally.

2.3.7 Characteristic Groups

- An Organization may have one or more Characteristic Groups.
- Mandatory fields:
  - Group ID - An ID that is unique within the Organization's list of Characteristic Groups.
  - Name - Enter the Organization-defined label for the aggregation of Characteristics.
  - Field Activity - The type of the Field Activity being performed. Distinguishes between Field Samples, Field Measurements and Observations, and Data Loggers.
  - Medium - The name of the medium represented by the Field Activity.
  - Intent - The goal or purpose of a Field Activity whose Medium is Biological. It is mandatory when Medium is Biological, and not permitted for other Mediums.
  - Community - The name of the biological community from which the Sample was taken. This is only valid when Medium is Biological and Intent is Taxon Abundance.
  - Result Group Type - The name of the kind of group. This is only valid when Medium is Biological and Intent is Taxon Abundance. Available types are:
    - Multi-Taxon Population Census – Groups that consist of a list of taxonomic names with an associated "count" for each.
    - Single Taxon Group Summary - Groups where Characteristics are evaluated in "summary form" for all the Subject Taxon Individuals in the group.
    - Single Taxon Individuals - Unlike the Single Taxon Group Summary where Characteristics are evaluated once for all within the group, in these groups, Characteristic(s) are measured for each individual within a group. In other words, the same Characteristics are studied for each individual.
- Optional fields:
  - Habitat Assessment (checkbox) - A Yes/No flag which indicates whether or not this Characteristic Group represents a Habitat Assessment Scheme. The default is "N".
  - Citation - Assign a Citation to the group. The list of available Citations includes National Citations as well as those defined for the current Organization.
  - Description - Any additional text that further describes the aggregation of Characteristics.

- If the group is a Habitat Assessment, the Field Activity type must be “Field Msr/Obs” and Medium is not applicable.
- Habitat Assessment Characteristic Groups can be either System-defined or User-defined to indicate what kind of Characteristics are used.
    - System-defined - Uses pre-defined Characteristics from the system.
    - User-defined - Uses user-defined Characteristics. These Characteristics can function similarly to system-defined Characteristics which present a “choice list”, except the user creates and defines the available Characteristics.

2.3.8 Characteristic Selection

- A Characteristic Group requires the selection of one or more Characteristics. User-defined Habitat Assessment Characteristic Groups, however, do not require Characteristic selection since the Characteristics are uniquely identified.
- Characteristics available for selection are based on the following rules:
    - If the Result Group Type = “Single Taxon Individuals” or “Single Taxon Group Summary”, then only Biological Physical Measures are displayed.
    - If Field Activity = “Data Logger”, then only Physical or Chemical Data-Logger Probes are displayed.
    - If Medium = “Biological”, Intent = “Taxon Abundance”, and Result Group Type = “Multi-Taxon Population Census”, then only taxon Characteristics are displayed (see Taxon Characteristic Selection below).
    - If Medium = “Biological” and Intent is either “Tissue” or “Individual”, then all Characteristics (Taxon and Non-Taxon) are permitted (see Taxon/Non-Taxon Characteristic Selection below).
    - If Medium is not “Biological”, then only Non-Taxon Characteristics are displayed (see Non-Taxon Characteristics Selection below).

2.3.9 Taxon Characteristic Selection

- Characteristics may be searched by Characteristic Taxon Name or Characteristic Alias Name.
- A Kingdom (i.e., a Characteristic with Taxon Rank Code = “KNG”) may be selected to narrow the search of available Taxon Characteristics.
- The default value for Kingdom is “Animalia”.
- For Characteristic Taxon Name searches, the Characteristic name or first few letters, numbers, or characters of the Characteristic name must be entered.
- For Characteristic Alias Name searches, an Alias Type (e.g., Taxon Common Name) must be specified followed by the Alias Name or first few letters, numbers, or characters of the Alias Name.
- Only Taxon Alias Types are displayed (i.e., Alias Type Category = “T”).

- After a valid search criteria is entered, an “is like” search is performed based on the entered search criteria and the Characteristics that meet that criteria are displayed.
- Display the Characteristics in alphabetical order of Display Name or Characteristic Alias Name, depending on which search method is used.
- The list of available Characteristics is maintained centrally.
- The list of available Characteristic Aliases is maintained centrally.
- The list of available Characteristic Alias Types is maintained centrally.

2.3.10 Taxon/Non-Taxon Characteristic Selection

- Characteristics can be searched by Characteristic Display Name or Characteristic Alias Name.
- Taxon and Non-Taxon Characteristics may not be displayed at the same time. Before a search can be performed, the user must choose which type of Characteristics to display (i.e., “Show Taxon Names” or “Show Substances/Physical Measures”). The default value is “Show Substances/Physical Measures”.
- “Show Taxon Names” will display Characteristics whose Alias Type Category = “T” (taxon).
- “Show Substances/Physical Measures” will display Characteristics whose Alias Type Category = “NT” (non-taxon).
- If “Show Taxon Names” is chosen, the Kingdom (i.e., a Characteristic with Taxon Rank Code = “KNG”) must be specified to narrow the search of available Taxon Characteristics.
- The default value for Kingdom is “Animalia”.
- For Characteristic Display Name searches, the Characteristic Name or first few letters, numbers, or characters of the Characteristic Name must be entered.
- For Characteristic Alias Name searches, an Alias Type (e.g., Taxon Common Name) must be specified followed by the Alias Name or first few letters, numbers, or characters of the Alias Name.
- The available Alias Types will always correspond to the chosen Alias Type Category (i.e., T or NT).
- After a valid search criteria is entered, an “is like” search is performed based on the entered search criteria and the Characteristics that meet that criteria are displayed.
- Display the characteristics in alphabetical order of Display Name or Characteristic Alias Name, depending on which search method is used.
- The list of available Characteristics is maintained centrally.
- The list of available Characteristic Aliases is maintained centrally.
- The list of available Characteristic Alias Types is maintained centrally.

2.3.11 Non-Taxon Characteristic Selection

- Characteristics can be searched by Characteristic Display Name or Characteristic Alias Name.
- Kingdom selection is not applicable for Non-Taxon Characteristic selection.
- For Characteristic Display Name searches, the Characteristic Name or first few letters, numbers, or characters of the Characteristic Name must be entered.
- For Characteristic Alias Name searches, an Alias Type (e.g., Chemical Abstract Service (CAS) Number) must be specified followed by the Alias Name or first few letters, numbers, or characters of the Alias Name.
- Only Non-Taxon Alias Types are displayed (i.e., Alias Type Category = “NT”).
- After a valid search criteria is entered, an “is like” search is performed based on the entered search criteria and the Characteristics that meet that criteria are displayed.
- Display the Characteristics in alphabetical order of Display Name or Characteristic Alias Name, depending on which search method is used.
- The list of available Characteristics is maintained centrally.
- The list of available Characteristic Aliases is maintained centrally.
- The list of available Characteristic Alias Types is maintained centrally.

2.3.12 Characteristic Char Group Assignment

- A Characteristic Group (i.e., Char Group) may have one or more Characteristic Char Group Assignments.
- Each Characteristic Char Group Assignment has one Characteristic Default and one Characteristic assigned.
- When a Characteristic is selected, a Characteristic Char Group Assignment is created for the selected Characteristic.
- The sequence order of Characteristic Char Group Assignments can be modified by the user. Cut/Copy/Paste is allowed.
- Characteristic Char Group Assignments may be added or deleted at any time.
- When a Characteristic Char Group Assignment is deleted, its Characteristic Default (if exists) is deleted.

2.3.13 Characteristic Defaults

- A Characteristic Group may have one or more Characteristic Defaults.
- A Characteristic Default is associated with one Characteristic Char Group Assignment and one Characteristic.
- A Characteristic Default must have a “complete” description to participate in Batch data entry.
- A Characteristic Default may be one of the following types: Physical, Chemical, Taxon, Permitted Value (PV), or Text.

2.3.13.1 Physical Characteristic Defaults

- A Characteristic Group may contain one or more Physical Characteristic Defaults.
- A Physical Characteristic Default is applicable for Characteristics with a Data Entry Screen Type Code = “PHYS”.
- There are no mandatory fields.
- “Complete” description (for batch data entry):
    - Row ID - The user-defined code that uniquely identifies the Characteristic Default within the Characteristic Group.
    - Result Units - A unit of measure for the Characteristic Result.
    - Field/Lab Analytical Procedure - Associate the default with a procedure from the Organization’s list of Field/Lab Analytical Procedures. This list includes both “created” and “adopted” procedures. This is mandatory for “completeness” only if the Characteristic requires it (i.e., Characteristic Procedure Required Indicator Code = “Y”).
- Optional fields:
    - Value Type - The term that represents the process that is used in determining the value for the Characteristic Result. This entry defaults to “Actual”.
    - Weight Basis - Select a Weight Basis for the Characteristic Result. This entry is defaulted to “Blank”. Weight Basis identifies the form of the Sample (or portion of the Sample) that is associated with the Result Value.
    - Statistic Type - Select the statistic or calculation type that best describes how the Result is reported.
    - Duration Basis - Select a Duration Basis for the Characteristic Result. This field defaults to “Blank”. Duration Basis refers to the period of time over which a measurement was made.
    - Temperature Basis - Select a Temperature Basis for the Characteristic Result. The field defaults to “Blank”. Temperature Basis refers to the controlled temperature at which the Sample was maintained during analysis.
    - Particle Size Basis - When the Characteristic is one of several substrate descriptors, this field defines a user-specified (free text) sediment size class.
    - Lower Acceptable Result Range - Represents the lower boundary value of the Result. Values stored below this limit cause warning messages to appear during data entry.
    - Upper Acceptable Result Range - Represents the upper boundary value of the Result. Values stored above this limit cause warning messages to appear during data entry.
    - Lab Sample Preparation Procedure - Associate the default with a procedure from the Organization’s list of Lab Sample Preparation Procedures. This list includes both “created” and “adopted” procedures.
- Statistic Type is disabled if the Characteristic Group’s Medium = “Biological”, Intent = “Taxon Abundance”, and Result Group Type = “Single Taxon Individual”.

- Upper Acceptable Result Range must be greater than or equal to the Lower Acceptable Result Range.
- Negative numbers are allowed for Physical Upper and Lower Acceptable Result Ranges.
- The units value for the Lower and Upper Acceptable Result Ranges is automatically carried from the Result Units.

2.3.13.2 Chemical Characteristic Defaults

- A Characteristic Group may contain one or more Chemical Characteristic Defaults.
- A Chemical Characteristic Default is applicable for Characteristics with a Data Entry Screen Type Code = “CHEM”.
- A Chemical Characteristic Default is applicable for Characteristics with a Data Entry Screen Type Code = “VAR” when the Characteristic Group’s Medium is not Biological.
- There are no mandatory fields.
- “Complete” description (for batch data entry):
    - Row ID - The user-defined code that uniquely identifies the Characteristic Default within the Characteristic Group.
    - Result Units - A unit of measure for the Characteristic Result.
    - Field/Lab Analytical Procedure - Associate the default with a procedure from the Organization’s list of Field/Lab Analytical Procedures. This list includes both “created” and “adopted” procedures. This is mandatory for “completeness” only if the Characteristic requires it (i.e., Characteristic Procedure Required Indicator Code= “Y”).
- Optional fields:
    - Value Type - The term that represents the process that is used in determining the value for the Characteristic Result. This entry defaults to “Actual”.
    - Sample Fraction Type - Select a Sample Fraction Type for the Characteristic result. For physically-partitioned samples, sample fraction describes the portion of the sample that was associated with the results.
    - Weight Basis - Select a Weight Basis for the Characteristic Result. This entry is defaulted to “Blank”. Weight Basis identifies the form of the Sample (or portion of the Sample) that is associated with the Result value.
    - Statistic Type - Select the statistic or calculation type that best describes how the Result is reported.
    - Duration Basis - Select a Duration Basis for the Characteristic Result. This field defaults to “Blank”. Duration Basis refers to the period of time over which a measurement was made.
    - Temperature Basis - Select a Temperature Basis for the Characteristic Result. The field defaults to “Blank”. Temperature Basis refers to the controlled temperature at which the Sample was maintained during analysis.

  - Lower Acceptable Result Range - Represents the lower boundary value of the Result. Values stored below this limit cause warning messages to appear during data entry.
  - Upper Acceptable Result Range - Represents the upper boundary value of the Result. Values stored above this limit cause warning messages to appear during data entry.
- Sample Fraction is required for specific Characteristics (i.e., where the Sample Fraction Required Code is “Y”).
- Upper Acceptable Result Range must be greater than or equal to the Lower Acceptable Result Range.
- Negative numbers are not allowed for Chemical Upper and Lower Acceptable Result Ranges.
- The units value for the Lower and Upper Acceptable Result Ranges is automatically carried from the Result Units.

2.3.13.3 Taxon Characteristic Defaults

- A Characteristic Group may contain one or more Taxon Characteristic Defaults.
- A Taxon Characteristic Default is applicable for Characteristics with a Data Entry Screen Type Code = “TAXA”.
- A Taxa Characteristic Default is applicable for Characteristics with a Data Entry Screen Type Code = “VAR” when the Characteristic Group’s Medium is Biological.
- There are no mandatory fields.
- “Complete” description (for batch data entry):
  - Row ID - The user-defined code that uniquely identifies the Characteristic Default within the Characteristic Group.
  - Result Units - A unit of measure for the Characteristic Result.
- Optional fields:
  - Species Number - Required for Subject Taxons that have a taxonomic rank greater than “species”.
  - Value Type - The term that represents the process that is used in determining the value for the Characteristic Result. This entry defaults to “Actual”.
  - Statistic Type - Select the statistic or calculation type that best describes how the Result is reported.
  - Taxon Pollution Tolerance - A taxon pollution tolerance value for the taxon. Pollution tolerance is a numeric estimate (on a scale from 1 to 10) of the ability of an organism to live in a polluted habitat, where 1 indicates “intolerant” and 10 indicates “very tolerant”.
  - Functional Feeding Group - Provide a Functional Feeding Group for the taxon. Feeding groups describe how an organism obtains food. Examples include “scraper”, “shredder”, “parasite”, etc.

- Trophic Level - Provide a Trophic Level for the taxon. Trophic Level describes where in the food chain an organism normally subsists. Examples include “plant”, “herbivore”, “primary predator”, etc.
- Habit - Provide a Habit for the taxon. Habit is a characteristic form, aspect, or mode of a plant or animal.
- Voltinism - Provide a Voltinism for the taxon. Voltinism is the duration required to complete a life cycle/generation.
- Field/Lab Analytical Procedure - Associate the default with a procedure from the Organization’s list of Field/Lab Analytical Procedures. This list includes both “created” and “adopted” procedures.

2.3.13.4 Text Characteristic Defaults

C A Characteristic Group may contain one or more Text Characteristic Defaults.
C A Text Characteristic Default is applicable for Characteristics with a Data Entry Screen Type Code = “TEXT”.
C There are no mandatory fields.
C “Complete” description (for batch data entry):
  - Row ID - The user-defined code that uniquely identifies the Characteristic Default within the Characteristic Group.

2.3.13.5 Permitted Value (PV) Characteristic Defaults

C A Characteristic Group may contain one or more PV Characteristic Defaults.
C A PV Characteristic Default is applicable for Characteristics with a Data Entry Screen Type Code = “PV”.
C There are no mandatory fields.
C “Complete” description (for batch data entry):
  - Row ID - The user-defined code that uniquely identifies the Characteristic Default within the Characteristic Group.

2.3.13.6 Habitat Class Scheme Characteristics (System-Defined)

C A Habitat Assessment Scheme Characteristic Group may consist of one or more system-defined Characteristics.
C A Habitat Assessment Scheme Characteristic Group may not consist of both system-defined and user-defined Characteristics.
C System-defined Habitat Assessment Scheme Characteristic Groups follow the same rules for Characteristic Default entry (i.e., Chemical, Physical, PV, and Text) as any other non-Biological group.

2.3.13.7 Habitat Class Scheme Characteristics (User-Defined)

C A Habitat Assessment Scheme Characteristic Group may consist of one or more user-defined Habitat Class Scheme Characteristics.

C A Habitat Assessment Scheme Characteristic Group may not consist of both system-defined and user-defined Characteristics.

C Mandatory fields:
  - Characteristic Name - The name of the portion of the Habitat that is being evaluated (e.g., bank erosion, bank stability, stream flow characteristics, cloud cover). The Habitat index is usually included in the Characteristic Description as a method of defining the value.

C "Complete" description (for batch data entry):
  - Row ID - The user-defined code that uniquely identifies the Characteristic within the Characteristic Group.

C Other optional fields:
  - Description - Any additional information to describe the Characteristic being evaluated. Instructions for performing the evaluation, including permitted values, are included in this Description.

C A user-defined Habitat Class Scheme Characteristic can be deleted; however, this action is disallowed if a Result exists that uses it.

2.3.14 Laboratories

C An Organization may have one or more Laboratories.

C Mandatory fields:
  - Lab ID - An ID for the Laboratory that is unique within the Organization's list of Laboratories.
  - Name - The formal title of the Laboratory facility.

C If the Laboratory has Result(s) associated with it, it cannot be deleted.

C All fields are modifiable.

2.3.14.1 Laboratory Physical Addresses

C A Laboratory may have one to three Physical Addresses but each address must be of a different type.

C Mandatory fields:
  - Address Type - Located at, Shipping, and Mailing.

C Optional fields:
  - Effective Date - Date upon which an Address became (or will become) valid, formatted as MM-DD-YYYY.
  - Line 1 - The first line of the Address, which usually denotes the Laboratory name.

- Line 2 - The second line of the Address. This line usually denotes a mail routing code, PO box number, or suite.
- Line 3 - The third line of the Address, which usually denotes the street address (including street name and type, house/office number, or sector designation).
- Line 4 - The fourth line of the Address (e.g., city, state, and zip code).
- Country - The appropriate country: US (United States), CN (Canada), or MX (Mexico).

C Country code is defaulted to “US”.
C All fields are modifiable.
C The list of Physical Addresses is sorted by Type.

2.3.14.2 Laboratory Electronic Addresses

C A Laboratory may have one or more Electronic Addresses.
C Mandatory fields:

- Address Type - Commercial Network, Fax, Internet, Phone, and Other.
- Number - The text or codes that are used to specify an Electronic Address for a company or individual.

C Optional field:

- Comments - Any text that further clarifies the Electronic Address Type.

C All fields are modifiable.
C The list of Electronic Addresses is sorted by Type.

2.3.15 Citations

C An Organization may have one or more Citations.
C Mandatory fields:

- Title Name - The official name of the publication being cited.
- Author Name - The full name(s) of the author(s) of the publication being cited.
- Publishing Organization’s Name - The name of the Organization that issued the publication being cited.
- Publication Year - The copyright year of the publication being cited.
- Volume and Page No. - The specific volume and page numbers, within the literature cited, that apply to data supporting the Citation.
- Organization Type Code - Automatically set to “ORG” for Organization-defined Citations. Set to “NAT” for National Citations.

C Optional fields:

- Citation ID - An ID used by the owning Organization to uniquely identify the Citation.
- Reference ID - An identifier used by the Organization that owns the Citation to identify it within their Organization.
- Comments - Any additional text concerning the Citation.

  - Document/Graphic - A document or graphic file that represents or supports the current Citation. Valid file types are Portable Document Format (PDF), Joint Photographic Experts Graphic (JPEG/JPG), Bitmap (BMP), Graphic Interchange Format (GIF), and Text (TXT).
- Both Citation ID and Title Name must be unique within an Organization.
- An Organization-defined Citation cannot be deleted if it is associated with one or more of the following:
  - Field Sampling Procedure.
  - Field/Lab Analytical Procedure.
  - Lab Sample Preparation Procedure.
  - Characteristic Group.
  - Project.
- The list of Citations includes all National Citations and Organization-defined Citations.
- Citations are displayed in a concatenated format (i.e., Author Name, Publication Year, Article or Book Title Name, Journal or Publisher Name, Volume and Page Number).
- National Citations are maintained centrally.
- All fields are modifiable.

2.3.16 External Reference Schemes

- An Organization may have one or more External Reference Schemes.
- Mandatory fields:
  - Scheme Acronym - Enter the abbreviation or acronym by which this scheme is commonly known. This acronym must be unique within the Organization’s list of External Reference Schemes.
  - Name - The name of the External Reference Scheme that an Organization uses.
- Optional fields:
  - Description - Detailed information about how Stations are numbered or otherwise identified using the stated External Reference Scheme.
- Deletion of an External Reference Scheme is disallowed if it has at least one Reference Label.
- All fields are modifiable.

3.0 PROJECT SUMMARY

3.1 Description

General: A Project or Survey is a plan to monitor the environment. The Organization must describe its Projects. The Organization must associate Monitoring Activities with one or more of its Projects. The Organization must describe Projects for which it has primary responsibility. A Project must have at least one assigned Station. Only Projects with an assigned Station are allowed to participate in "Trips". Projects must participate in "Trips" in order to have Monitoring Activities, Samples and Results assigned to them.

Each Project/Survey consists of several descriptive areas:

- Project Description (with many subdivisions).
- Voucher Specimen Collections.
- Stations on Project.
- Station Roles on Project.
- Programs for Project.
- Cooperation Organizations associated with Project.
- Citations supporting the Project.
- Project Data Summary.
- Document/Graphic supporting the Project Description.

Project Description: Project Description is divided into several subsections; Project Purpose, Project Study Area, Project Design-Sampling Frequency, How/Where to Obtain Complete Plan, Quality Assurance Project Plan Summary, and Measurement Specific Quality Objectives.

Voucher Specimen Collection: A Voucher Specimen is a specimen or material used to define a species. The Voucher Specimen Collection is used by a Project to verify taxonomic identifications. A Voucher Specimen is used as a "standard" against which all other specimens are compared for the purpose of taxonomic identification. For example, the Smithsonian maintains a large collection of Voucher Specimens so that researchers can compare organisms collected in the field to the standard or phenotype of the museum.

Stations on Project: For a Project to participate in a Trip, have a Station Visit, own Monitoring Activities and Results, it must have assigned at least one Station. The Organization must assign Stations to each Project. Only Stations which have been assigned to at least one Project are allowed to participate in Monitoring Activities and Results. After a Station is assigned to a Project, it may further receive a series of qualifiers describing its participation in a Probability Survey (e.g., Station Weight/Units, Stratum, Category, Site

Status, Administration Year, and Comments). A Station may participate in many probability surveys, and receive a different set of qualifiers for each survey.

Station Roles on Project: The Organization may assign roles to each Station associated with the Project (e.g., a Station may be a “Reference” Station for the Project). Any one Station may have many roles for the Project to which it is assigned, and any one Station may have different roles on each Project to which it is assigned.

Personnel/Roles on Project: The Organization may assign people to a Project and at the same time ascribe them a role in the Project (e.g., John Smith will be assigned to the Project and will be the *Project Manager*, and a *Taxonomist* on the Project). If Project Roles are assigned, the Organization must choose people from its list of identified Personnel. A single person may participate in many Projects and hold multiple roles on each.

Programs for Project: The Organization may assign the Project to one or many Programs for which the Organization has primary responsibility.

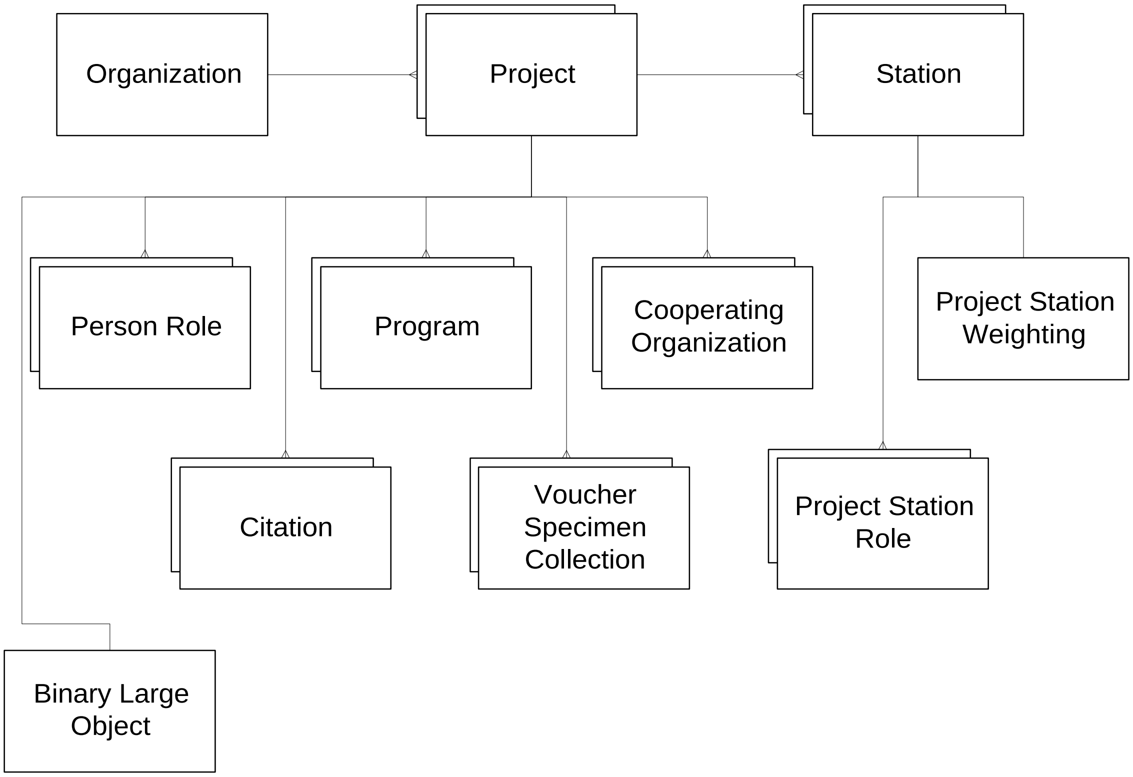
Cooperating Organizations: The Organization may assign Cooperating Organizations to the Project. Cooperating Organization must be chosen from the Organization’s defined list of Cooperating Organizations. Multiple Cooperating Organizations are allowed for each Project.

Citations for Project: The Organization may associate the Project with one or more Citations from the Organization’s defined list of Citations.

Document/Graphic: The Organization may choose to store a Project Plan directly in the database. The system will accept BMP, PDF, GIF, JPG, and TXT files directly for storage. These documents/pictures are stored as Binary Large Objects (BLOBs) in the Oracle database, and may be retrieved for future use.

.

3.2 Functional Diagram



- A Project may have one or more Stations assigned.
- A Project may have one or more Person Roles assigned.
- A Project may have one or more Citations assigned.
- A Project may have one or more Programs assigned.
- A Project may have one or more Cooperating Organizations assigned.
- A Station assigned to a Project may have one or more Project/Station specific Roles assigned.
- A Station assigned to a Project may have one set of Project Station Weighting qualifiers.
- A Project may have one Binary Large Object.

3.3 Business Rules

3.3.1 Projects

- An Organization may have one or more Projects defined.
- Projects cannot span across multiple Organizations.
- The user may add, update, or delete Projects.

- The list of existing Projects for a given Organization are sorted by ascending Project ID.
- Mandatory fields:
    - ID - A code that will identify the Project in the database. This code must be unique within the Organization.
    - Start Date - Date upon which a Project or Survey began.
    - Planned Duration - The expected duration of the Project.
    - Project Name - The name assigned by the owning Organization to the Project or Survey. Project Name must be unique within the Organization.
    - Project Purpose - A summary that describes the purpose of or the hypothesis to be tested by the Project or Survey.
- Optional fields:
    - Project Study Area - A description of the study area within which the Project or Survey is conducted.
    - Project Design/Sampling Frequency - A description of the Project Design and/or Sampling Frequency information.
    - How/Where to Obtain Complete Plan - A description of how a secondary user might get a copy of the complete Project Plan.
    - Quality Assurance (QA) Project Plan Summary - A summary of the Project QA plan.
    - Measurement Specific Quality Objectives - A summary of the quality objectives that are specific to the Project.
    - Document/Graphic - A document or graphic file that represents or supports the current Project. Valid file types are Portable Document Format (PDF), Joint Photographic Experts Graphic (JPEG/JPG), Bitmap (BMP), Graphic Interchange Format (GIF), and Text (TXT).
- All fields are modifiable.
- Date requirements:
    - All date fields must have the following format: MM-DD-YYYY.

3.3.2 Project Voucher Specimen Collection

- A Project may specify one or more Voucher Specimen Collections to be used.
- The user may add, update, or delete Voucher Specimen Collections.
- The list of existing Voucher Specimen Collections for a Project are sorted by ascending Collection Name.
- Mandatory fields:
    - Collection Name - The name of the collection that was used for an initial taxonomic identification or to confirm an identification made in the field or lab. This name must be unique within the Project.

- Optional fields:
  - Description - A description of the Voucher Specimen Collection.
  - Contact Person - The name of the person who will actually make the identification, or the person in charge of the voucher collection.
  - Location - The shipping or mailing address of the location where the specimen is located.
- All fields are modifiable.

3.3.3 Project Station Assignment

- A Project may be assigned at least one sampling Station before it can be used in a Trip or Data Logger activity.
- The list of sampling Stations are those created for the current Organization.
- All Stations available for assignment must be “complete”. A complete Station has:
  - A Station ID.
  - A Station Type.
  - A Point of Record that is designated by a Latitude and Longitude coordinate (i.e., an Absolute Location Point).
  - A Point of Record that is associated with a County/State or Province. Exceptions to this rule are Ocean, Great Lake, and Estuary Stations.
  - For Ocean, Great Lake, or Estuary Stations, a Point of Record that is associated with location descriptor information (i.e., ocean location, great lake location, or estuary location respectively).
- A sampling Station may not be unassigned from a Project if the Station has an activity assigned to the Project, or if the Project has been assigned to a Trip that has a Station Visit created for the sampling Station and this is the only Project supporting that Station Visit.
- A sampling Station may not be unassigned from a Project if the Station is associated with an Automated Data Logger and it has at least one Operating Period that is associated with the Project.

3.3.4 Project Station Weighting

- Project Station Weighting information (one record) can be entered for each Project Station assignment.
- Mandatory fields:
  - Weight - The quantitative or qualitative statistical weight assigned to the Station, describing its relevance to the Project.
  - Weight Unit Code - The unit of the weight entered.
- Optional fields:
  - Stratum - The statistical stratum from which the Station is drawn relevant to its participation in the Project.

  - Category - The statistical category to which the Station is assigned relative to its participation in the Project.
  - Site Status - The status of the Station with respect to the Project.
  - Admin. Year - The administrative year of the Station's participation in the Project.
  - Comments - Additional comments to further describe the design criteria for the inclusion of the Station in the Project.
- All fields are modifiable.

3.3.5 Project Station Roles Assignment

- A sampling Station that has been assigned to a Project may be assigned one or more Roles (e.g., Biological Monitoring, Habitat Evaluation).
- The list of available Station Roles are maintained centrally.
- A Station may be assigned different Roles on different projects.
- The list of assigned Stations and their Roles may be sorted by ascending Station ID or by ascending Role.

3.3.6 Project Personnel Roles Assignment

- No Person may be assigned to a Project without a designated Role on that Project.
- The list of available Person Roles are those created for the current Organization.
- A Person may have one or more Roles on a Project.
- A Person may have a different Role on each Project to which it is assigned.
- The list of assigned Personnel and their Roles may be sorted by ascending Last Name or by ascending Role.

3.3.7 Project Program Assignment

- A Project may have one or more Programs (organizational or national) assigned.
- The list of organizational Programs are those created for the current Organization.
- The list of national Programs are maintained centrally.

3.3.8 Project Cooperating Organization Assignment

- A Project may have one or more Cooperating Organizations assigned.
- The list of available Cooperating Organizations are those created for the current Organization.

3.3.9 Project Citation Assignment

- A Project may have one or more Citations (organizational or national) assigned.

- The list of organizational Citations are those created for the current Organization.
- The list of national Citations is maintained centrally.

3.3.10 Project Data Summary

- A summary list of all monitoring activities (Samples, Measurements/Observations, and Data Logger Operating Periods) that have been assigned to the Project are provided.
- The list of Samples and Measurements/Observations is sorted chronologically by Trip Start Date, Trip Start Time, Station Visit Arrival Date, Station Visit Arrival Time, Field Activity Start Date, and Field Activity Start Time. The list of Data Logger Operating Periods is sorted chronologically by Operating Period Start Date and Start Time.
- The user may perform change or delete actions on the Project Data Summary.
- The user may not perform add actions on the Project Data Summary.
- Delete is not allowed on a Field Activity if it is a Parent of a Composite or Sample from Sample. Only its Results may be deleted in such case.

4.0 STATION SUMMARY

4.1 Definitions

General: A Station is the location of the sample collection, measurement, or observation. A Station may be a single point or an area. The Station may be defined with many latitude/longitude points. All Stations must have at least one latitude/longitude. The first latitude/longitude recorded for a Station is defaulted to the Station's Point of Record. The Point of Record receives the assignment of State/County/Province, Hydrologic Unit Code (HUC), Native American Land, River Reach File version 1 (RF1) Code, Natural Resources Conservation Service (NRCS) code, and Ocean/Estuary/Great Lake designation if applicable.

All Stations must have a Primary and Secondary Station Type. STORET provides valid Primary/Secondary Station Type pairs. All Station Types except Ocean, Estuary, and Great Lake must have a State/County/Province assignment. Primary Station Types of Facility, Well, and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Superfund Site are allowed extensive descriptions of both intake/discharge pipes and well structures.

All Stations except Wells, Facilities, Springs and Caves may have a Permanent Grid and/or Permanent Transect. Permanent Grids require a Grid Origin latitude/longitude. Permanent Transects require a Transect Origin and may have up to 999 Transect Sampling Points.

All Stations may have Physical and Electronic Addresses.

All Stations may have an unlimited number of External Station Labels.

Basic Station Information: The Organization must provide a unique Station ID and Primary and Secondary Station Type. The Organization may provide Station Name, Establishment Date, Water Depth, Station Description, EPA Key Identifier, Ecoregion Name, Travel Directions, Influence Area, and Station location in relationship to the Zone of Initial Dilution (ZID) (this is relevant for Clean Water Act Section 301h dischargers only).

Geographic Areas: The Geographic Area provides the Organization the ability to create Latitude/Longitudes for the Station, associate the Station with a State and County, and record Ocean/Estuary/Great Lake descriptions if applicable. Native American Land, HUC, RF1, and NRCS Watershed Code information may also be stored.

> **Latitude/Longitude:** A Station can be a single point or may be an area described by a series of boundary points. The first Latitude/Longitude defined for a Station is designated by default as its "Point of Record". The "Point of Record" is the location which determines the Station's association with a State, County, USGS HUC, RF1,

Native American Land, Ocean/Estuary/Great Lake if applicable, and NRCS Watershed. A series of “Boundary Points” which must be sequenced may be created to define the Station area. The sequenced points provide a connect-the-dots methodology to determined the boundary of the Station. In addition to the “Point of Record” and “Boundary Points”, the user may enter any number of “Sampling Points” for the Station.

This area also allows for the entry of Station Elevation.

State/County/Province: The database supports two assignments of state/county for each station; a *Primary* and *Secondary*. Based on the latitude and longitude of the station the system will provide candidate States and Counties. The Organization may assign from the candidates, or all State and Counties provided by the STORET system. For all Stations except Ocean, Estuary, and Great Lake, a *Primary* State/County assignment must be made to “Complete” the Station description. Only “Complete” Stations may be assigned to Projects. Only Stations assigned to Projects may store data. For Ocean, Estuary, and Great Lake stations, all State/County assignments are optional.

Ocean/Estuary/Great Lake Stations: When the Station Primary Type is Ocean, Estuary, or Great Lake, the Organization must provide additional location descriptors. For example, an Ocean Station has the following additional descriptors:

- Ocean Name.
- Near Shore/Off Shore indicator.
- Distance to Shore and Reference Point identifier.
- Bottom Topography.
- Loran C readings for the Station.

A Great Lake Station has the following additional descriptors:

- Great Lake Name.
- Additional Location Name (e.g., bay, inlet, river mouth).
- Distance to Shore and Reference Point.

An Estuary Station has the following additional descriptors:

- Name of major estuary system.
- Additional Location Name.
- Distance to Shore and Reference Point.

Native American Land: Based on the State assigned to the Station the system will provide candidate Native American Lands as defined in Federal Information Processing Standard (FIPS) Publication 55-2. For Stations without a State assignment (i.e., Oceans, Great Lakes, Estuaries) the system provides all Native American Lands.

FIPS Hydrologic Unit: Based on Latitude and Longitude of the Point of Record the system will provide a candidate list of USGS eight-digit Hydrologic Unit Codes (HUCs). For Ocean, Estuary, and Great Lake Stations which are not located within HUC boundaries, the system provides all HUCs.

RF1 River Reach: Based on the HUC selected by the user, the system will provide a candidate list of RF1 codes/segments for Station assignment. One RF1 code may be applied to each Station. With the application of the RF1 segment, a River Mile Location and Indicator signifying if the Station is located on the RF1 segment may also be applied.

NRCS Watershed: The Natural Resources Conservation Service Watershed designator inherits its first eight digits from the assigned USGS HUC. Up to eight additional digits may be provided for this descriptor.

Addresses: The Address for Stations is similar to the Addresses section for Organizations. The user has the ability to provide three types of Physical Addresses and an unlimited number of Electronic Addresses for each Station.

External Station ID Schemes: The Organization has the ability to use External Station ID Schemes created by the organization, and provide one label for the Station from each scheme. This ability to provide unlimited “alias” names for a single Station is a very powerful feature. These “aliases” may act as keys into other data systems. For example, a STORET Organization and USGS are sampling at the same Station. The Organization has its ID for the station which differs from the USGS identifier. The Organization creates an External Reference Scheme of “USGS Station IDs” and labels its Station with the corresponding USGS Station ID, thereby creating a key into the USGS database at the Station level.

Facility: For Stations with a Primary Type of Facility, Well, or CERCLA Superfund Site, additional description information may be provided. The Organization may associate the Station with the following:

NAICS:	North American Industrial Classification System (NAICS). The NAICS groups together industries/economic units that use like processes to produce goods or services. The Organization may assign as many codes as apply to the Station.

SIC:	Standard Industrial Classification (SIC). The Organization may assign as many SIC codes as apply to the Station.
Pipes:	The Organization may describe up to 999 pipes for the Station. The Organization may record: Pipe Status, Pipe Treatment, Pipe Flow, Discharge Frequency, Pipe Use, provide a Description, and provide the Receiving Water name for each pipe. In addition, the Organization may provide a latitude/longitude for each pipe.

Wells: For Stations with a Primary Type of Facility, Well, or CERCLA Superfund Site, additional description information may be provided. Any number of wells with associated latitudes and longitudes may be applied to a given Station. These well head locations are in addition to any other Station sampling points. Detailed descriptions of each well including pumping information, well construction, legal entities (e.g., owner, operator), and geologic/lithologic identification may be included with each well.

Spring: For those Stations with a Primary Station Type of Spring, an Organization may describe the following: improvements made to the Spring, Spring Water Flow, Geologic Unit accessed by the Spring, and Lithologic Unit in which the Spring is located. Geologic Units and Lithologic Units are provided by USGS.

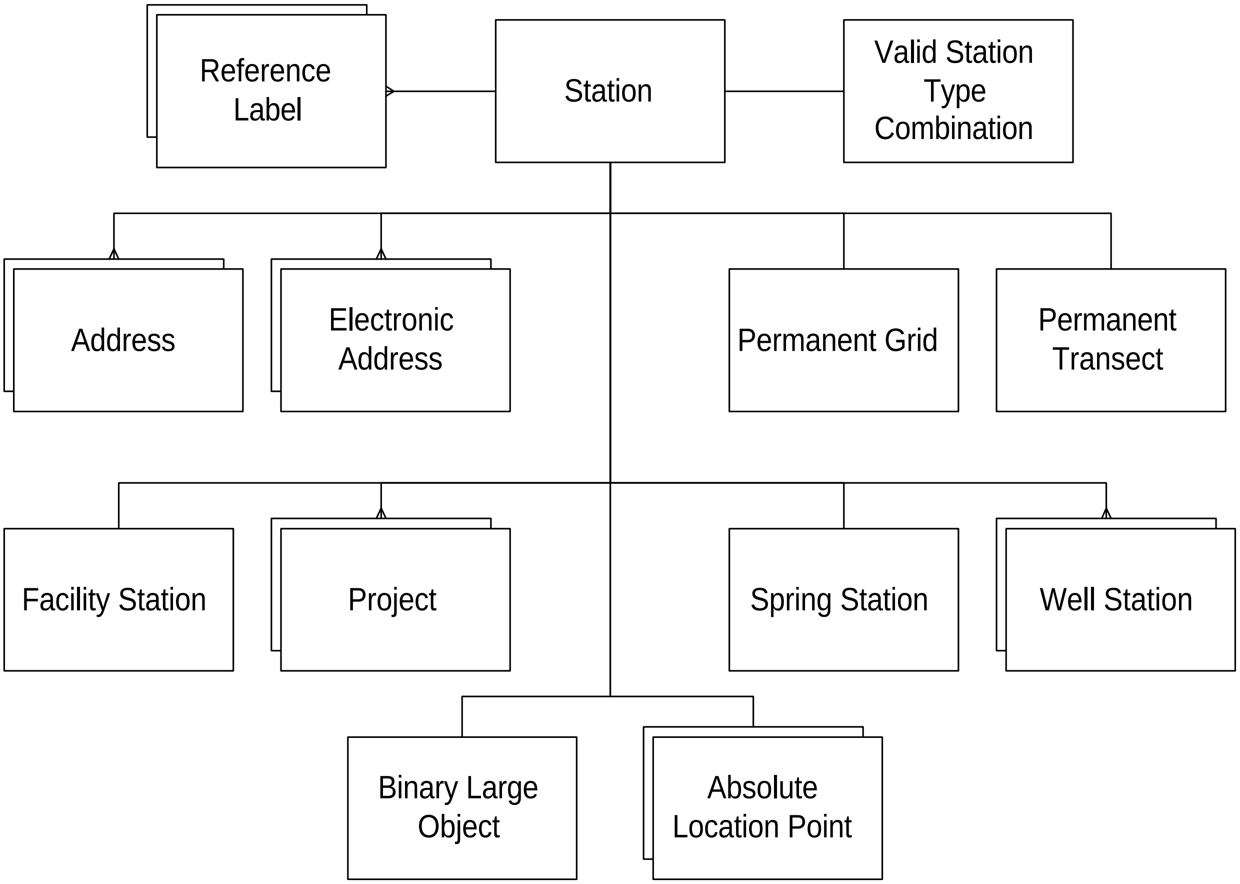
Permanent Grid: Stations except Wells, Facilities, Spring, and Caves may have one Permanent Grid. This grid is different than one which is established at the time of sampling, and not returned to for future sampling. The Permanent Grid is intended to support repeatable sampling activities, and may have physical markers permanently installed to indicate its location and orientation. The Permanent Grid may be used to support random sampling techniques in the defined grid area. A Permanent Grid is described as follows: X-Axis Length, Y-Axis Length, Cell Size, Grid Labeling Scheme, and Grid Description. In addition, the latitude and longitude of the Grid Origin Point may be provided.

Permanent Transect: Station except Wells, Facilities, Spring, and Caves may have one Permanent Transect. Like Permanent Grid, Permanent Transect is meant to be permanently established and to support repeatable field monitoring activities. The Organization may provide the following: Overall Length, Distance Between Points, Transect Labeling Scheme, and Transect Description. In addition, the Organization may provide the latitude and longitude of all Transect Sampling points. The first latitude and longitude entered is defaulted to be the Transect Origin. Additional Transect Sampling Points must have a unique sequence number.

Document/Graphic: The Organization may choose to store a Station support document or picture directly in the database. The system will accept JPG, PDF, BMP, GIF, and TXT files for storage. These documents/pictures are stored as Binary Large Objects in the Oracle database, and may be retrieved for future use.

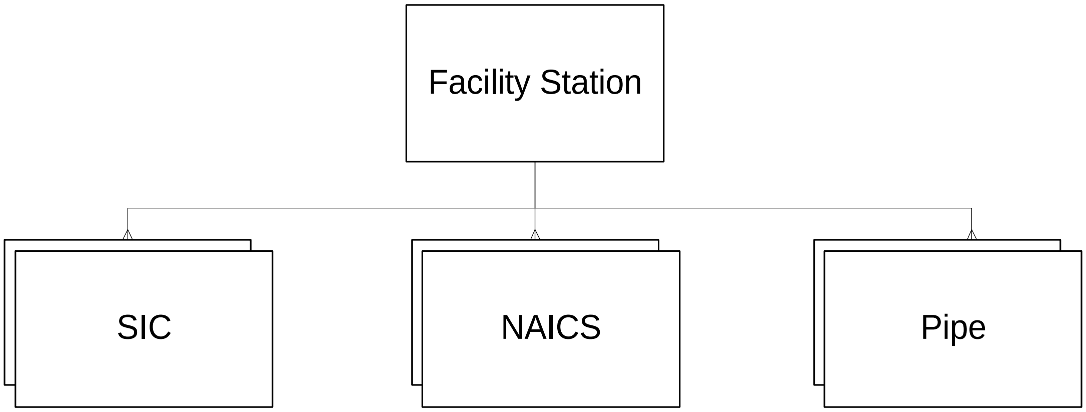
4.2 Functional Diagrams

4.2.1 Station



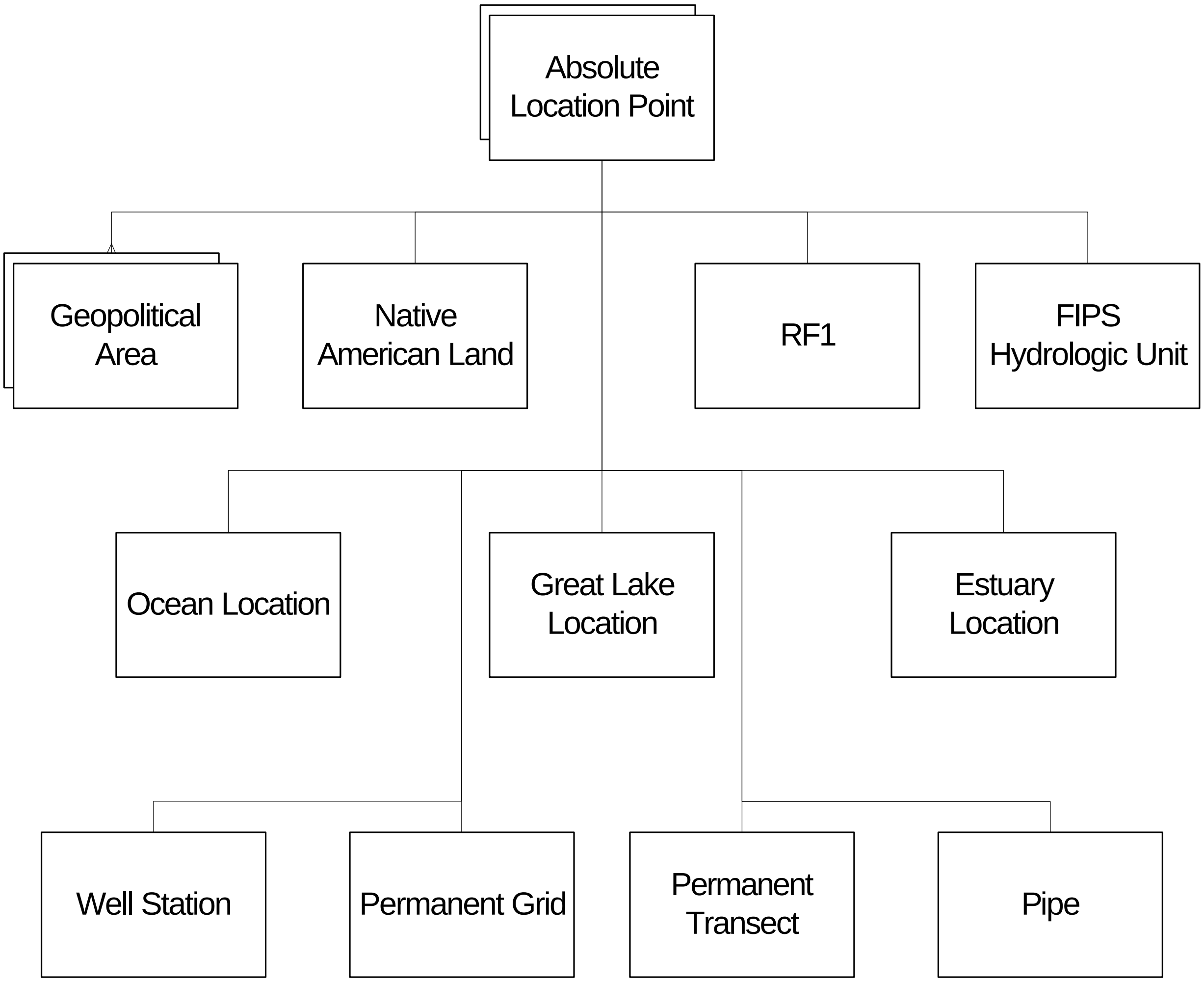
- A Station may have one Valid Station Type Combination.
- A Station may have one or more Reference Labels.
- A Station may have one or more Addresses.
- A Station may have one or more Electronic Addresses.
- A Station may have one Permanent Grid.
- A Station may have one Permanent Transect.
- A Station may have one or more Absolute Location Points.
- A Station may have one or more Projects assigned.
- A Station may have one Spring Station.
- A Station may have one or more Well Stations.
- A Station may have one Facility Station.

4.2.2 Facility



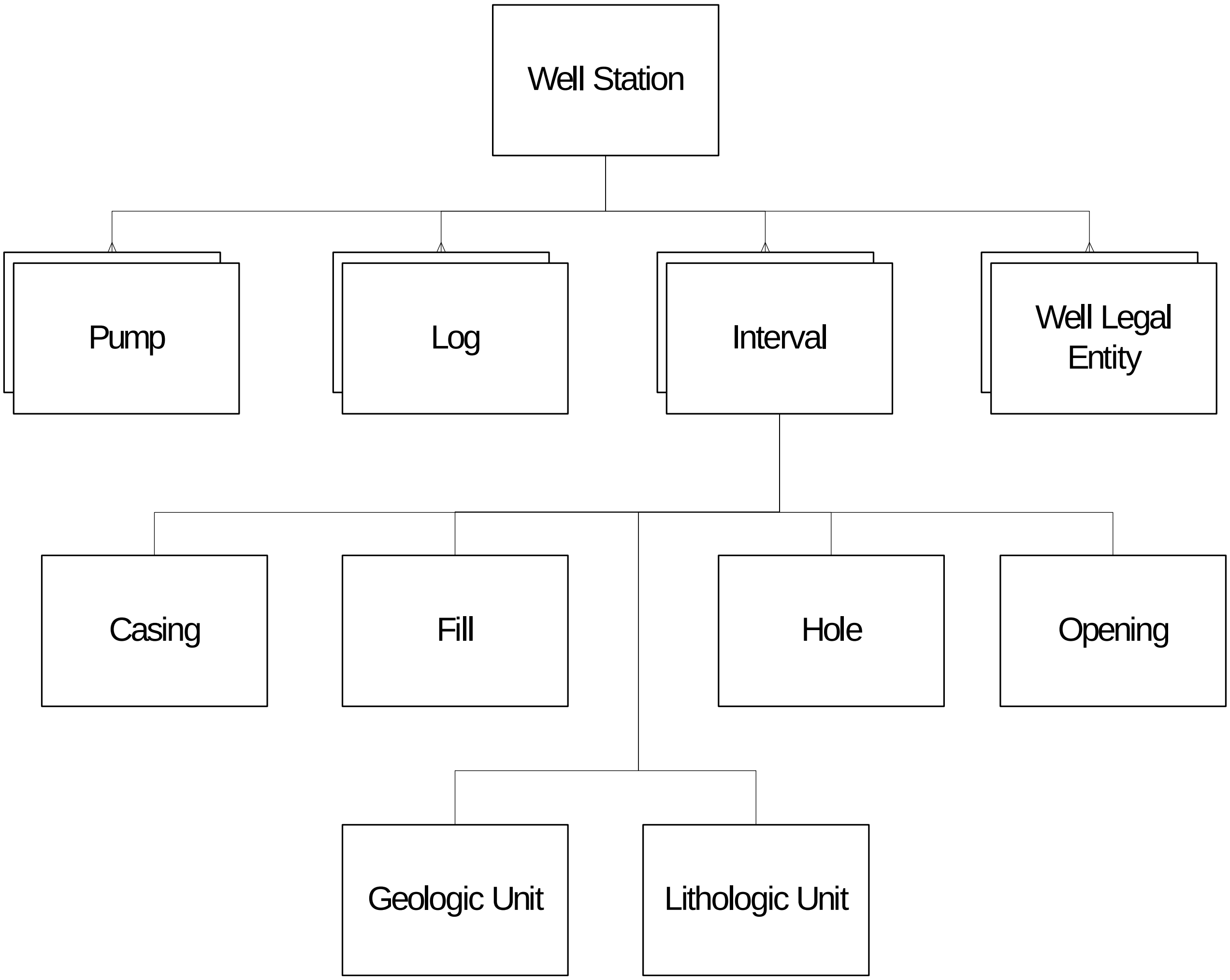
C A Facility Station may have one or more SIC assignments.
C A Facility Station may have one or more NAICS assignments.
C A Facility Station may have one or more Pipes.

4.2.3 Absolute Location Point



- An Absolute Location Point may have one or more Geopolitical Areas assigned.
- An Absolute Location Point may have one Native American Land assigned.
- An Absolute Location Point may have one RF1 assigned.
- An Absolute Location Point may have one FIPS Hydrologic Unit assigned.
- An Absolute Location Point may have one Ocean Location.
- An Absolute Location Point may have one Great Lake Location.
- An Absolute Location Point may have one Estuary Location.
- An Absolute Location Point may have one Well Station.
- An Absolute Location Point may have one Permanent Grid.
- An Absolute Location Point may have one Permanent Transect.
- An Absolute Location Point may have one Pipe.

4.2.4 Well Station



- A Well Station may have one or more Pumps.
- A Well Station may have one or more Logs.
- A Well Station may have one or more Well Legal Entities.
- A Well Station may have one or more Intervals.
- An Interval may have one Casing.
- An Interval may have one Fill.
- An Interval may have one Hole.
- An Interval may have one Opening.
- An Interval may have one Geologic Unit.
- An Interval may have one Lithologic Unit.

4.3 Business Rules

4.3.1 Basic Station Information

- An Organization may have one or more Stations defined.
- A Station may only access station data within its owning Organization.
- The user may add, update, delete, or suspend Stations.
- Deletion of a Station which has monitoring activities assigned to it is not allowed. All monitoring activities that are assigned to a Station must be deleted before that Station can be deleted. However, one may "suspend" a Station that has assigned monitoring activities when this Station will no longer be used to conduct monitoring.
- Once a station has been suspended, it may only be "unsuspended" by the System Administrator.
- Mandatory fields:
  - ID - A code that will identify the Station in the database. This code must be unique within the Organization.
  - Primary Type - The principle designation of the Station (e.g., estuary, ocean, great lake, facility).
  - Secondary type - A further clarification of the Primary Station Type, such as the type of facility Station (e.g., Industrial, Municipal Sewage Publicly Owned Treatment Works (POTW), Municipal Water Supply (PWS)).
- Optional fields:
  - Name - The name by which an Organization refers to a Station.
  - Establishment Date - Date upon which a Station was established.
  - Water Depth and Unit - The total water depth (value and unit) that is typical of the Station, irrespective of tidal stage.
  - Description - The Organization-defined description of the Station.
  - EPA Key Identifier - The US EPA Facility Key Identifier. This ID is assigned by either the State or by US EPA directly.
  - Ecoregion Name - The name of the Ecoregion in which the Station is located.
  - Travel Directions - A description of the route, track, or path used to travel to a Station.
  - Influence Area - Describes the extent of the area that is represented by the selected Station.
  - Zone of Initial Dilution (ZID) Relation - The Station's position in relationship to the Publicly Owned Treatment Works (POTW) outfall.
  - Document/Graphic - A document or graphic file that represents or supports the current Station. Valid file types are Portable Document Format (PDF), Joint Photographic Experts Graphic (JPEG/JPG), Bitmap (BMP), Graphic Interchange Format (GIF), and Text (TXT).
- Date must have MM-DD-YYYY format.

- All fields are modifiable except Primary and Secondary Type when Primary Type is one of the following: Well, Facility, Spring, Ocean, Great Lake, or Estuary.
- If Water Depth Value is entered, then unit must also be entered and vice versa.
- The list of existing Stations for a given Organization are sorted by ascending Station ID.
- The list of available Primary and Secondary Station Types is maintained centrally.

4.3.2 Station Search

- The user may search for Stations by entering search criteria for either the Station ID, Station Name, Primary Type, or FIPS HUC fields in combination with Country, State, and County.

4.3.3 Station Physical Address

- A Station may have one to three Physical Addresses but each Address must be of a different Type.
- Mandatory fields:
  - Address Type - Located at, Shipping, and Mailing.
- Optional fields:
  - Effective Date - Date upon which an address became (or will become) valid.
  - Line 1 - The first line of the Address, which usually denotes the Station Name.
  - Line 2 - The second line of the Address. This line usually denotes a mail routing code, PO box number, or suite.
  - Line 3 - The third line of the Address, which usually denotes the street address (including street name and type, house/office number, or sector designation).
  - Line 4 - The fourth line of the Address (e.g., city, state, and zip code).
  - Country - The appropriate country: US (United States), CN (Canada), or MX (Mexico).
- Country Code is defaulted to “US”.
- All fields are modifiable.
- Date format must be MM-DD-YYYY.

4.3.4 Station Electronic Address

- A Station may have one or more electronic addresses defined.
- Mandatory fields:
  - Address Type - Commercial Network, Fax, Internet, Phone, and Other.
  - Number - The text or codes that are used to specify an Electronic Address for a Station or Individual.
- Optional field:
  - Comments - Any text that further clarifies the Electronic Address Type.

- All fields are modifiable.

4.3.5 "Complete" Stations

- A Station must be "complete" before it may be used by a Project to record environmental monitoring.
- Stations are "complete" when they have the following data:
  - A Station ID.
  - A Station Type.
  - A Point of Record that is designated by a Latitude and Longitude coordinate (i.e., an Absolute Location Point).
  - A Point of Record that is associated with a County/State or Province. Exceptions to this rule are Ocean, Great lake, and Estuary Stations.
  - For Ocean, Great lake, or Estuary Stations, a Point of Record is associated with location descriptor information (i.e., Ocean location, Great Lake location, or Estuary location respectively).

4.3.6 Station Absolute Location

- A "complete" Station may have one Point of Record Absolute Location Point defined.
- A Station may have one or more Sampling or Boundary Points defined.
- The user may add, update, or delete Sampling or Boundary Points.
- The user may add or update a Point of Record (not delete).
- Mandatory fields:
  - Location Type:
    - Point of Record - A single point used to characterize the entire Station. This point determines the primary assignment of State, County, HUC, and Reach for the Station. Each Station may have one and only one Point of Record.
    - Boundary Point - One of a set of points used to describe the perimeter of a Station. A Station may have up to 99 Boundary Points. When connected in sequence, these points form a closed polygon that defines the extent of the Station.
    - Sampling Point - Designates a point at which Samples are collected. A Station may have up to 99 Sampling Points.
  - Latitude/Longitude or Decimal Minute Latitude/Longitude or Decimal Degrees Latitude/Longitude.
  - Latitude/Longitude Direction - North, South, East or West of the equator.
  - Sequence Number - A two-digit number that indicates the sequence of either a Boundary Point or Sampling Point.
  - Geopositioning Method - The method that was used to determine the geographic coordinates for a location point.

  - Geopositioning Datum - The datum information used to determine the accuracy of the ALP (Absolute Location Point) measurement.
- Optional fields:
  - Point Name - A name used to define the Absolute Location Point.
  - Scale - The scale ratio of the Geopositioning Method.
  - Geopositioning Measurement Date - Date upon which a latitude and longitude were determined.
  - Elevation Measure and Unit - The vertical distance (value and unit) from the Absolute Location Point to the reference datum.
  - Elevation Method - The method that was used to determine the elevation of the Absolute Location Point.
  - Elevation Datum - The datum information used to determine the accuracy of the elevation measure.
  - Elevation Measurement Date - Date upon which a elevation measurement or calculation was determined.
- If Latitude/Longitude is changed, then the Decimal Minute Latitude/Longitude and Decimal Degree Latitude/Longitude are automatically calculated and populated.
- If Decimal Minute Latitude/Longitude is changed, then Latitude/Longitude and Decimal Degree Latitude/Longitude are automatically calculated and populated.
- If Decimal Degree Latitude/Longitude is changed, then Latitude/Longitude and Decimal Minute Latitude/Longitude are automatically calculated and populated.
- Elevation information which is conditionally mandatory: Elevation Measure/Unit, Elevation Method, and Elevation Datum. These are all mandatory if at least ONE entry is provided. Otherwise, Elevation information is optional for the Absolute Location.
- Scale is required when the Geopositioning Method is “Interpolation Map”.
- Dates must have MM-DD-YYYY format.
- All fields except the Location Type are modifiable.
- The list of available Methods and Datums is maintained centrally.

4.3.7 State/County/Province Assignment

- A “complete” Station must have a Primary State/County assigned. Exceptions to this rule are Ocean, Great Lake, and Estuary Stations where only the Point of Record and location information are required.
- A Station may have a Secondary State/County Assignment.
- The selected primary/secondary state/county is associated with the Station’s Point of Record.
- State selection is mandatory for Primary and Secondary Assignments.
- County selection is optional. If no County is selected, the County is defaulted to “Not Applicable”.
- The list of available States/Counties/Provinces is maintained centrally.

4.3.8 Ocean Location

- An Ocean Station may have one Ocean Location.
- Ocean Stations are "complete" once a valid Point of Record and Ocean Location is created.
- The Ocean Location is associated with the Station's Point of Record.
- Mandatory fields:
  - Ocean Location Name - The name of the ocean where the Station is located.
  - Shore Relation - Indicates whether the Station is near shore (within 12 miles from shore) or off shore.
- Optional fields:
  - Loran C Reading 1 - The first Loran C instrument reading.
  - Loran C Reading 2 - The second Loran C instrument reading.
  - Bottom Topography - Text that describes the material and form of the bottom that is associated with an ocean-monitoring site.
  - Additional Location Name - Text that gives further information concerning the region of the Ocean in which the Station is located.
  - Distance to Shore/Unit - The distance (value and unit) from the Station to a Reference Point located on or near the shore.
  - Reference Point **-** The name or description of the Reference Point (located on or near the shore) from which the distance to the Station was measured.
- If a Distance to Shore value is entered, then a unit must be provided, and vice versa.
- All fields are modifiable.

4.3.9 Estuary Location

- An Estuary Station may have one Estuary Location.
- Estuary Stations are "complete" once a valid Point of Record and Estuary Location is created.
- The Estuary Location is associated with the Station's Point of Record.
- Mandatory fields:
  - Country - The country where the estuary is located.
  - State - The State or Province within which the estuary is located.
  - Primary Estuary - The primary estuary with which a Station is associated.
- Optional fields:
  - Secondary Estuary - The secondary estuary with which a Station is associated.
  - Other Estuary - Any other or local name for the estuary.
  - Additional Location Name - Text that gives further information concerning the region of the Estuary in which the Station is located.
  - Distance to Shore/Unit.
  - Reference Point.
- The list of estuaries is maintained centrally.

- If a Distance to Shore value is entered, then a unit must be provided, and vice versa.
- All fields are modifiable.

4.3.10 Great Lake Location

- A Great Lake Station may have one Great Lake Location.
- Great Lake Stations are "complete" once a valid Point of Record and Great Lake Location is created.
- The Great Lake Location is associated with the Station's Point of Record.
- Mandatory fields:
  - Great Lake Location Name - One of the five fresh water lakes of Central North America on either side of the US-Canadian boundary where the Station is located.
- Optional fields:
  - Additional Location Name - Text that gives further information concerning the region of the Great Lake in which the Station is located.
  - Distance to Shore/Unit.
  - Reference Point.
- If a Distance to Shore value is entered, then a unit must be provided, and vice versa.
- All fields are modifiable.

4.3.11 Native American Land

- A Station may have one Native American Land identifier assigned to it.
- The selected Native American Land is associated with the Station's Point of Record.
- The list of available Native American Lands is maintained centrally.

4.3.12 FIPS HUC

- A Station may have one FIPS HUC assigned to it.
- The selected FIPS HUC is associated with the Station's Point of Record.
- Deletion of a Station's FIPS HUC results in the deletion of its River Reach File version 1 (RF1) and National Resource Conservation Service (NRCS) Watershed information.
- The list of available FIPS HUCs is maintained centrally.

4.3.13 National Hydrography Dataset

- Informational text about National Hydrography Dataset can only be accessed if the Station has a FIPS HUC assignment.

4.3.14 NRCS Watershed

- A Station may have one NRCS Watershed ID assigned to it.
- The NRCS Watershed ID is part of the Station's Point of Record.
- The NRCS Watershed ID can be assigned to a Station only if the Station has a FIPS HUC assignment.
- Optional field:
    - NRCS Watershed ID - The NRCS Watershed ID for the station description.
- The NRCS Watershed ID field is modifiable.

4.3.15 RF1 Assignment

- A Station may have one RF1 assigned to it.
- The selected RF1 is associated with the Station's Point of Record.
- RF1 may be assigned to a Station only if the Station has a FIPS HUC assignment.
- Station Location value cannot exceed the Reach Length mileage measure.
- Optional fields:
    - Station Location - The station location in miles from the downstream end of the selected reach segment.
    - On River Reach - An indicator used to show if the Station is located on the selected RF1 segment.
- The list of available RF1 segment IDs and names is maintained centrally.
- All fields are modifiable.

4.3.16 External Station ID Schemes Assignment

- An Organization may have one or more External Reference Schemes (ERS). An ERS is a scheme, method, or plan that creates alternate references or provides supplemental information to identify or reference Stations.
- An ERS may have one or more Reference Labels.
- A Station may have one or more Reference Labels.
- Mandatory fields:
    - Label - Label that provides the identifier for a Station in a specific ERS (e.g., National Pollutant Discharge Elimination System (NPDES) permit number).
- Reference Labels must be unique within an ERS.
- The Label field is modifiable.

4.3.17 Facility

- Facility information applies to "Facility" and "Well" Station Types.
- A Facility or Well Station can have one Facility.
- The Facility is created automatically whenever a Facility or Well Station is created.

4.3.17.1 Facility SIC Assignment

- A Facility may have one or more SIC codes assigned.
- If a search function is provided, then the Available SIC codes will be sorted by SIC Code or Name depending upon which criteria is picked.
- The list of available SICs is maintained centrally.

4.3.17.2 Facility NAICS Assignment

- A Facility may have one or more NAICS codes assigned.
- If a search function is provided, then the Available NAICS codes will be sorted by NAICS Code or Title depending upon which criteria is selected.
- The list of available NAICS codes is maintained centrally.

4.3.17.3 Pipes

- A Facility may have one or more Pipes.
- Mandatory fields:
  - Pipe Number - A code that uniquely identifies the Pipe within the Facility.
  - Status - The status of the Pipe (i.e., Active, Inactive, Abandoned, Unknown).
  - Treatment - The name describing the treatment status of the discharge or intake flowing through the Pipe.
  - Flow Type - A description of the Pipe flow.
- Optional fields:
  - Discharge Frequency - The frequency of the Pipe’s discharge.
  - Pipe Use - The purpose or use of the Pipe by the Facility (e.g., Storm Water Runoff, Sanitary Sewer).
  - Description - Text that describes the physical features of the Pipe or its intake/outfall qualities.
  - Receiving Water - The name or other descriptive information about the body of water receiving the discharge or acting as the source of an intake Pipe.
  - Subsurface Discharge - Indicates that either part or all of the discharge is subsurface.
- All fields are modifiable.
- The list of Pipes is sorted in ascending Pipe Number order.

4.3.17.4 Pipe Absolute Location

- A Pipe may have one “End of Pipe” Absolute Location Point.
- When a new Pipe is added, an “End of Pipe” Absolute Location Point is created and all values is defaulted to the Station’s Point of Record. The Point Type is set to “End of Pipe”.

- Mandatory fields:
  - Latitude/Longitude or Decimal Minute Latitude/Longitude or Decimal Degree Latitude/Longitude.
  - Method.
  - Datum.
- Optional fields:
  - Point Name.
  - Scale.
  - Measurement Date.
- If Latitude/Longitude is changed, then the Decimal Minute Latitude/Longitude and Decimal Degree Latitude/Longitude are automatically calculated and populated.
- If Decimal Minute Latitude/Longitude is changed, then Latitude/Longitude and Decimal Degree Latitude/Longitude are automatically calculated and populated.
- If Decimal Degree Latitude/Longitude is changed, then Latitude/Longitude and Decimal Minute Latitude/Longitude are automatically calculated and populated.
- Scale is required when the Geopositioning Method is “Interpolation Map”.
- Date format must be MM-DD-YYYY.
- All fields except the Location Type are modifiable.

4.3.18 Wells

- A Facility/Well Station may have one or more Wells.
- Mandatory fields:
  - Well Number - A code that identifies the Well within the Station. It must be a unique ID within the Station.
  - Well Name - The name of the Well.
  - Status - The code (either “Active” or “Abandoned”) that describes the status of the Well.
  - Well Use - The code that describes the use of the Well, which is not to be confused with the use of the water from the Well.
- Optional fields:
  - Water Primary Use - The code that represents the main use of the water from the Well.
  - Construction Method - The code that identifies the method used to create the borehole in which the Well was constructed.
  - Construction Start Date - Date upon which the bore hole excavation began.
  - Construction End Date - Date upon which the construction was completed on the Well or bore hole.
  - Gradient - Field that describes the relation of the Well to the topography surrounding a source of contamination. This field is used for wells whose Well Use is for monitoring a known source of potential ground water contamination.

  - Development Method - A code that identifies the method by which the Well was brought into production (i.e., how the Well was developed after it was constructed).
  - Initial Pumping Duration/Unit - The duration of initial pumping that occurs at the Well or borehole at the end of construction, prior to production.
  - Initial Pumping Rate/Unit - The initial pumping rate measurement.
  - Initial Bore Hole Diameter/Unit - The surface measure of the bore hole diameter.
  - Casing Height Measure/Unit - The measure that indicates the height of the well head.
  - Depth at Completion from Ground Surface/Unit - The measure indicating the total depth of the Well upon completion of construction.
  - Depth of Hole from Ground Surface/Unit - The measure of the bore hole depth prior to Well construction.
  - Depth to Bedrock/Unit - The depth at which the Well intercepts the bedrock.
  - Depth of Unconsolidated Material/Unit - The depth of unconsolidated material through which the Well is drilled or bored.
  - Natural Flow - Indicates if flow from the well is natural (i.e., it is unassisted by man-made devices).
  - Disinfected - Indicates if well was disinfected at the time of completion.

C If any measure value is entered, then a corresponding unit must be provided, and vice versa.

C All fields are modifiable.

C The list of Wells is sorted in ascending Well Number order.

4.3.18.1 Well Absolute Location

C A Well may have one “Well Head” Absolute Location Point.

C When a new Well is added, a “Well Head” Absolute Location Point is created and all values are defaulted to the Station’s Point of Record. The Point Type is set to “Well Head”.

C Mandatory fields:
  - Latitude/Longitude or Decimal Minute Latitude/Longitude or Decimal Degree Latitude/Longitude.
  - Method.
  - Datum.

C Optional fields:
  - Point Name.
  - Scale.
  - Measurement Date.

C The Point Type of a Well Absolute Location is set to “Well Head”.

- If Latitude/Longitude is changed, then the Decimal Minute Latitude/Longitude and Decimal Degree Latitude/Longitude are automatically calculated and populated.
- If Decimal Minute Latitude/Longitude is changed, then Latitude/Longitude and Decimal Degree Latitude/Longitude are automatically calculated and populated.
- If Decimal Degree Latitude/Longitude is changed, then Latitude/Longitude and Decimal Minute Latitude/Longitude are automatically calculated and populated.
- Scale is required when the Geopositioning Method is “Interpolation Map”.
- Date format must be MM-DD-YYYY.
- All fields except the location type are modifiable.

4.3.18.2 Well Legal Entities

- A Well may have one or more Well Legal Entities.
- The list of Well Legal Entities is sorted by Well Legal Entity Type.
- For a given Well, there can only be one of each Legal Entity Type.
- Mandatory fields:
  - Legal Entity Type - The nature of the interest held in the Well by a Person or Organization. Valid types are: Driller, Operator, and Owner.
  - Legal Entity Name - The name of the Person or Organization with specific interest in the Well.
- Only the Well Legal Entity Name is modifiable.

4.3.18.3 Well Legal Entities Address

- A Well Legal Entity may have up to three Well Legal Entity Addresses.
- For a given Well Legal Entity, there may only be one of each Type.
- Mandatory fields:
  - Type Code - Valid Address Types are: Located at, Shipping, and Mailing.
- Optional fields:
  - Line 1.
  - Line 2.
  - Line 3.
  - Line 4.
  - Country.
  - Effective Date.
- Country Code is defaulted to “US”.
- All fields are modifiable.
- Date format must be MM-DD-YYYY.
- The list of Well Legal Entity Addresses is sorted by Type Code.

4.3.18.4 Well Intervals

- A Well may have one or more Intervals defined.
- Mandatory fields:
  - Interval Type - The official United States Geological Survey (USGS) National Water Information System (NWIS)-II name that describes the type of Well Interval.
  - Start Depth/Stop Depth/Unit - The measure of the starting and ending depth of a Well Interval.
- The following types of Intervals are allowed:
  - Casing - A liner placed in a borehole to prevent entry of loose rock, gas, or liquid into the borehole or to prevent loss of circulation liquid into porous, cavernous, or crevassed ground. Liners may be constructed of sections of tubing fastened or screwed together, or concrete poured in place.
  - Fill - The material placed in the area between a Casing and a borehole in order to prevent fluid migration between permeable zones and to support the casing.
  - Hole - A cavity in the ground constructed for the purpose of creating a Well.
  - Opening - A perforation in the casing or the bore hole which allows water in the surrounding strata to enter the Well. When the opening is in the casing it may be screened or unscreened. Screened openings may have a mesh size and material.
  - Geologic Unit - The name of a stratum characterized by consolidated or unconsolidated rock containing a degree of lithologic homogeneity. Geologic Units are linked to individual Well Intervals to describe geologic layers through which the Well has been drilled. Water-bearing geologic units are commonly called “aquifers”.
  - Lithologic Unit - A homogeneous body of strata characterized by certain observable physical features, or by the dominance of certain rock types or the combination of certain rock types.
- All fields except Interval Type are modifiable.
- The Stop Depth must be greater than the Start Depth.
- The list of Well Intervals is sorted by ascending Interval Type.

4.3.18.5 Casing Well Interval

- A Well can have one or more Casing Well Intervals.
- A Casing is associated to a Well Interval.
- Mandatory fields:
  - Material Type - The material from which the casing is made.
- Optional fields:
  - Inside Diameter - The diameter measurement inside the Casing.
  - Outside Diameter - The diameter measurement outside the Casing.

  - Unit for Inside/Outside Diameter - The unit of measure that corresponds to the inside and outside diameter measurements.
  - Thickness/Unit - The measurement of the thickness of the Casing.
- If any measure value is entered, then a corresponding unit must be provided, and vice versa.
- All fields are modifiable.

4.3.18.6 Fill Well Interval

- A Well can have one or more Fill Well Intervals.
- A Fill is associated to a Well Interval.
- Mandatory fields:
  - Material Type - The material used for the Fill.
- Optional fields:
  - Volume/Unit - The volume measurement of the Fill.
  - Average Thickness/Unit - The thickness measurement of the Fill.
- If any measure value is entered, then a corresponding unit must be provided, and vice versa.
- All fields are modifiable.

4.3.18.7 Geologic Unit Well Interval

- A Well can have one or more Geologic Unit Well Intervals.
- A Geologic Unit is associated to a Well Interval.
- Mandatory fields:
  - USGS Geologic Unit Code - The postal abbreviation code of the State under which the geologic unit lies followed by a colon and the official USGS NWIS II code which identifies the geologic unit.
  - USGS Geologic Unit Name - The name that corresponds to the USGS code for the geologic unit.
- Optional fields:
  - Other Name - Another name by which the selected USGS geologic unit may be known within the local area or study area.
  - Water Bearing - Indicates whether or not the geologic unit for the interval is water bearing.
  - Primary Aquifer - Indicates whether or not the geologic unit for the interval has a primary aquifer.
- All fields are modifiable.
- The list of available USGS Geologic Units is maintained centrally.

4.3.18.8 Hole Well Interval

C A Well can have one or more Hole Well Intervals.
C A Hole is associated to a Well Interval.
C Optional fields:
  - Diameter/Unit - The diameter of the bore hole in which the Well is located.

C If a measure value is entered, then a unit must be provided, and vice versa.
C All fields are modifiable.

4.3.18.9 Lithologic Unit Well Interval

C A Well can have one or more Lithologic Unit Well Intervals.
C A Lithologic Unit is associated to a Well Interval.
C Mandatory fields:
  - USGS Lithologic Unit code - The official USGS NWIS II code that identifies the lithologic unit.
  - USGS Lithologic Unit name - The official USGS NWIS II lithologic unit name.

C The list of available USGS Lithologic Units is maintained centrally.

4.3.18.10 Opening Well Interval

C A Well can have one or more Opening Well Intervals.
C An Opening is associated to a Well Interval.
C Mandatory fields:
  - Opening Type - The type of opening interval.

C Optional fields:
  - Material Type - The type of material with which the Opening is constructed or screened.
  - Length/Unit - The length of the Opening.
  - Mesh Size/Unit - The mesh size that is used for the Opening.
  - Width/Unit - The width of the Opening.

C If any measure value is entered, then a corresponding unit must be provided, and vice versa.
C All fields are modifiable.

4.3.18.11 Well Pumps

C A Well can have one or more Well Pumps.
C Mandatory fields:
  - Pump Type - The type of Pump used for the well.

C Optional fields:
  - Installation Date - The date that the Pump was installed.

  - Removal Date - The date that the Pump was removed.
  - Manufacturer - The name of the pump manufacturer.
  - Model - The manufacturer's model name/number for the Pump.
  - S/N - The serial number that the manufacturer uses to identify the Pump.
  - Rating RPM - The Pump's designed operating speed in revolutions per minute (RPM), as stated by the manufacturer.
  - Rating Capacity - The Pump's designed flow at the manufacturer's rated RPM of the Pump.
  - Rating Power - The Pump's power output at the manufacturer's designed RPM.
  - Intake Depth/Unit - The depth of a Pump's intake within a well or bore hole.
  - Intake Depth Reference - Text that describes the point on the well (or well structure) from which the Intake Depth measurement is made.
  - Pump Location Depth/Unit - The depth of the Pump in the well or bore hole (relative to a specific reference point).
  - Pump Location Reference - Text that describes the point on the Well (or well structure) from which the Pump Location measurement is made.
- If any measure value is entered, then a corresponding unit must be provided, and vice versa.
- The pump removal date must be later than the installation date.
- All fields are modifiable.
- The list of Well Pumps is sorted by Pump Type.

4.3.18.12 Well Logs

- A Well can have one or more Logs defined.
- Mandatory fields:
  - Log Number - An ID or number that identifies the Well Log.
  - Log Type - The method used to record the Well Log.
  - Format - The format of the stored Well Log (i.e., Paper File, Electronic, Published).
- Optional fields:
  - Date - The date that the log was conducted.
  - Location - A location at which the Well Log can be reviewed.
- Date format must be MM-DD-YYYY.
- All fields are modifiable.
- The list of Well Logs is sorted by ascending Log Type.

4.3.19 Spring Stations

- Stations of type “Spring” may have one Spring Station.
- Mandatory fields:

  - Improvement - The term that best describes the man-made improvement made to the spring.
- Optional fields:
  - Permanence - Used to classify the flow frequency of the spring (e.g., Continuous, Intermittent).
  - USGS Geologic Unit Code - The USGS unit code of the geologic unit that is associated with the spring station.
  - USGS Geologic Unit Name - The name of the geologic unit that is associated with the spring station.
  - USGS Geologic Unit Other Name - An additional geologic unit name for the spring such as a local name or a synonym.
  - USGS Lithologic Unit Code - The USGS code of the lithologic unit code that is associated with the spring station.
  - USGS Lithologic Unit Name - The name of the lithologic unit that is associated with the spring station.
- All fields are modifiable.
- The list of available USGS Geologic Units is maintained centrally.
- The list of available USGS Lithologic Units is maintained centrally.

4.3.20 Permanent Grids

- A Permanent Grid can be defined for any Station except those of type Well, Facility, Spring, or Cave.
- The Permanent Grid is associated to the Station’s Point of Record Absolute Location Point.
- Mandatory Permanent Grid fields:
  - X-Axis length/unit - The x-axis length (number and unit) of the Grid.
  - Y-Axis length/unit - The y-axis length (number and unit) of the Grid.
  - Cell size/ unit - The cell size (value and unit) of the Permanent Grid.
  - Labeling scheme - The labeling scheme for the Permanent Grid.
- Optional Permanent Grid fields:
  - Grid Description - Text that describes the permanent grid.
- If any measure value is entered, then a corresponding unit must be provided, and vice versa.
- On creation of a new Permanent Grid record, the Station’s Point of Record is defaulted to the Grid Origin Point, and the Point Type is set to “Grid Origin”.
- The user cannot delete the Grid Origin point.
- Mandatory Grid Origin fields:
  - Latitude/Longitude or Decimal Minute Latitude/Longitude or Decimal Degree Latitude/Longitude.
  - Method.
  - Datum.

- Optional Grid Origin fields:
  - Point Name.
  - Scale.
  - Measurement Date.
- If Latitude/Longitude is changed, then the Decimal Minute Latitude/Longitude and Decimal Degree Latitude/Longitude are automatically calculated and populated.
- If Decimal Minute Latitude/Longitude is changed, then Latitude/Longitude and Decimal Degree Latitude/Longitude are automatically calculated and populated.
- If Decimal Degree Latitude/Longitude is changed, then Latitude/Longitude and Decimal Minute Latitude/Longitude are automatically calculated and populated.
- Scale is required when the Geopositioning Method is “Interpolation Map”.
- Date format must be MM-DD-YYYY.
- All fields except Location Type are modifiable.

4.3.21 Permanent Transects

- A Permanent Transect can be defined for any Station except those of type Well, Facility, Spring, or Cave.
- The Permanent Transect is associated to the Station’s Point of Record Absolute Location.
- Mandatory Permanent Transect fields:
  - Overall Length - The overall length of the Transect.
  - Distance Between Points - The distance between transect points.
  - Labeling Scheme - The labeling scheme of the points on the Permanent Transect.
- Optional Permanent Transect fields:
  - Transect Description - Text that describes the permanent physical marking of the transect line or belt.
- On creation of a new Permanent Transect record, the Station’s Point of Record is defaulted to the Transect Origin Point, and the Point Type is set to “Transect Origin”.
- The user cannot delete the Transect Origin point.
- A Permanent Transect can have one to 99 transect sampling points.
- Mandatory Permanent Transect fields:
  - Latitude/Longitude or Decimal Minute Latitude/Longitude or Decimal Degree Latitude/Longitude.
  - Method.
  - Datum.
- Optional Permanent Transect fields:
  - Point Name.
  - Scale.
  - Measurement Date.

- If Latitude/Longitude is changed, then the Decimal Minute Latitude/Longitude and Decimal Degree Latitude/Longitude are automatically calculated and populated.
- If Decimal Minute Latitude/Longitude is changed, then Latitude/Longitude and Decimal Degree Latitude/Longitude are automatically calculated and populated.
- If Decimal Degree Latitude/Longitude is changed, then Latitude/Longitude and Decimal Minute Latitude/Longitude are automatically calculated and populated.
- Scale is required when the Geopositioning Method is “Interpolation Map”.
- Date format must be MM-DD-YYYY.
- All fields except Location Type are modifiable.
- The list of Permanent Transect Absolute Locations is sorted by Sequence Number.

5.0 TRIP/STATION VISIT SUMMARY

5.1 Description

General: The Organization organizes its monitoring strategy and activities leading to the collection and recording of data with Trips and Station Visits. A Trip can best be described as a collection of Station Visits in support of one or more Projects. What defines the duration and frequency of a Trip or Station Visit depends upon monitoring business practices. A Trip may be a few hours, a day, a year, or any other length of time; there are no restrictions. Similarly, the duration and/or frequency of a Station Visit may vary, and will likely depend upon the Trip definition. For example, Trips typically defined as a days' worth of sampling where ten different Stations are visited, may commonly only have one Visit to each Station per Trip. Multiple Visits to a given Station during a Trip may be rare and driven by unexpected factors such as a temporary interruption in sampling activity due to bad weather. Conversely, Trips typically defined as a years' worth of sampling where a given Station is visited once each week, may commonly end up with 52 Visits to each Station per Trip.

Trip level Quality Control (QC) samples (QC samples without a Station association, [e.g., Trip Blank]) and Station Visit Field Sets may be recorded. Individuals may be assigned to each QC sample.

Trips are linked to those Projects they support, and through this linkage, inherit information about visited Stations. Any single Station may be visited many times during a single Trip. Each Visit on a Trip receives a unique identifier. Each Station Visit may also have a Document/Graphic. Monitoring Activities are conducted during Station Visits. Monitoring Activities may be grouped into Field Sets at the Station Visit level. Trip level QC samples may be associated with individual Monitoring Activities.

Projects Supported by Trip: The Organization is required to link each Trip to as many Projects as the Trip supports. Further data entry is inhibited until the Trip is linked to at least one Project. The Stations available to the Trip for Station Visits is limited to the Stations associated with the Projects linked/assigned to the Trip.

QC Sample Descriptions: QC Samples may be created for the Trip. Some QC samples (e.g., Reagent Blanks, Field Blanks, Trip Blanks, Field Spikes) do not require a Station assignment. These types of QC samples need to be assigned directly to individual Monitoring Activities. There are other QC samples which do need a Station association (e.g., Field Split, Field Replicate Sample).

> **Method, Transport, and Storage:** The Organization must identify the kind of container used, and optionally its size. The container may be further described by color. Using text comments, the QC samples' creation Method and Reagents Used, and

its Handling, Transport, and Storage may be described. If the Organization has established default sets for QC Sample Handling, Transport, and Storage in the Preferences and Defaults section, one may be assigned and used in lieu of manual data entry.

Results: Following analysis of a QC Sample by the Lab, results of the analysis may be stored. The procedure for storing QC sample results is identical to chemical results.

Personnel for QC Samples: The user may identify the person(s) responsible for the QC Sample Creation. The user selects the desired person(s) from the list of Personnel created by the Organization.

Station Visit: A Station Visit is a stop during a Trip for the purposes of taking measurements, making observations, or collecting samples. During any Trip, any Station may be visited many times. During any one Visit, any number of measurement, observational, or sample collecting activities may occur. The Organization may also store a Document/Graphic supporting the Station Visit.

Samples, Measurements, and Observations: A variety of Monitoring Activities may be created for a Station Visit. The kinds of Monitoring Activities that may be created are as follows:

Sample: Samples are collections of material found in the environment at the site, and taken elsewhere for analysis and evaluation. Examples include water samples, sediment samples, and biological samples. The nature of the results to be obtained for a sample depend on the medium sampled and the intent for which the sample was collected.

Field Measurements/Observation: Measurements are those activities conducted in the field, usually involving the use of instruments of some sort, which produce environmental results without the creation of samples to be evaluated elsewhere. Examples include flow measurements, water temperature measurements, probe measurements like pH or dissolved oxygen. Observations are those activities conducted in the field which yield results without the use of instruments and usually rely on the judgement of the observer. Examples include habitat evaluations, certain meteorological observations, and general observations about conditions at the station.

Created from Sample: Created from Sample describes a sample created by extracting a portion from another sample already recorded. Some information concerning the new sample is deduced from the “parent” sample. The Parent of the Created from Sample must have been collected at the same Station Visit. Examples include: sub-samples taken from a single water sample, phytoplankton samples extracted from water samples, and tissue samples extracted from Biological Individual samples.

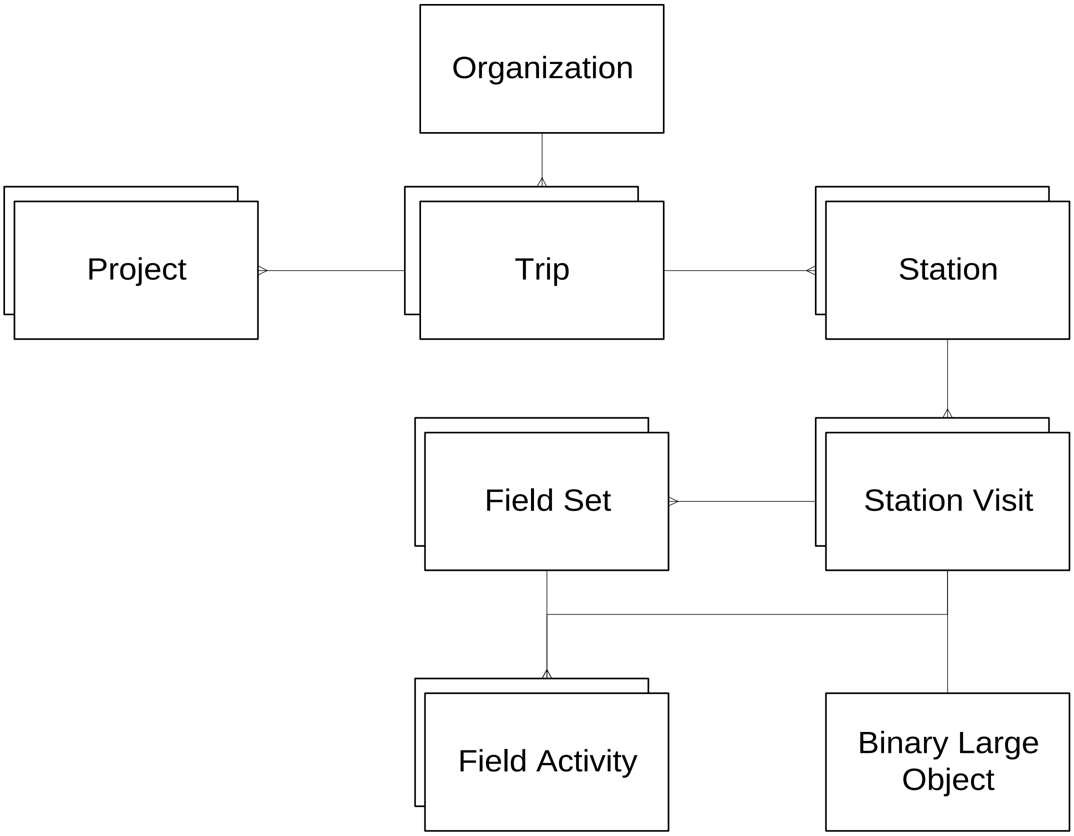
> **Composite with Parents:** Composite with Parents describes a sample created by combining two or more other samples. The “parent” samples will determine much of the description of the composite. All Parent samples must be described during the same Station Visit as the Composite. Results are recorded independently for each parent and composite.

Field Set Descriptions: The Organization may create Field Sets for the Station Visit. A Field Set is an arbitrary user-defined grouping concept for monitoring activities. This optional capability provides a mechanism by which the user might, for example, link a water sample to a meteorological observation, or link a micro-habitat evaluation to a biological sample. Any number of Field Sets may be defined. Once each has been defined, it may be used to group any number of monitoring activities which occurred during the Station Visit. Any one monitoring activity may be associated with many Field Sets.

QC Sample to Sample: QC Samples which were prepared for the Trip may be assigned to any or all of the samples collected during the Trip. This is the only assignment that may be performed for QC Samples.

Project to Monitoring Activity: For Trips which support multiple Projects, the user must assign each monitoring activity to its appropriate Project. A single monitoring activity may be assigned to many Projects. Project to monitoring activity assignment can be a powerful tool for distinguishing collection data and reporting desired results. For example, a project supporting pesticide toxicity may only be interested in sample analysis of chemicals, while a game fish project may perform different activities involving catches and counts. Both collection purposes could be performed on the same Trip with each Project being assigned to the appropriate activity. Data retrieval may then be performed based on the Project to provide data which is focused on the Project’s purpose.

5.2 Functional Diagram



- An Organization may have one or more Trips.
- A Trip may have one or more Projects assigned.
- A Trip may have one or more Stations assigned.
- A Trip may have one or more Station Visits.
- A Station Visit may have one Binary Large Object.
- A Station Visit may have one or more Field Sets.
- A Station Visit may have one or more Field Activities.
- A Field Set may have one or more Field Activities.

5.3 Business Rules

5.3.1 Trips

- An Organization may have one or more Trips defined.
- Trips cannot span across multiple Organizations.

- Trips are conducted in support of one or more of the Organization's Projects, during which, sampling Stations are visited, monitoring Activities are performed, and Results are generated.
- The user may add, update, or delete Trips.
- The list of existing Trips for a given Organization is sorted by ascending Trip Start Date.
- Mandatory fields:
  - ID - A code that will identify the Trip in the database. This code must be unique within the Organization.
  - Start Date - Date upon which a Trip began.
- The Trip Start Date will be used as the default value for the Trip's associated Station Visits.
- Optional fields:
  - Start Time - Time when a Trip began.
  - Start Time Zone - Code that represents the time zone for the Trip Start Time. A list of possible values is provided.
  - Stop Date - Date upon which a Trip concluded.
  - Stop Time - Time when a Trip concluded.
  - Stop Time Zone - Code that represents the time zone for the Trip Stop Time. A list of possible values is provided.
  - Trip Name - The name assigned by the Organization to the Trip.
  - Leader - The name of the individual who has primary responsibility in the field for the conduct of the Trip.
  - Vehicle/Ship - The name of the vehicle, vessel, or ship that was used to convey people and equipment to the sites (i.e., Stations) being monitored.
  - Trip Origin and Plan Summary - A brief summary of the Trip plan. It may indicate where the complete Trip plan is located.
  - Comments - Any further information about the Trip.
- All fields are modifiable.
- Date requirements:
  - All date fields must have the following format: MM-DD-YYYY.
  - All time fields must have the following format: HHMM.
  - Time cannot be entered without an associated date.
  - If a time is entered, then a time zone must be provided and vice versa.
  - The Trip Stop Date cannot be before the Trip Start Date.
  - The Trip Stop Date cannot be before any of its Station Visit Arrival Dates or Departure Dates.

5.3.2 Trip Project Assignment

- Each Trip must be assigned to at least one Project before Station Visits, Activities, and Results can be created.
- All Projects associated with a Trip must have at least one Project Station Assignment.
- If the Trip only supports one Project, all Field Activities defined will automatically be assigned to that Project.
- If the Trip supports multiple Projects, the user will have to assign each Field Activity to the Project(s) it supports.

5.3.3 Station Visits

- A Trip may have one or more Station Visits defined.
- A given Station can be visited more than once in a single Trip.
- Station Visits cannot span across multiple Trips.
- The user may add, update, or delete Station Visits.
- The list of existing Station Visits for a given Trip may be sorted by ascending Station ID or chronologically by Arrival Date/Time.
- Mandatory fields:
    - Station ID - The user chooses from a list of Stations associated with any Project assigned to the Trip.
    - Visit Number - A number that will differentiate this Station Visit from other visits to the same Station during the same Trip. This number must be unique for that Station but not necessarily unique within the Trip.
    - Arrival Date - Date that a Station Visit commenced. This field is defaulted to the Trip Start Date.
- Optional fields:
    - Arrival Time - Time that a Station Visit commenced.
    - Arrival Time Zone - Code that represents the time zone for the Station Visit Arrival Time. A list of possible values is provided.
    - Departure Date - Date that a Station Visit concluded.
    - Departure Time - Time that a Station Visit concluded.
    - Departure Time Zone - Code that represents the time zone for the Station Visit Departure Time. A list of possible values is provided.
    - Station Conditions and Other Comments - Any field notes, including notes about the condition of the Station itself.
    - Document/Graphic - A document or graphic file that represents or supports the current Station Visit. Valid file types are Portable Document Format (PDF), Joint Photographic Experts Graphic (JPEG/JPG), Bitmap (BMP), Graphic Interchange Format (GIF), and Text (TXT).
- All fields except the Station ID are modifiable.
- Date requirements:

  - All date fields must have the following format: MM-DD-YYYY.
  - All time fields must have the following format: HHMM.
  - Time cannot be entered without an associated date.
  - If a time is entered, then a time zone must be provided and vice versa.
  - The Station Visit Arrival Date cannot be before the Trip Start Date.
  - The Station Visit Departure Date cannot be before the Station Visit Arrival Date.
  - The Station Visit Arrival Date cannot be after the Trip Stop Date.
  - The Station Visit Departure Date cannot be before the Trip Start Date.
  - The Station Visit Departure Date cannot be after the Trip Stop Date.
  - The Station Visit Arrival Date cannot be after any Field Activity Start Date.
  - The Field Activity Start Date cannot be after the Station Visit Departure Date.
  - The Field Activity Stop Date cannot be after the Station Visit Departure Date.
  - The Field Activity Stop Date cannot be before the Station Visit Arrival Date.

5.3.4 Trip Station Assignment

- When a Station Visit is created, it is associated to the current Trip and selected Station.

5.3.5 Field Sets

- A Station Visit may have one or more Field Sets defined.
- A Field Set is a user-defined grouping of monitoring activities conducted during a single Station Visit.
- Field Sets cannot span across multiple Station Visits.
- The user may add, update, or delete Field Sets.
- The list of existing Field Sets for a given Station Visit is sorted by ascending ID.
- Mandatory fields:
  - ID - A code that will identify the Field Set. This ID must be unique within the Station Visit list of Field Sets.
  - Name - The name assigned by the Organization to the Field Set.
- Optional fields:
  - Description - A description of the Field Set.
- All fields are modifiable.

5.3.6 Field Set Activity Assignment

- A Field Set may have one or more Field Activities assigned to it.
- Available Field Activities consist of all monitoring activities that have been conducted during the Station Visit.

5.3.7 Trip Activity Project Assignment

- If the Trip only supports one Project, then all Field Activities defined will automatically be assigned to that Project; otherwise the assignment is manual.
- One or more Projects can be associated to a given Field Activity.
- A Project can only be associated to a Field Activity whose Station visited is associated to it via a Project Station Assignment.

5.3.8 Trip Summary

- A summary listing of all monitoring activities and Field Quality Control (QC) Samples for a given Trip is provided.
- The Field Activities listing may be sorted by ascending Station ID or chronologically by Trip Activity Start Date/Time.
- The user may update or delete monitoring activities and/or QC samples from this list.
- The user cannot add monitoring activities and/or QC samples from this list.
- Delete is not allowed on a Field Activity if it is a parent of a Composite or Sample from Sample. Only its results may be deleted in such case.

6.0 MONITORING ACTIVITIES SUMMARY

6.1 Description

General: Monitoring Activities are performed during a Station Visit to evaluate conditions in the environment. Monitoring Activities consist of Sample Collection, direct field Measurements (here after known as Measurements) and Observations made during the Station Visit.

C Sample Collection involves extracting something from its environmental setting using some type of equipment.

C Measurement involves direct measurement of the environment. Measurement requires the use of some type of equipment.

C Observation involves observing the environmental setting, always without equipment.

Monitoring Activity Basic Information: The user must provide: a “unique to the Station Visit” Activity ID, Medium, and Activity Category. If activity category is Field Replicate or Depletion Replicate the user must provide a replicate number. If the medium is Biological an Intent is also required. If the Intent is Individual a Subject Taxon is required. If the Intent is Tissue a Subject Taxon and Bio Part are required. If the Intent is Taxon Abundance then Community is required. The user must indicate whether or not the activity is a QC activity. The user may also provide an Activity Start Date.

The user may provide an Activity Start Time, Activity Stop Date and Time, Sample Matrix, Chain of Custody ID, Activity Duration and Unit, Sample Volume and Unit, Sample Weight and Unit, Data Log Name and Location, and Activity Comments.

Sample Collection/Creation Procedures: For all Monitoring Activities except direct field Measurements the user must identify the “Sample Collection/Creation Procedure” used to generate the Sample. The available Sample Collection/Creation Procedures, and optionally their associated Field Sampling Gear and Gear Configurations, are those identified by the Organization as a Preference and Default. In addition, the user may provide text comments describing any unusual aspects of collection gear deployment during the actual field activity.

Sample Preservation, Transport, and Storage: This area is not allowed for direct field Measurements. For all other Monitoring Activities the Organization must provide details concerning the sample container and post-collection handling of the sample. The available Sample Preservation, Transport, and Storage profiles are those identified by the Organization as a Preference and Default, or created independently for the specific activity. The user may provide additional information in the Transport and Storage Comments area.

Actual Activity Location: The Organization must provide the Station Location Point location of the Monitoring Activity. The only applicable Station Location Points are those points created for the Station (e.g., Point of Record, Sampling Point, Boundary Point).

The Organization has the ability to optionally provide a Activity Location Point and Elevation. This Activity Location remains with the Monitoring Activity description and does not become part of the Station's Location Points or "formal" description. In this way an Activity may have a much more precise location and elevation than those available as Station Location Points. Monitoring Activities involving a trawl may have two Activity Location Points representing the trawl stop and trawl stop locations. A free text area for Additional Location Information is also available.

Project(s) Supporting this Activity: The Organization must assign the Monitoring Activity to at least one Project. A single monitoring activity may be assigned to many Projects. Project to monitoring activity assignment can be a powerful tool for distinguishing collection data and reporting desired results. For example, a project supporting pesticide toxicity may only be interested in sample analysis of chemicals, while a game fish project may perform different activities involving catches and counts. Both collection purposes could be performed on the same Trip with each Project being assigned to the appropriate activity. Data retrieval may then be performed based on the Project to provide data which is focused on the Project's purpose.

Activity Depth and Stratification: The Organization may provide an Activity Depth. Activity may be described in one of two ways:

- A discreet Depth, Unit, and Relative Depth.

- A Depth Range consisting of an Upper Depth and Lower Depth, and Depth Measurement Reference Point.

In addition to measured depth, there are several relative water column areas available to indicate the location of the Monitoring Activity: Zone Type, Thermocline, Halocline, Pycnocline.

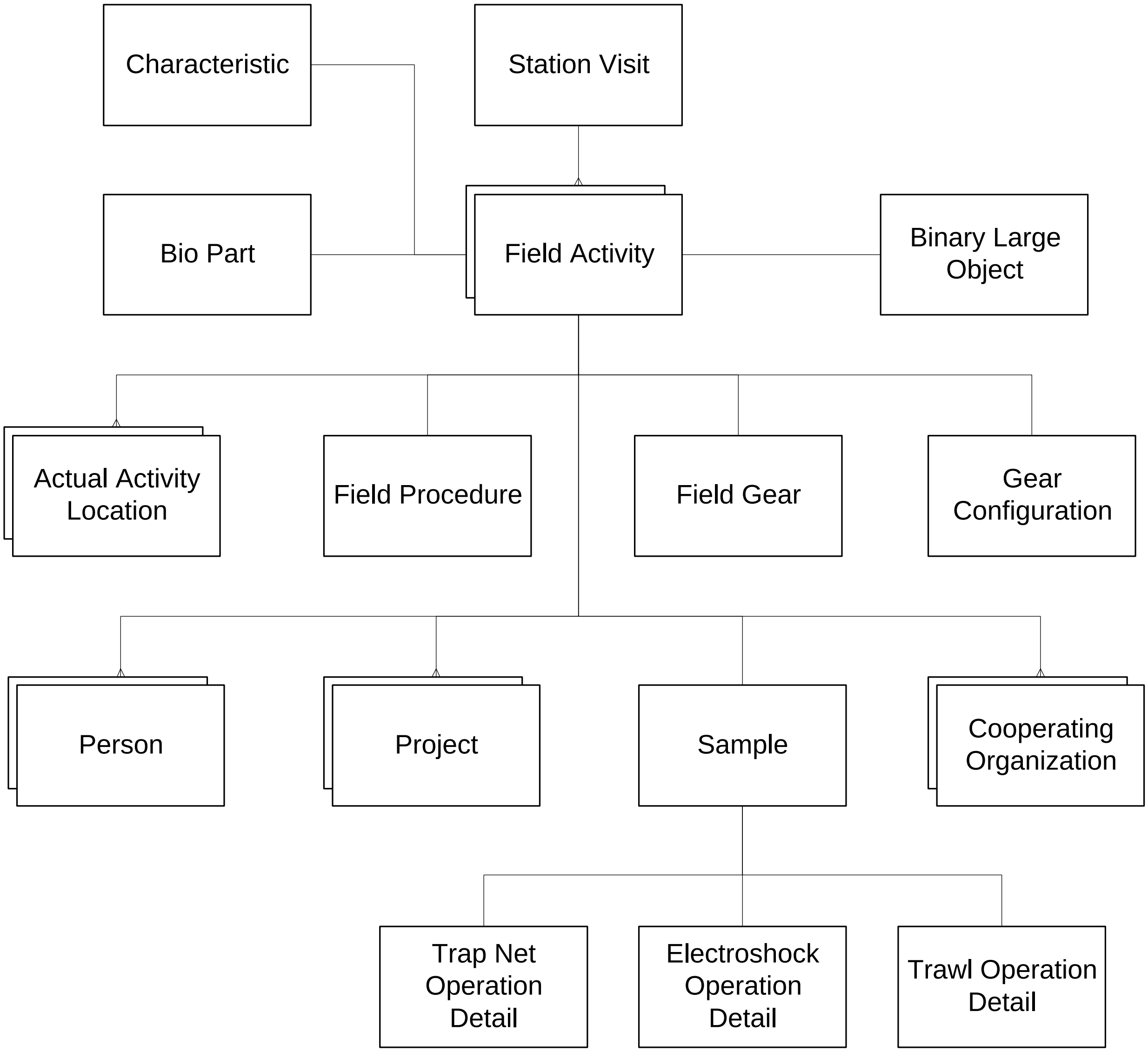
Net, Trawl, Electroshock Details: This only applicable to Biological Samples. Trap and Net Operational Details may be described by Sampling Duration and Unit, Relative Current Direction, Relative Wind Direction, Orientation to Current, and Comments. Electroshock Operational Details may be described by Voltage, Current Type, Amperage, Pulse Rate, Number of Passes, Total Energized Time and Unit, Length of Pass and Unit, and Comments. Trawl/Horizontal Tow Operational Details may be described by Fished Duration and Unit, Distanced Fished and Unit, Boat Speed and Unit, Relative Wind Direction, and Relative Current Direction. All these operational details contain information on sampling effort and equipment settings/configuration.

Cooperating Organizations Performing Activity: An Organization may associate one or more of its Cooperating Organizations with this Monitoring Activity.

Personnel Performing Activity: An Organization may associate one or more Personnel with this Monitoring Activity.

Document/Graphic: The Organization may store a document or graphic to better document any aspect of the Monitoring Activity.

6.2 Functional Diagram



- A Station Visit may have one or more Field Activities.
- A Field Activity may have one Subject Taxon Characteristic assigned.
- A Field Activity may have one Bio Part assigned.
- A Field Activity may have one Binary Large Object.
- A Field Activity may have one or more Actual Activity Locations.
- A Field Activity may have one Sample.
- A Field Activity may have one Field Procedure assigned.
- A Field Activity may have one Field Gear assigned.

- A Field Activity may have one Gear Configuration assigned.
- A Field Activity may have one or more Persons assigned.
- A Field Activity may have one or more Projects assigned.
- A Field Activity may have one or more Cooperating Organizations assigned.
- A Sample may have one Trap Net Operation Detail.
- A Sample may have one Electroshock Operation Detail.
- A Sample may have one Trawl Operation Detail.

6.3 Business Rules

6.3.1 Field Activity (General)

- A Station Visit may have one or more Field Activities defined.
- Field Activities are performed during a Station Visit to evaluate conditions in the environment.
- A Field Activity falls into one of four categories:
  - Sample - Material collected at the station and taken elsewhere for analysis and evaluation.
  - Field Measurement/Observation - An activity conducted in the field, usually involving the use of instruments of some sort that produce environmental results without the creation of Samples.
  - Created from Sample - A Sample created by extracting a portion from another Sample.
  - Composite with Parents - A Sample created by combining all or parts of other Samples.
- Mandatory fields:
  - ID - An alphanumeric that uniquely identifies a Field Activity.
  - Type Name - Automatically set to either “Sample” or “Field Msr/Obs”.
  - Medium - The name of the medium where the Field Activity occurred (e.g., Water).
  - Activity Category - A descriptor that further distinguishes between the different kinds of activities.
  - Start Date - Date upon which a Field Activity began. This field defaults to the Station Visit Arrival Date.
- Optional fields:
  - Quality Control (QC) Indicator - Indicates whether the Field Activity is for QC purposes. Between the choices of Yes or No, the default is set to No.
  - Chain of Custody ID - A user-specified ID Code which may be used to identify a record kept elsewhere describing the Chain of Custody for a Sample and its associated Results.
  - Start Time - Time when a Field Activity began.

  - Start Time Zone - Code that represents the time zone for the Field Activity Start Time.
  - Comments - Additional comments that further describe the Field Activity.
  - Document/Graphic - A document or graphic file that represents or supports the current activity. Valid file types are Portable Document Format (PDF), Joint Photographic Experts Graphic (JPEG/JPG), Bitmap (BMP), Graphic Interchange Format (GIF), and Text (TXT).
- The combination of the Activity ID and the Replicate Number if applicable must be unique within a given Station Visit.
- Date Requirements:
  - All date fields must have the following format: MM-DD-YYYY.
  - All time fields must have the following format: HHMM.
  - Time cannot be entered without an associated date.
  - If a time is entered, then a time zone must be provided and vice versa.
  - Stop Date must be later than Start Date.
  - Start Date must be greater than or equal to the Station Visit Arrival Date.
  - Start Date must be less than or equal to the Station Visit Departure Date.
  - Stop Date must be less than or equal to the Station Visit Departure Date.
- For measures and associated units, both must be provided.
- If there is only one Project assigned to the Trip, then automatically assign the new Field Activity to the Project.

6.3.2 Sample (General)

- A Field Activity may have one Sample.
- If the Activity Category is either “Field Replicate/Duplicate” or “Depletion Replicate”, then you must enter a Replicate Number.
- Possible Medium Types are: Air, Soil, Sediment, Water, Biological, and Other.

6.3.2.1 Non-Biological Sample

- Non-Biological Samples are those Samples where the Medium is one of the following: Air, Soil, Sediment, Water, or Other.
- A Non-Biological Sample may optionally include:
  - Matrix - The substance in/on which your target characteristic is located.
  - Stop Date - Date when a Field Activity concluded.
  - Stop Time - Time when a Field Activity concluded.
  - Stop Time Zone - Code that represents the time zone for a Field Activity Stop Time.
  - Sampling Duration/Units - The length of time that elapsed between the Start Time and Stop Time.

  - Sample Volume - The total volume of the material that composes the extracted Sample in the field.
  - Sample Weight - The total weight of the material that composes the Sample in the field.
  - Data Log Name and Location - If applicable, describes the location of the data file for Samples where raw data are recorded in a continuous fashion in either digital or analog format, or video images.
- All fields are modifiable except Medium, Activity Category, and Replicate #.

6.3.2.2 Biological Sample

- Biological Samples are those samples where the Medium is Biological.
- Matrix is not applicable for Biological Samples.
- Biological Samples require an Intent (i.e., the reason or purpose for the Field Activity):
  - Individual - Indicates that the whole sample is composed of a single organism or individual.
  - Taxon Abundance - Indicates that multiple organisms or individuals are present, and that information concerning their population abundance will be reported.
  - Tissue - Indicates when a Sample is made up of tissue derived from an organism or individual, or from a specific part of such an organism or individual.
- Biological Individual Samples require:
  - Subject Taxon - The organism that composes the Sample.
  - Species # - Required for Subject Taxon that have a taxonomic rank greater than “species”.
- Biological Tissue Samples require:
  - Subject Taxon.
  - Species #.
  - Bio Part - Identifies the portion of the organism on which analysis will be done. The list of available Bio Parts is maintained centrally.
- Biological Taxon Abundance Samples require:
  - Community - The name of the biological community from which the Sample was taken.
- A Biological Sample may optionally include:
  - Stop Date - Date when a Field Activity concluded.
  - Stop Time - Time when a Field Activity concluded.
  - Stop Time Zone - Code that represents the time zone for a Field Activity Stop Time.
  - Sampling Duration/Units - The length of time that elapsed between the Start Time and Stop Time.
  - Sample Volume - The total volume of the material that composes the extracted Sample in the field.

  - Sample Weight - The total weight of the material that composes the Sample in the field.
  - Data Log Name and Location - If applicable, describes the location of the data file for Samples where raw data are recorded in a continuous fashion in either digital or analog format, or video images.

C All fields are modifiable except Medium, Activity Category, Replicate #, Intent, Community, Subject Taxon, Species #, and Bio Part.

6.3.2.3 Created from Sample

C A Created from Sample is a Sample Field Activity where the Type Category is "Created from Sample".
C A Created from Sample is "created" by extracting a portion from another Sample.
C A Created from Sample can be either Biological or Non-Biological (i.e., all Mediums are allowed).
C A Created from Sample must have one and only one parent Sample assigned.
C The available Sample parent list is drawn from the current Station Visit and does not include parents of Composite with Parents.
C The available Sample parent list can be any Medium Type.
C A given Sample may be used multiple times as a Created from Sample parent.
C A Created from Sample may optionally include:

  - Matrix - The substance in/on which your target characteristic is located.
  - Sampling Duration/Units - The length of time that elapsed between the Start Time and Stop Time.
  - Sample Volume - The total volume of the material that composes the extracted Sample in the field.
  - Sample Weight - The total weight of the material that composes the Sample in the field.
  - Data Log Name and Location - If applicable, describes the location of the data file for Samples where raw data are recorded in a continuous fashion in either digital or analog format, or video images.

C All fields are modifiable except Medium Type, Intent, Subject Taxon, Bio Part, Species #, and assigned parent.
C Activity Stop Date information is not applicable for Created from Sample.
C The Category Type Name is inherited by the parent Sample. No entry is allowed.
C The Created from Sample inherits the activity location information from its parent sample. No entry is allowed.
C The Created from Sample inherits the depth and stratification information from its parent sample. No entry is allowed.

6.3.2.4 Composite with Parents Sample

- A Composite with Parents Sample is a Sample Field Activity where the Type Category is “Composite with Parents”.
- A Composite with Parents Sample describes a sample created by combining all or parts of other Samples.
- A Composite with Parents Sample can be either Biological or Non-Biological (i.e., all Mediums are allowed).
- A Composite with Parents Sample may have two or more parents (minimum is two).
- The available Sample parent list is drawn from the current Station Visit and does not include parents of Composite with Parents.
- The available Sample parent list can be any Medium Type.
- Once a Sample has been used as a “parent” of a composite sample, it cannot be used as a parent again.
- A Composite with Parents Sample may optionally include:
  - Matrix - The substance in/on which your target characteristic is located.
  - Sampling Duration/Units - The length of time that elapsed between the Start Time and Stop Time.
  - Sample Volume - The total volume of the material that composes the extracted Sample in the field.
  - Sample Weight - The total weight of the material that composes the Sample in the field.
  - Data Log Name and Location - If applicable, describes the location of the data file for Samples where raw data are recorded in a continuous fashion in either digital or analog format, or video images.
- All fields are modifiable except Medium Type, Intent, Subject Taxon, Bio Part, Species #, and the assigned parents.
- Activity Stop Date information is not applicable for Composite with Parents.
- The Category Type Name is inherited by the parent Sample. No entry is allowed.
- The Composite with Parents Sample inherits the activity location information from its parent samples. No entry is allowed.
- The Composite with Parents Sample inherits the depth and stratification information from its parent samples. No entry is allowed.

6.3.3 Field Measurement/Observation

- The Medium for a Field Measurement/Observation can be all Medium Types except Biological (i.e., Air, Soil, Sediment, Water, and Other).
- If the Activity Category is “Replicate Measurement/Observation” or “Replicate Habitat Assessment”, then a Replicate Number must also be provided.

- Other special types of Field Measurement/Observations:
  - Portable Data Logger - A device used to take measurements that can be moved from one location to another. The device typically takes measurements at established intervals.
  - Habitat Assessment - A Field Activity conducted to evaluate a Habitat according to an organization's pre-defined Habitat Assessment scheme.
- A Field Measurement/Observation may optionally include:
  - Matrix - The substance in/on which your target characteristic is located.
  - Stop Date - Date when a Field Activity concluded.
  - Stop Time - Time when a Field Activity concluded.
  - Stop Time Zone - Code that represents the time zone for a Field Activity Stop Time.
- Medium and Matrix do not apply for Habitat Assessment activities.
- All fields are modifiable except Medium Type, Activity Category, and Replicate #.

6.3.4 Field Procedure

- A Sample Field Activity may have a Field Procedure assigned.
- A Field Procedure, used to collect a Sample, is selected from a list of Organization-defined sample collection procedures.
- Field Procedure is not applicable for Field Measurement/Observations.

6.3.5 Field Gear and Gear Configuration

- A Sample Field Activity may have a Field Gear and Gear Configuration assigned.
- If the Field Procedure selected has a Gear Group Name, then a Field Gear is required. Otherwise, the Field Gear is not applicable.
- The Field Gear selection list displays all the possible Field Gears available in the system that match the Field Procedure's Gear Group Name.
- If a Field Gear is provided, then a Gear Configuration may optionally be assigned.
- The Gear Configuration selection list displays all Organization-defined configurations that match the chosen Field Gear.
- Optional fields:
  - Gear Deployment Comments - Other comments about the Gear deployment.
- If the Gear Type is changed from "Net/Horizontal Tow" to something else, then the Trawl Start/Trawl Stop Activity Points need to be removed as they no longer apply.
- If the Gear Type is changed from a Non-Trawl Gear to "Net/Horizontal Tow", then the Activity Point (if present) needs to be removed.

6.3.6 Sample Handling, Transport, and Storage

- A Sample Field Activity may contain Sample Handling, Transport, and Storage information.
- There are no mandatory fields.
- Optional fields:
    - Container Type - Container Type that best describes the style and material of the container that was used to collect and transport the Sample.
    - Container Color - Color that best describes the container that was used to collect and transport the Sample.
    - Container Size/Unit - Size of the container.
    - Temperature Preservation Type - Identifies any Temperature Preservation Type that was used.
    - Chemical Preservation and Storage Procedure - Describe any Chemical Preservation and Storage Procedures that were employed by the profile.
    - Transport and Storage Comments - Used to add any additional comments.
- If a measure value is entered, then a corresponding unit must be provided, and vice versa.
- The user can populate this information more quickly by choosing a Sample Preservation, Transport & Storage default profile that has been created for the Organization.

6.3.7 Activity Actual Location (General)

- All Field Activities except Created from Sample and Composite with Parents must have at least one Actual Activity Location that describes the actual sampling location.
- An Actual Activity Location has one Absolute Location Point (ALP).
- There are two types of Actual Activity Location Points:
    - Station Location Points - Latitude/longitude points associated with the Station.
    - Activity Location Points - Latitude/longitude points not associated with a Station.

6.3.7.1 Station Location

- A Field Activity may have one Station Location Point assigned.
- The Station Location Point is not defaulted to the point of record.
- Select the Station Location Point from a list of all location points associated with the Station visited. A Station may have many potential sampling points (point of record, boundary, sampling, transect origin, well head, grid origin, and end of pipe).
- The Actual Activity Location Type Name is set to “General”.

6.3.7.2 Non-Trawl/Horizontal Tow Actual Activity Location

- A Non-Trawl/Horizontal Tow Field Activity may have a single Activity Location Point to more accurately depict the point at which the Sample/Measurement was taken.
- The Activity Location Point is associated to the Actual Activity Location for the Field Activity.
- The Activity Location Point Type Code is set to “ACTIVITY POINT”. All other location point fields follow regular business rules (see Station Business Rule Summary).
- The Actual Activity Location Type Name is set to “General”.
- Optional Actual Activity Location fields:
    - Additional Location Information - Provides a further description of the actual point of sampling.
- Deletion of a Field Activity must also delete the Activity Location Point, if it exists.

6.3.7.3 Trawl/Horizontal Tow Actual Activity Location

- A Trawl/Horizontal Tow Field Activity may have a Trawl Start and Trawl Stop Activity Location Point.
- Trawl Start and Trawl Stop Activity Location Points are both optional.
- The Trawl Start/Trawl Stop Activity Location Points are associated to two individual Actual Activity Locations for the Field Activity.
- The Activity Location Point Type Code is set to “ACTIVITY POINT”. All other location fields follow regular business rules (see Station Business Rule Summary).
- The Trawl Start/Trawl Stop Location Points will each have a single Actual Activity Location.
- The Trawl Start Actual Activity Location Type Name is set to “Trawl Start”.
- The Trawl Stop Actual Activity Location Type Name is set to “Trawl Stop”.
- Optional Trawl Start/Trawl Stop Actual Activity Location fields:
    - Depth to Bottom/Unit - The distance from the surface to the bottom for the start point.
    - Additional Location Information - Provide further description of the actual point of sampling.
- Deletion of a Field Activity must also delete the Activity Location Point(s), if present.
- Depth fields are textual; however, entry must be restricted to the following characters: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and . (i.e., period).

6.3.8 Field Activity Project Assignment

- If there is only one Project assigned to the Trip, then that Project is automatically assigned to each new Field Activity.

- If there are multiple Projects assigned to the Trip, then Project assignment is manual and mandatory.
- The list of available Projects includes only those projects that are associated with the current Station and supported by the current Trip (i.e., The Project has a Trip Project Assignment for the current Trip, and the current Trip has a Trip Station Assignment for the current Station, and the Project has a Project Station Assignment for the current Station.)
- The list of available Projects may be sorted by Project ID or Project Name.
- A Project cannot be unassigned from the Field Activity if it is the only one currently assigned to this Field Activity because at least one Project must be assigned to this Field Activity.

6.3.9 Depth and Stratification

- A Field Activity may contain Depth and Stratification information.
- Depth and Stratification information is not applicable for Created from Sample and Composite with Parent Samples.
- Depth and Stratification information is applicable for all Field Observation/Measurements except Habitat Assessments and Portable Data Loggers.
- There are no mandatory fields.
- Optional fields:
    - Depth to Activity/Units - The distance from the surface to the point in the water column at which the activity is conducted.
    - Relative Depth - The name that indicates the approximate location within the water column at which the activity occurred (e.g., Bottom).
    - Upper Depth Range for Activity/Units - The distance from the surface to the upper boundary of the zone within which the activity was conducted.
    - Lower Depth Range for Activity/Units - The distance from the surface to the lower boundary of the zone within which the activity was conducted.
    - Zone Type - The name of the zone within which the activity occurs (e.g., Epilimnion).
    - Thermocline - The code that indicates whether a particular Field Activity was conducted “Above”, “Below”, or “In” the layer identified as the Thermocline.
    - Halocline - The code that indicates whether a particular Field Activity was conducted “Above”, “Below”, or “In” the layer identified as the Halocline.
    - Pycnocline - The code that indicates whether a particular Field Activity was conducted “Above”, “Below”, or “In” the layer identified as the Pycnocline.
    - Depth Measured from - Describes the reference point from which the depth was measured.
- Entry of Depth to Activity/Relative Depth and Depth Range for Activity information is disallowed.
- For measures and associated units, both must be provided.

- If Upper Depth is provided, then Lower Depth must also be provided, and vice versa.
- Upper Depth cannot be less than Lower Depth.
- Depth fields are textual; however, entry must be restricted to the following characters: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and . (i.e., period).

6.3.10 Electroshock Operation Detail

- A Sample Field Activity may have Electroshock Operation Details when its Field Procedure Gear Group Name is “Electroshock”.
- Electroshock Operation Details provide additional information about the equipment operation and the sample collection process.
- Mandatory fields:
  - Voltage - The magnitude of the electromotive force (volts) applied to the electroshock equipment that was used to collect the Sample.
  - Current Type - The type of current that was produced by the electroshock equipment (i.e., AC (Alternating Current) or DC (Direct Current)).
- Optional Fields:
  - Amperage - The magnitude of the current (amperes) produced by the electroshock equipment while collecting the Sample.
  - Pulse Rate - The number of times the electric current is interrupted in one second during use of the gear. This rate is measured in pulse/second.
  - Number of Passes - The number of times the electroshock gear was swept through the water from which the Sample was collected.
  - Total Energized Time/Units - The total energized time for the Field Activity.
  - Length of Pass/Units - The distance through which the electroshock was swept on each pass through the water from which the Sample was collected. If more than one pass was made, enter the average length of a pass.
  - Comments - Any further text concerning the electroshock operation.
- For measures and associated units, both must be provided.

6.3.11 Trap Net Operation Detail

- A Sample Field Activity may have Trap Net Operation Details when its Field Procedure Gear Group Name is “Net/Non-Tow”, “Trap/Substrate”, or “Net/Vertical Tow”.
- Trap Net Operation Details provide additional information about the sample collection process.
- Mandatory fields:
  - Sampling Duration/Units - The sampling time in the field.
- Optional fields:

  - Relative Current Direction - The direction of water current movement relative to the trap/net mouth. It should be measured in degrees clockwise (0-359) from the trap/net heading, with zero indicating a heading directly into the current.
  - Relative Wind Direction - The direction of wind movement relative to the mouth of the trap/net. It should be measured in degrees clockwise (0-359) from the heading of the trap/net, with zero indicating a trap/net heading directly into the wind.
  - Orientation to Current/Units - Indicate the relation of the trap or net's mouth to the current (e.g., Down Current).
  - Comments - Any other comments about the trap or net operation.
- For measures and associated units, both must be provided.
- Direction measures must be within the acceptable range (i.e., 0-359).

6.3.12 Trawl Operation Detail

- A Sample Field Activity may have Trawl Operation Details when its Field Procedure Gear Group Name is "Net/Horizontal Tow".
- Trawl Operation Details provide additional information about the sample collection process.
- Mandatory fields:
  - Fished Duration/Units - The length of time the net was fishing.
- Optional fields:
  - Distance Fished/Units - The distance covered while fishing.
  - Boat Speed/Units - The boat speed during fishing.
  - Relative Wind Direction - The direction of wind movement relative to the bow heading of the trawling boat. It is measured in degrees (0-359) clockwise from the bow heading, with zero indicating a bow heading directly into the wind.
  - Relative Current Direction - The direction of water current movement relative to the bow heading of the trawling boat. It is measured in degrees (0-359) clockwise from the bow heading, with zero indicating a bow heading directly into the current.
  - Comments - Any additional comments about the towing operation.
- For measures and associated units, both must be provided.
- Direction measures must be within the acceptable range (i.e., 0-359).

6.3.13 Field Activity Cooperating Organization Assignment

- A Field Activity may have one or more Cooperating Organizations assigned.
- The list of available Cooperating Organizations consists of those defined for the current Organization.

6.3.14 Field Activity Person Assignment

- A Field Activity may have one or more Person assigned.
- The list of available Personnel consists of those defined for the current Organization.
- The Person must currently be “active”.

6.3.15 Creating Results

- A Field Activity must be “complete” before Results can be created.
- A “complete” regular Sample must have the following:
  - Basic Field Activity information.
  - Field Procedure/Gear Configuration information.
  - Actual Activity Location information.
  - Project assignment information.
- A “complete” Created from Sample/Composite with Parents Sample must have the following:
  - Basic Field Activity information.
  - Field Procedure/Gear Configuration information.
  - Project assignment information.
- A “complete” Field Measurement/Observation must have the following:
  - Basic Field Activity information.
  - Actual Activity Location information.
  - Project assignment information.

7.0 ALL RESULTS EXCEPT BIOLOGICAL / TAXON ABUNDANCE SUMMARY

7.1 Description

General: This section covers all sample results, including results from samples derived from other samples (splits and composites), and all results from direct field measurements made during a Station Visit. These results include all Physical and Chemical results associated with a non-biological mediums, Biological Tissue and Biological Individual samples, and Habitat Assessments. Automated Data Logger and population census results (i.e., Monitoring Activities with a Biological Medium and Taxon Abundance Intent) are not covered in this section.

Field Activity Results: Characteristic Groups created by the Organization as a Preferences and Default may be utilized to facilitate Characteristic selection. Characteristics may be applied individually to an Activity from the full list of available Characteristics provided by the STORET system. Some Activities allow mixing Characteristics from both sources.

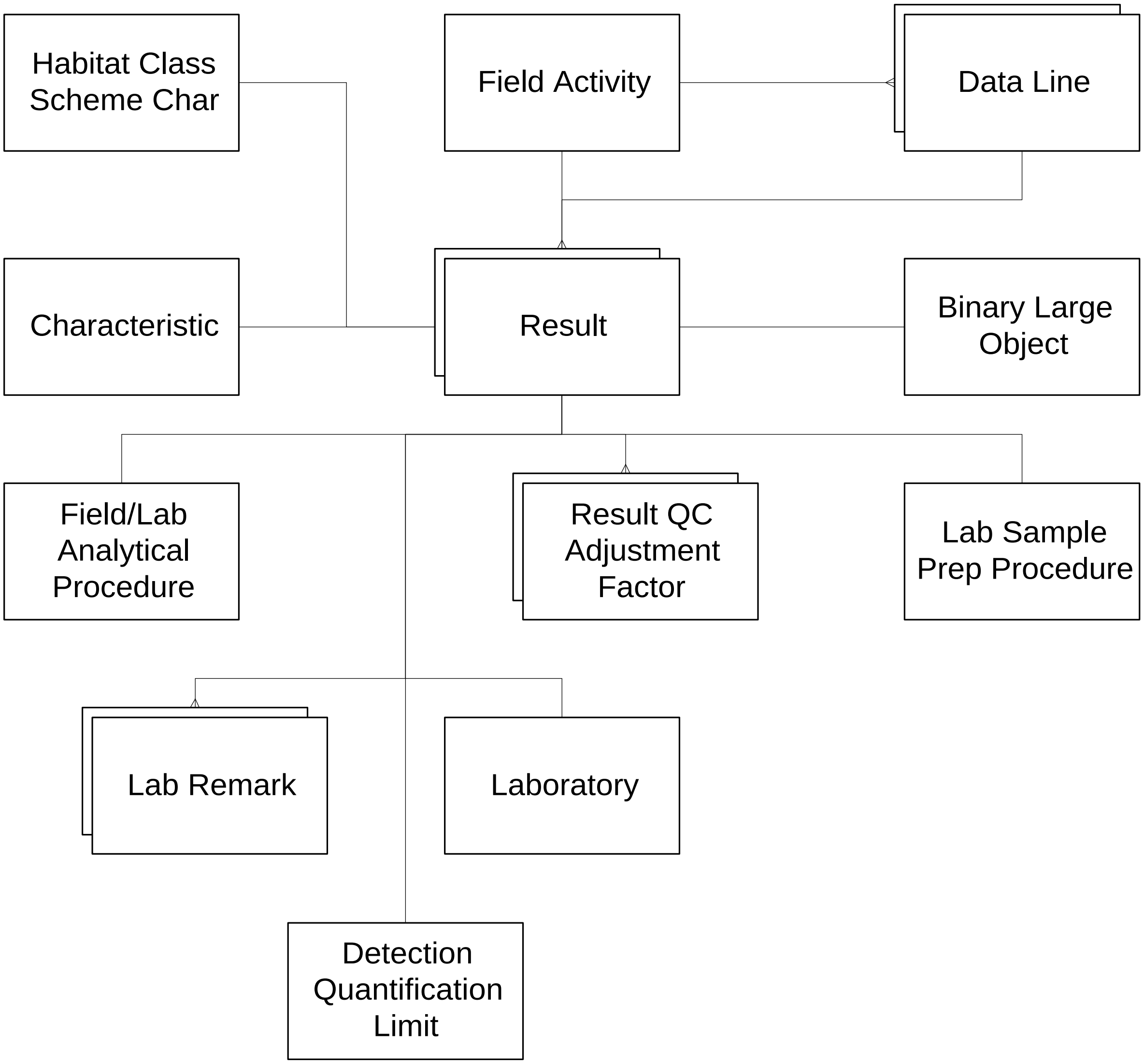
> **Chemical Results:** Allows for the identification of a Detection Condition (i.e., Detected and Quantified, Detected not Quantified, Not Reported, Present above Quantification Limit, Not Detected, Present below Quantification Limit), and Value Status (i.e., Final, Preliminary). Data for Chemical Results includes Value and Unit, Value Type, Sample Fraction Type, Statistic Type, Weight, Duration, Temperature, Precision, Confidence Level, Corrected for Bias, Bias, # of Replicate Analyses, Comments, and Document/Graphic.
>
> **Physical Results:** Allows for the identification of Value Status (i.e., Final, Preliminary). Data for Physical Results includes Value and Unit, Statistic Type, Value Type, Weight, Duration, Temperature, Particle Size Basis, From and To, Precision, Confidence Level, Corrected for Bias, Bias, # of Replicate Analyses, Comments, and Document/Graphic.
>
> **Permitted Value Results:** Allows results to be captured from a fixed list of acceptable values. A characteristic with “choice list” as part of its name has a fixed list of acceptable values such as “Tide Stage (choice list)”. The Permitted Value results also allows identification of Value Status (i.e., Final, Preliminary), associated Comments, and a Document/Graphic.
>
> **Text Results:** Allows for the capture results which are entirely textual. A characteristic with “text” as part of its name such as General Observation (text) captures a text result. The Value Status (i.e., Final, Preliminary) and a Document/Graphic may also be included with the result.

A Field/Lab Procedure, Laboratory Preparation Procedure, and Laboratory Information may be applied to each result. This allows for the proper association of a characteristic to the specific procedure(s) necessary to achieve the result. Special exceptions for a Field/Lab Procedure may be identified with the procedure to assist in capturing unusual circumstances. Laboratory Information captures several data elements including the Laboratory, Lab Batch ID, Lab Certification, Analysis Date and Time, Limits on Quantification and Detection, QC Adjustment Factors and multiple Lab Remarks.

Portable Data Logger Results: Portable Data Loggers generate Data Lines. Each Data Line is associated with an array of probes where each probe represents a Characteristic. A result is given for each Characteristic for each Data Line. A Data Line may be defined as a full probe scan (e.g., if the researcher scans the probes at the surface, mid-water, and bottom; that's three Data Lines). Clearly, Portable Data Loggers have the ability to record large volumes of data. A continuous scan from surface to bottom may generate hundreds of Data Lines. The researcher has the ability to store all Data Lines or just a select few. In support of the results, the entire data logger text/electronic file output may be stored using the Document/Graphic functionality which exists at the Activity level.

A name may be applied to each Data Line to assist in proper identification such as the surface, mid-water, and bottom example given above. Although Portable Data Loggers do not allow for a Lab Sample Preparation Procedure assignment to each probe, Portable Data Loggers capture Field/Lab Procedures and Laboratory Information.

7.2 Functional Diagram


Habitat Class Scheme Char
Field Activity
Data Line
Characteristic
Result
Binary Large Object
Field/Lab Analytical Procedure
Result QC Adjustment Factor
Lab Sample Prep Procedure
Lab Remark
Laboratory
Detection Quantification Limit

- A Field Activity may have one or more Results.
- A Field Activity may have one or more Data Lines.
- A Data Line may have one or more Results.
- A Result may have one Characteristic assigned.
- A Result may have one Habitat Class Scheme Char assigned.
- A Result may have one Binary Large Object.
- A Result may have one Analytical Procedure assigned.
- A Result may have one Laboratory Sample Preparation Procedure assigned.

- A Result may have one Laboratory assigned.
- A Result may have one Detection Quantification Limit.
- A Result may have one or more Laboratory Remarks assigned.
- A Result may have one or more Result QC Adjustment Factors.

7.3 Business Rules

7.3.1 Regular Results

- A Field Activity may have an unlimited number of regular Results.
- A regular Result is always associated with one Characteristic.
- A regular Result may have a related document/graphic.
- Mandatory fields:
  - Value Text.
  - Value Unit (if a numeric value is specified for the Result).
  - Value Status - Result values are either preliminary or final.
  - Value Type - The name that represents the process that was used in the determination of the result value (e.g., actual, estimated, calculated).
- For numeric Value Text entries, the Value Measure is derived by the system as the numeric equivalent of the textual value.
- Value Status defaults to “Final”.
- Value Type defaults to “Actual”.
- The user may add, update, or delete results.
- If a value is specified for a Result, a Unit of Measure is required.
- If a Unit of Measure is specified for a result, a value is required.
- The regular Results for a given Field Activity are sorted by the system assigned Result Sequence Number.
- A Characteristic Group may be used to associate a group of Characteristics with Results for a given Field Activity.
- A regular Result may be one of the following types: Chemical, Physical, Text, and Permitted Value (PV). If the Sample is Biological Individual or Tissue, then the Result can also be Taxa.

7.3.2 Chemical Results

- Chemical Results are required for Characteristics with a Data Entry Screen Type of “CHEM”.
- Chemical Results are required for Characteristics with a Data Entry Screen Type of “VAR” when the Field Activity’s Medium is not Biological.

C A Chemical Result may include values for the following attributes:

- Detection Condition - Indicates whether a Characteristic was detected, and if it was detected whether or not it was in a range which permitted it to be quantified. The default is “Detected and Quantified”. With a Detection Condition of “Detected and Quantified”, a Result Value and Unit are required.
- Value Status - Indicates Preliminary or Final Status of the result value.
- Value Text (mandatory) - This field is only available when Detection Condition is “Detected and Quantified.”
- Unit of Measure (mandatory) - This field is only available when Detection Condition is “Detected and Quantified.”
- Value Type (mandatory - defaulted) - This field is only available when Detection Condition is “Detected and Quantified.”
- Sample Fraction Type (mandatory- defaulted) - When Results are obtained from a Physically-Partitioned Sample, use this field to select the portion of the Sample that was associated with the Results.
- Statistic Type - The Statistic or Calculation Type that best describes the reported Result. This field is only available when Detection Condition is “Detected and Quantified.”
- Weight Basis - The name that represents the form of the Sample or portion of the Sample that is associated with the Result Value. This field is only available when Detection Condition is “Detected and Quantified.”
- Duration Basis - The period of time over which a measurement was made. This field is only available when Detection Condition is “Detected and Quantified.”
- Temperature Basis - Identifies the controlled temperature at which the Sample was maintained during analysis. This field is only available when Detection Condition is “Detected and Quantified.”
- Precision - Estimate the maximum possible error in the Result (e.g., counting error in determining Radiological Beta Particle Counts). This field is only available when Detection Condition is “Detected and Quantified.”
- Confidence Level - When a Result has a confidence Interval (i.e., precision estimate), the Confidence Level associated with the Interval is recorded in this field. This field is only applicable when there is a precision Value Text. This field is only available when Detection Condition is “Detected and Quantified.”
- Corrected For Bias - Indicates whether the Confidence Level has been corrected for Bias.
- Bias - A consistent deviation of measured values from the true value, caused by systematic errors in a procedure, as determined by applying identical procedures to a specimen of known properties.
- # of Replicate Analyses - The number of replicate analyses conducted to determine the Result Value.
- Comments - Free text description of the Result Value.

C The Value Text entry must be a numeric value.

7.3.3 Physical Results

- Physical Results are required for Characteristics with a Data Entry Screen Type of “PHYS”.
- A Physical Result may include values for the following attributes:
  - Value Text (mandatory).
  - Unit of Measure (mandatory).
  - Value Status (mandatory - defaulted).
  - Statistic Type.
  - Value Type (mandatory - defaulted).
  - Weight Basis.
  - Duration Basis.
  - Temperature Basis.
  - Particle Size Basis - Provides a particle size basis for the Characteristic Result. Entry applies mostly to sediment, substrate, or soil analysis.
  - Reference Point From - Indicates the beginning point from which a Measurement, such as surface elevation or stream width, was taken.
  - Reference Point To - Indicates the end point to which a Measurement, such as surface elevation or stream width, was taken.
  - Precision.
  - Confidence Level.
  - Corrected For Bias.
  - Bias.
  - # of Replicate Analyses.
  - Comments.
- The Value Text entry must be a numeric value.

7.3.4 Text Results

- Text Results are required for Characteristics with a Data Entry Screen Type of “TEXT”.
- A Text Result may include values for the following attributes:
  - Result Text/Description (mandatory) - In the form of a free text field.
  - Value Status (mandatory - defaulted)
- Value Text is set by the system to “*Text”.

7.3.5 Permitted Value Results

- Permitted Value Results are required for Characteristics with a Data Entry Screen Type of “PV”.

- A Permitted Value Result may include values for the following attributes:
  - Result Permitted Value (mandatory) - Pick from a list of possible values for the chosen Characteristic.
  - Value Status (mandatory - defaulted).
  - Comments.
- Value Text is set to the selected Permitted Value.

7.3.6 Portable Data Logger Results

This section includes additional general business rules that are specific to Portable Data Logger Field Activities.

- A Field Measurement/Observation Activity may have one or more Data Lines.
- A Result for a Portable Data Logger Field Activity is always associated with one Data Line.
- The list of portable Data Logger Results includes those Results associated with a selected Data Line.
- The Portable Data Logger Results are sorted by the system assigned Result Sequence Number.
- A Portable Data Logger Result may have one Analytical Procedure associated with it.
- A Portable Data Logger Result may have one Laboratory associated with it.
- A Data Line associated with a Portable Data Logger Result may include a value for the following attribute:
  - Line Name - Enter a name for the selected Data Line for a Portable Data Logger activity.

7.3.7 Biological Individual/Tissue (Taxa) Results

This section includes additional general business rules that are specific to Biological Individual and Biological Tissue Field Activities.

- A Biological Individual Result is associated with a Sample Field Activity whose medium is “Biological” and intent is “Individual”.
- A Biological Tissue Result is associated with a Sample Field Activity whose Medium is “Biological” and intent is “Tissue”.
- Taxa Results are required for Characteristics with a Data Entry Screen Type of “TAXA”.
- Taxa Results are required for Characteristics with a Data Entry Screen Type of “VAR” when the Field Activity’s Medium is Biological.
- A Taxa Result may include values for the following attributes:
  - Value (mandatory).
  - Unit of Measure (mandatory).

  - Value Status (mandatory - defaulted).
  - Value Type (mandatory - defaulted).
  - Species # - Use this field to provide a user-defined species number for the Subject Taxon. This field applies to those Subject Taxons that have a taxonomic rank greater than “species”.
  - Statistic Type.
  - Comments - Enter a free text description of the Result Value.

7.3.8 Habitat Class Scheme Results (System-defined)

This section includes additional general business rules that are specific to system-defined Habitat Assessment Field Activities.

- Habitat Class Scheme Results may be either system-defined or user-defined, not both.
- System-defined Scheme Results are based on a selected Characteristic group of system-defined Characteristics. A Habitat Assessment Field Activity may have one or more Results associated with it.
- A Result may have one Characteristic associated with it.
- System-defined Scheme Results follow all the rules as regular Results.
- Once a Habitat group has been selected for a given Field Activity, additional Characteristics may not be added. Deletions are allowed.

7.3.9 Habitat Class Schemes Results (User-defined)

This section includes additional general business rules that are specific to user-defined Habitat Assessment Field Activities.

- Habitat Class Scheme Results may be either system-defined or user-defined, not both.
- User-defined Scheme Results are based on a selected Characteristic group of user-defined Habitat Class Scheme Characteristics.
- A Habitat Assessment Field Activity may have one or more Results associated with it.
- A Result may have one Habitat Class Scheme Characteristic associated with it.
- Mandatory fields:
  - Value Measure.
- Lab Sample Prep, Field/Lab Procedure, and Laboratory Info are not applicable for user-defined Habitat Assessment Results.
- Once a Habitat group has been selected for a given Field Activity, additional Characteristics may not be added or deleted.

7.3.10 Result Laboratory

- A regular Result may have one Laboratory associated with it.

C A Result Laboratory record may include values for the following result attributes:

- Lab Batch ID - The code that represents the Laboratory Batch ID for a Result or a group of Results.
- Lab Certified indicator - This field is used to indicate whether the Laboratory was certified for the Analyte and the Analytical Procedure at the time that the Result determination was made.
- Analysis Date - Date upon which a selected Result Value was analyzed.
- Analysis Time - Time a selected result value was analyzed.
- Analysis Time Zone - Code that represents the time zone for the selected Result Value Analysis Time.
- Dilution Indicator - A factor applied because the Sample was diluted before the analysis, usually to render the measurement within the calibration range of the Analytical Equipment or Method.
- Correction Indicator - A generalized correction applied to compensate for all differences between the measured Result and actual conditions presumed to have existed in the environment.
- Recovery Indicator - A factor applied because the presumed recovery of the substance being measured was other than 100 percent.

C A regular Result may have one or more Result QC adjustment factors associated with it.

C Date requirements:

- All date fields must have the following format: MM-DD-YYYY.
- All time fields must have the following format: HHMM.
- Time cannot be entered without an associated date.
- If a time is entered, then a time zone must be provided and vice versa.

7.3.10.1 Result Limits (Detection Quantification Limit)

C A Result may have one Detection Quantification Limit record associated with it.

C A Result may include values for the following Detection Quantification Limit attributes:

- Minimum/Maximum Quantification Limit - Quantification refers to the limits of an Instrument or Analytical process when detecting and/or quantifying a substance associated with a Result Value. High represents the largest amount of the target substance that could be quantified by the Instrument or Analytical process. Low represents the smallest amount. Values above the minimum and below the maximum Quantification Limits are reported as valid numeric Results.
- Minimum Detection Limit - Detection Limit refers to the least amount of the target substance that could be detected by the Instrument or Analytical process that was used to determine the Result. Above this value, the target substance is presumed to be present.

  - Unit of Measure - This field defaults to the Unit of Measure of the Result if no Limits have been entered.
  - Description - Use this field to enter comments concerning the Quantification Limits. This field is visible upon entering a Quantification Limit.

C If a Limit is provided, then a Unit of Measure is required and vise versa.

7.3.10.2 Lab Remarks

C A regular Result may have one or more Laboratory Remarks associated with it.
C Laboratory Remarks are assigned to a Result from a list of centrally maintained Laboratory Remarks.
C Assigned Laboratory Remarks may be selected and unassigned from a Result.

7.3.11 Field/Lab Analytical Procedure

C A regular Result may have one Analytical Procedure associated with it.
C Analytical Procedures may be assigned to a Result from a list of available Analytical Procedures. This list includes organization-defined procedures as well as those procedures that have been adopted from the centrally maintained national list of procedures.
C An assigned Analytical Procedure may be unassigned from a Result.

7.3.12 Lab Sample Prep Procedure

C A regular Result may have one associated Laboratory Sample Preparation Procedure.
C Laboratory Sample Preparation Procedures may be assigned to a Result from a list of available Laboratory Sample Preparation Procedures. This list includes organization-defined procedures as well as those procedures that have been adopted from the centrally maintained national list of procedures.
C An assigned Laboratory Sample Preparation Procedure may be unassigned from a Result.

8.0 BIOLOGICAL TAXON ABUNDANCE RESULTS SUMMARY

8.1 Description

General: Biological sampling for population census is similar to water chemistry sampling in all ways except the description of results. The system provides for the extensive description of population census samples. For activities where the Medium is Biological, and the Intent is Taxon Abundance, the user must describe sample results through the creation of a series of "Result Groups". The user may create as many "Result Groups" and in any combination to fully describe the sample results. All Result Groups except Multi-Taxon Population Census are taxon specific (i.e., restricted to a single taxon of any rank). Each taxon may be grouped as many times as necessary to tabulate all desired counts. Multiple groups of the same "Single Taxon" type may be made in order to capture detailed information about each taxon in a sample/catch. There are four result group types:

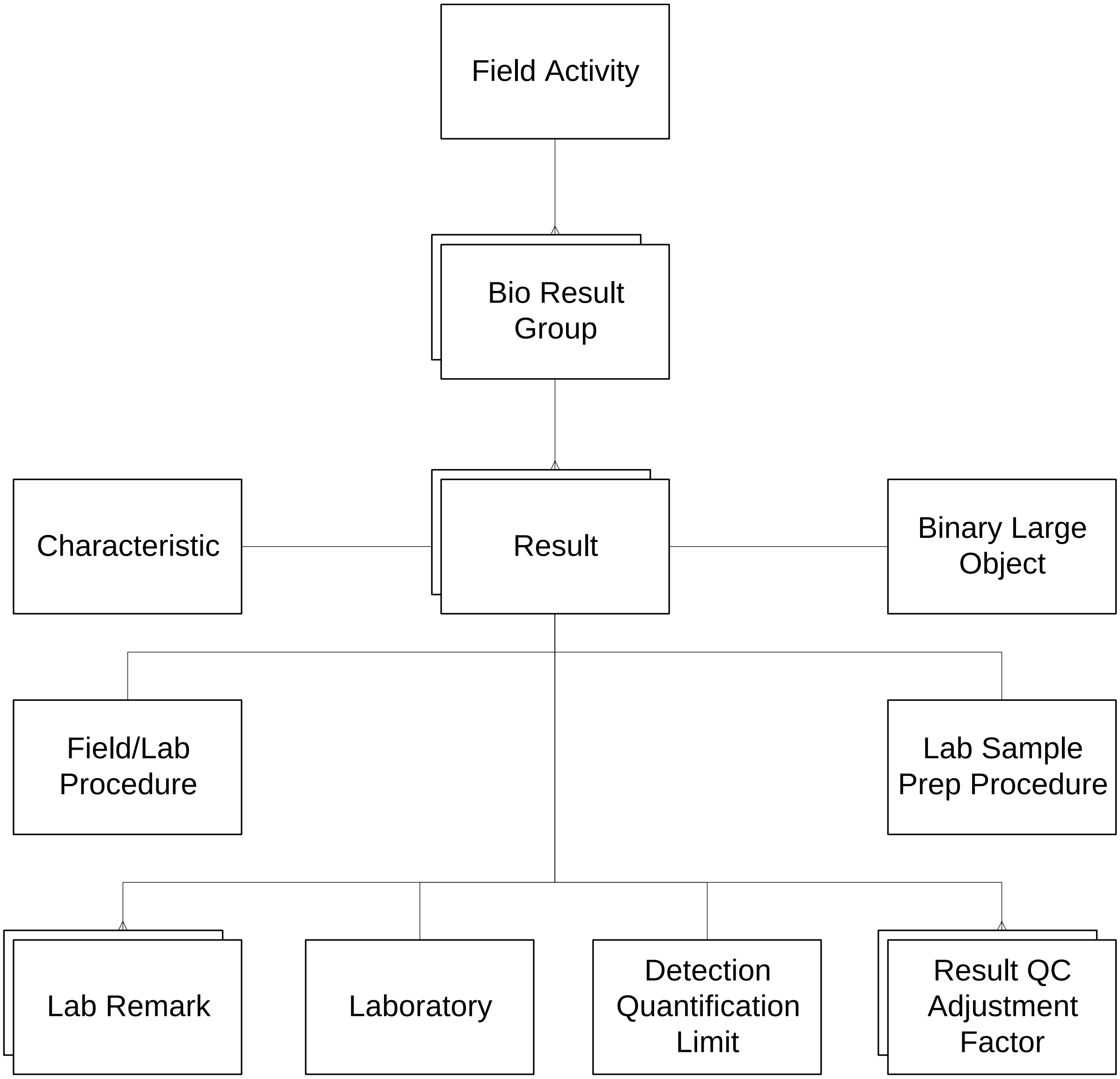
> **Multi-Taxon Population Census:** This group captures the total count of each taxa observed in the sample. Taxonomic Names may be of any Taxonomic Rank. Species Numbers may be added to all Ranks above Species. Lab Sample Preparation Procedure, Field/Lab Procedure, and Laboratory Information are available for each taxon.
>
> **Single Taxon Frequency Classes:** A biological "catch" may be subdivided by taxon, and each single-taxon subset may be grouped. This Group has two sub-groups; Physical Measures, used to describe histograms of size or weight within a taxon, and Biological Condition used to tabulate counts by sex and/or life stage within a taxon.
>
> **Single Taxon Group Summary:** Once the "catch" is subdivided by taxon, rather than recording data for each individual within the Single Taxon Group, the user may summarize the group according to items such as the number of individuals, average weight or length, and maxima and minima of various measures of the group. Lab Sample Preparation Procedure, Field/Lab Procedure, and Laboratory Information are available for each characteristic.
>
> **Single Taxon Individuals:** Once the "catch" is subdivided by taxon, the user may record results on an individual basis. For example, the user may wish to measure and weigh each member of a given taxon. This Group provides the ability to record individual observations. The same Characteristics must be recorded for each member of this group. Lab Sample Preparation and Field/Lab Procedures are available for each individual.

For all groups except Single Taxon Frequency Classes the user must provide characteristics. Characteristics for Single Taxon Frequency Classes are selected directly on the Result screen.

For all the remaining group types the user may select directly from the “master list of characteristics” provided by the STORET Administrators at EPA and/or from the list of characteristic groups created by the Organization in the Preferences and Defaults area of the Organization. For a Multi-Taxon Population Census group the characteristics are limited to taxonomic names. For Single Taxon Group Summary and Single Taxon Individuals the characteristics are limited to physical characteristics.

8.2 Functional Diagram

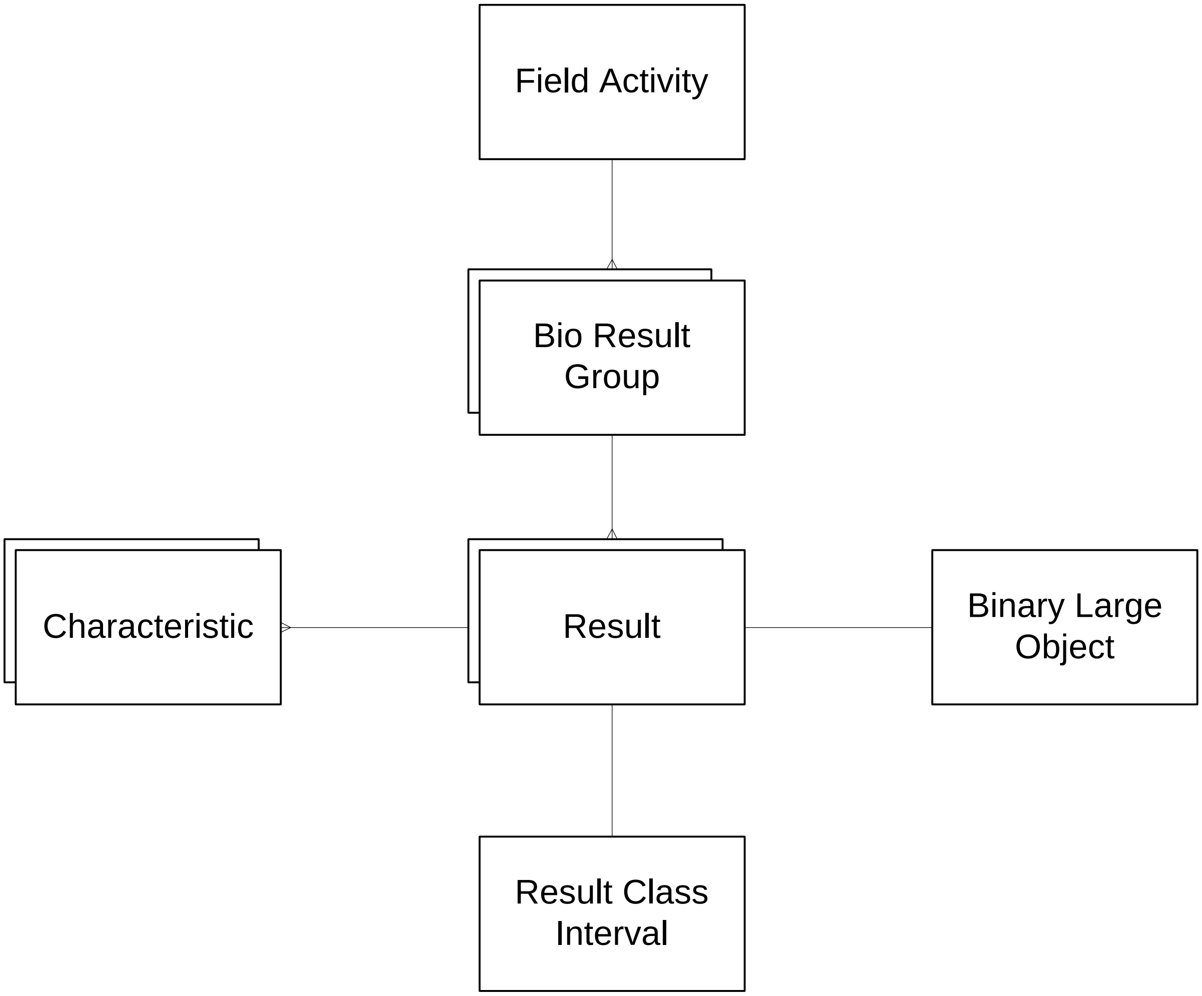
8.2.1 Multi-Taxon Population Census and Single Taxon Group Summary Groups



- A Field Activity may have one or more Bio Result Groups.
- A Bio Result Group may have one or more Results.
- A Result may have one Characteristic assigned.
- A Result may have one Binary Large Object.

- A Result may have one Field/Lab Analytical Procedure assigned.
- A Result may have one Lab Sample Preparation Procedure assigned.
- A Result may have one Laboratory assigned.
- A Result may have one Detection Quantification Limit.
- A Result may have one or more Lab Remarks assigned.
- A Result may have one or more Result QC Adjustment Factors.

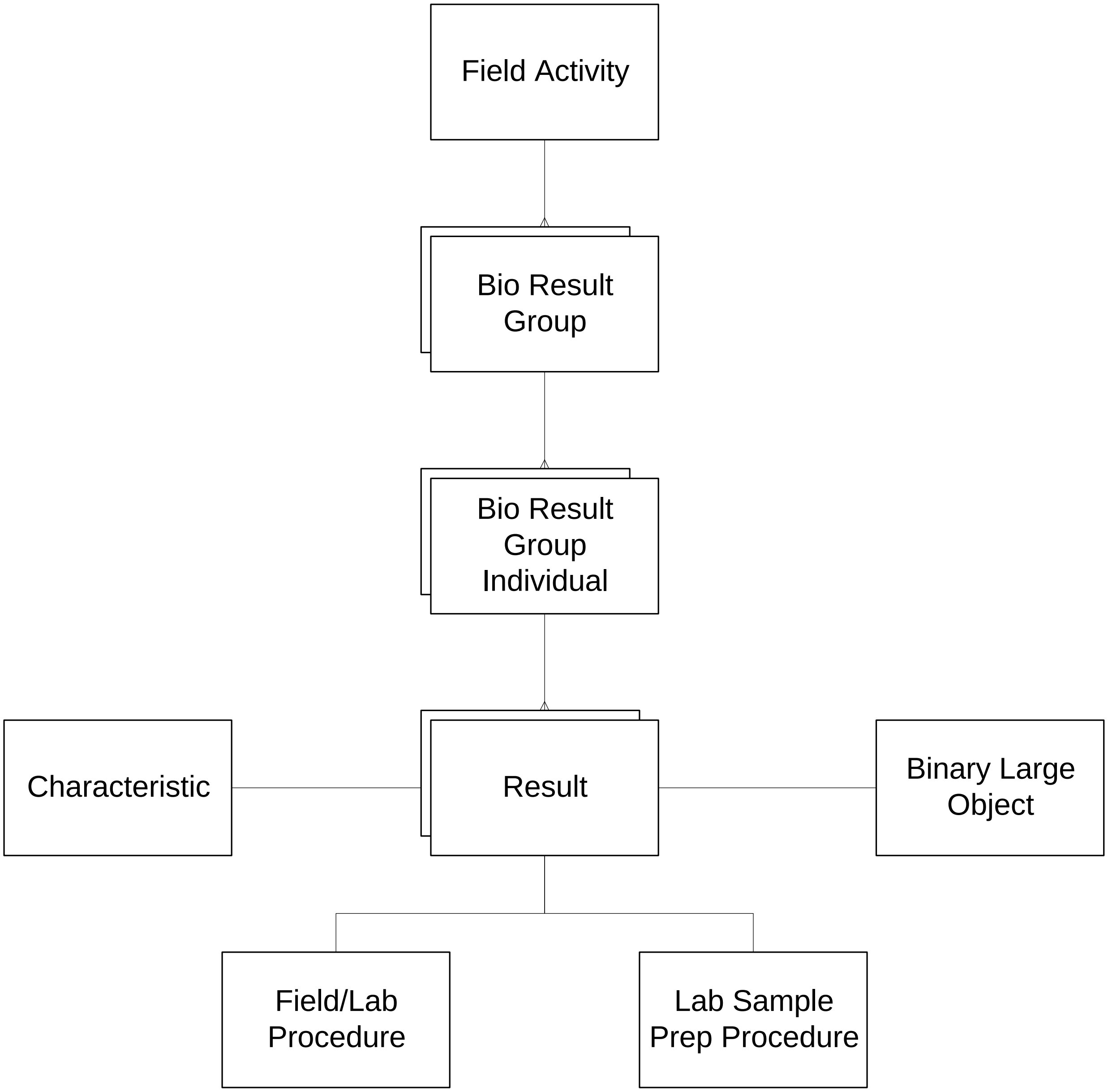
8.2.2 Single Taxon Frequency Classes Group



- A Field Activity may have one or more Bio Result Groups.
- A Bio Result Group may have one or more Results.
- A Result may have one and at most two Characteristics assigned.

- A Result may have one Binary Large Object.
- A Result may have one Result Class Interval.

8.2.3 Single Taxon Individuals Group



- A Field Activity may have one or more Bio Result Groups.
- A Bio Result Group may have one or more Bio Result Group Individuals.

- A Bio Result Group Individual may have one or more Results.
- A Result may have one Characteristic assigned.
- A Result may have one Binary Large Object.
- A Result may have one Field/Lab Analytical Procedure assigned.
- A Result may have one Lab Sample Prep Procedure assigned.

8.3 Business Rules

8.3.1 Biological Taxon Abundance Results (General)

- Taxon Abundance Samples are Samples where:
  - Medium = Biological.
  - Intent = Taxon Abundance.
  - Community is defined (e.g., phytoplankton/zooplankton).
- Taxon Abundance Samples may have one or more Bio Result Groups.
- Bio Result Groups cannot span across multiple Field Activities.
- A Bio Result Group is one of four types:
  - Multi-Taxon Population Census - Consists of a list of taxonomic names with an associated "count" for each.
  - Single Taxon Individuals - Characteristic(s) are measured for each individual within the group. The same Characteristic(s) are studied for each individual.
  - Single Taxon Group Summary - Characteristics are evaluated in "summary form" for all the Subject Taxon Individuals in the group.
  - Single Taxon Frequency Classes (Physical Measures) - Subject Taxon Individuals are separated into classes based on "physical" parameters (e.g., length, weight, age, etc.). After a class is described, counts are entered for the various ranges of the selected physical parameter.
  - Single Taxon Frequency Classes (Biological Condition) - Subject Taxon Individuals are separated into classes based on "biological" parameters (i.e., sex, lifestage, or both). After a class is described, counts are entered for the various ranges of the selected biological parameter(s).
- Once a group has been added, its type cannot be changed.
- There is no order in which groups must be entered.
- No group type is mandatory for a given Field Activity.

8.3.2 Multi-Taxon Population Census (MTPC)

- Only one MTPC group may be created for a given Field Activity.
- Mandatory MTPC Result Group fields:
  - ID - Code that uniquely identifies the Multi-Taxon Population Census among Result groups for the Sample.
- Optional fields:

  - Description - Any additional text describing the Biological Result Group.
- The ID field cannot be modified.
- A MTPC Result Group may have one or more Results defined.
- Each result is associated to a Taxa Characteristic (i.e., type “T” or “G”).
- Characteristic selection may be from a pre-defined Characteristic Group or by Individual selection.
- The sequence order of Results may be modified by the user. Cut/Copy/Paste are allowed.
- A new Characteristic Group may be created that is based on the Characteristics selected for the MTPC group.
- MTPC Chars/Results may be added or removed at any time.
- Mandatory MTPC Result fields:
  - Result Value.
  - Result Unit of Measure (if not TEXT or PV) - (selection list).
- Optional MTPC Result fields:
  - Species Number - A user-defined species number for the Subject Taxon (drop down list).
  - Statistic Type - The statistic or calculation type that best describes the reported Result (drop down list).
  - Value Type - The name that represents the process that was used in the determination of the count (i.e., actual, estimated, calculated) (drop down list).
  - Value Status - The status of the Result (i.e., final or preliminary) (drop down list).
  - Functional Feeding Group - Enter the means by which the Organization obtains food.
  - Taxon Pollution Tolerance - An estimate of the ability of an organism to live in a polluted habitat.
  - Trophic Level - Where in the food chain an organism normally subsists (e.g., plant).
  - Habit - A characteristic form, aspect, or mode of a plant or animal (drop down list).
  - Voltinism - The duration required to complete a life cycle/generation (drop down list).
  - Comments - Any additional comments concerning the count.
  - Document/Graphic - A document or graphic file that represents the current Result. Valid file types are Portable Document Format (PDF), Joint Photographic Experts Graphic (JPEG/JPG), Bitmap (BMP), Graphic Interchange Format (GIF), and Text (TXT).
  - Lab Sample Prep - Choose a sample preparation procedure used in the lab that the current organization has identified as applicable to this analyte (selection list).

  - Field/Lab Procedure - Choose a method that the current organization has identified that is used in the field and/or lab to generate numeric values (results) for a Chemical or Field Measurement (selection list).
  - Lab Info - Choose a laboratory that the current organization has identified (selection list) and enter other information about its processing for this analyte, including its Detection and Quantification Limits during processing.
- Value Type defaults to “Actual”.
- Value Status defaults to “Final”.
- If the Field Activity community equals Phytoplankton/Zooplankton, Periphyton, or Bacteria/Virus, then the following additional optional MTPC Result fields are available:
  - Cell Form - The name of the cell form for the organism (drop down list). A single species may have a Result Value for any or all of these Cell Forms.
  - Cell Shape - The cell shape of the organism (drop down list). For example, a chrysophyta can have a form and a shape.
- If a null Result Value is detected, then the user is warned.
- If a duplicate Result is detected, then the user is warned.

8.3.3 Single Taxon Individuals (STI)

- One or more of STI type groups may be created for a given Field Activity.
- Mandatory STI Result Group fields:
  - ID - An ID that uniquely identifies the Single Taxon Individual group among other Result groups for the Sample.
  - Subject Taxon - The organism that was the focus of the study (selection list).
  - Species Number - Required for Subject Taxons that have a taxonomic rank greater than “species” (drop down list).
  - Total Number of Individuals - The total number of individuals in the group. The maximum number of individuals that can be examined for a result group is 999. Must be a value greater than 0.
- Optional fields:
  - Description.
- The following fields cannot be changed: ID, Subject Taxon, and Species Number.
- If the selected Subject Taxon characteristic is a MTPC Characteristic, then default “total number of individuals” with the MTPC Result Value.
- On change, the “Total Number of Individuals” may be increased but not decreased.
- A STI Result Group may have one or more Individuals defined (based on the “Total Number of Individuals” value).
- A Single Taxon Individual group may have one or more Results defined.
- Each individual in a given Single Taxon Individual group has the same number of Results.
- Each Result is associated to a Biological Physical Measure Characteristic.

- Characteristic selection may be from a pre-defined Characteristic Group or by Individual selection.
- When a Characteristic is selected, it creates a Result for each Individual in the group.
- The sequence order of Results may be modified by the user. Cut/Copy/Paste are allowed.
- A new Characteristic Group may be created based on the Characteristics selected for the STI group.
- STI Chars/Results may be added or removed at any time.
- Deleting a Char/Result will delete that row from each Individual.
- Deletion of an Individual will also delete all its Char/Results.
- Mandatory STI Result fields:
  - Result Value.
  - Result Unit of Measure (if not TEXT or PV) (selection list).
- Optional STI Result fields:
  - Value Type.
  - Value Status.
  - Weight Basis - The name that represents the form of the Sample or portion of the Sample that is associated with the Result Value (drop down list).
  - Comments.
  - Document/Graphic.
  - Lab Sample Prep.
  - Field/Lab Procedure.
- Value Type defaults to “Actual”.
- Value Status defaults to “Final”.
- Lab Information is not applicable for STI Results.
- If a lower and upper range is provided, give the user a warning message if the Result Value entered is outside the lower and upper range values. Leave range values in place regardless.
- If a lower and upper range is provided and the Unit of Measure is changed, give the user a warning message. If the new unit is confirmed, then clear out range values since they are no longer valid with the different unit specified.
- If a null Result Value is detected, then the user is warned.
- If a duplicate Result is detected, then the user is warned.

8.3.4 Single Taxon Group Summary (STGS)

- One or more of STGS type groups may be created for a given Field Activity.
- Mandatory STGS Result Group fields:
  - ID - An ID that uniquely identifies the summary group among other Result groups for the Sample.
  - Subject Taxon.
  - Species Number (if required).

  - Total Number in Group - The total number of organisms in the summary group.
  - Count Type - The type that represents the process that was used in the determination of the count (i.e., Actual, Estimated, Calculated). This choice applies to all counts entered for the Result Group. The default value is “Actual”.
- Optional fields:
  - Description.
- The following fields cannot be changed: ID, Subject Taxon, and Species Number.
- If the selected Subject Taxon characteristic is an MTPC Characteristic, then default “Total Number in Group” with the MTPC Result Value.
- A STGS Result Group may have one or more Results defined.
- Each Result is associated to a Biological Physical Measure Characteristic.
- Characteristic selection may be from a pre-defined Characteristic Group or by Individual selection.
- The sequence order of Results may be modified by the user. Cut/Copy/Paste are allowed.
- A new Characteristic Group may be created that is based on the Characteristics selected for the STGS group.
- STGS Chars/Results may be added or removed at any time.
- Mandatory STGS Result fields:
  - Result Value.
  - Result Unit of Measure (if not TEXT or PV) (selection list).
- Optional STGS Result fields:
  - Value Type.
  - Statistic Type.
  - Value Status.
  - Weight Basis.
  - Comments.
  - Document/Graphic.
  - Lab Sample Prep.
  - Field/Lab Procedure.
  - Lab Info.
- Value Type defaults to “Actual”.
- Value Status defaults to “Final”.
- If a lower and upper range is provided, give the user a warning message if the Result Value entered is outside the lower and upper range values. Leave range values in place regardless.
- If a lower and upper range is provided and the Unit of Measure is changed, give the user a warning message. If the new unit is confirmed, then clear out range values since they are no longer valid with the different unit specified.
- If a null Result Value is detected, then the user is warned.
- If a duplicate Result is detected, then the user is warned.

8.3.5 Single Taxon Frequency Classes (STFC) (General)

C One or more of STFC type groups may be created for a given Field Activity.
C Mandatory STFC Result Group fields:
  - ID - An ID that uniquely identifies the frequency class among other Result groups for the Sample.
  - Subject Taxon.
  - Species Number (if required).
  - Frequency Analysis (radio button) - Choose the frequency type that best describes the count that was performed:
    -- Single Taxon Frequency Classes – Physical Measures.
    -- Single Taxon Frequency Classes – Biological Condition.

C Optional fields:
  - Description.

C The following fields cannot be changed: ID, Subject Taxon, Species Number, and Frequency Analysis.
C On initial add of the Class Group, default the Count Type to “Actual” and Value Status to “Final”.
C Count Type must be the same for all Results in a given Class.
C Value Status must be the same for all Results in a given Class.
C Result Unit of Measure is always “Count” and is set behind the scenes.
C STFC Results/Result Class Intervals may be added or removed at any time.
C Lab Sample Prep, Field/Lab Procedure, and Lab Info are not applicable for STFC.

8.3.6 Single Taxon Frequency Classes (Physical Measures)

C A STFC Physical Measure group may have of one or more Results defined (i.e., Result/Result Class Interval combinations).
C Mandatory STFC Physical Measure Result “class” fields:
  - Common Class Descriptor Subject Taxon - The physical parameter that was used to group the Individuals.
  - Common Class Descriptor Unit - A unit of measurement of the common class descriptor.
  - Count Type - The type that represents the process that was used in the determination of the count (i.e., Actual, Estimated, Calculated).
  - Value Status.
  - Lower Bound Amount - Lower range for the class.
  - Upper Bound Amount - Upper range for the class.
  - Count - The Result class value.

C Optional STGS Result fields:

  - Sex Group Descriptor (drop down list) - Used when the entire group of Individuals share the same sex or you desire to discriminate your physical measurements based on sex.
  - Lifestage Group Descriptor (drop down list) - Used when the entire group of Individuals share the same lifestage or you desire to discriminate your physical measurements based on lifestage.
- Upper Bound Amount cannot be less than Lower Bound Amount.
- Overlapping Class boundaries are not allowed.
- Optional group descriptors and common class descriptor Subject Taxon/Unit are the same for all Results in a given Class.

8.3.7 Single Taxon Frequency Classes (Biological Condition)

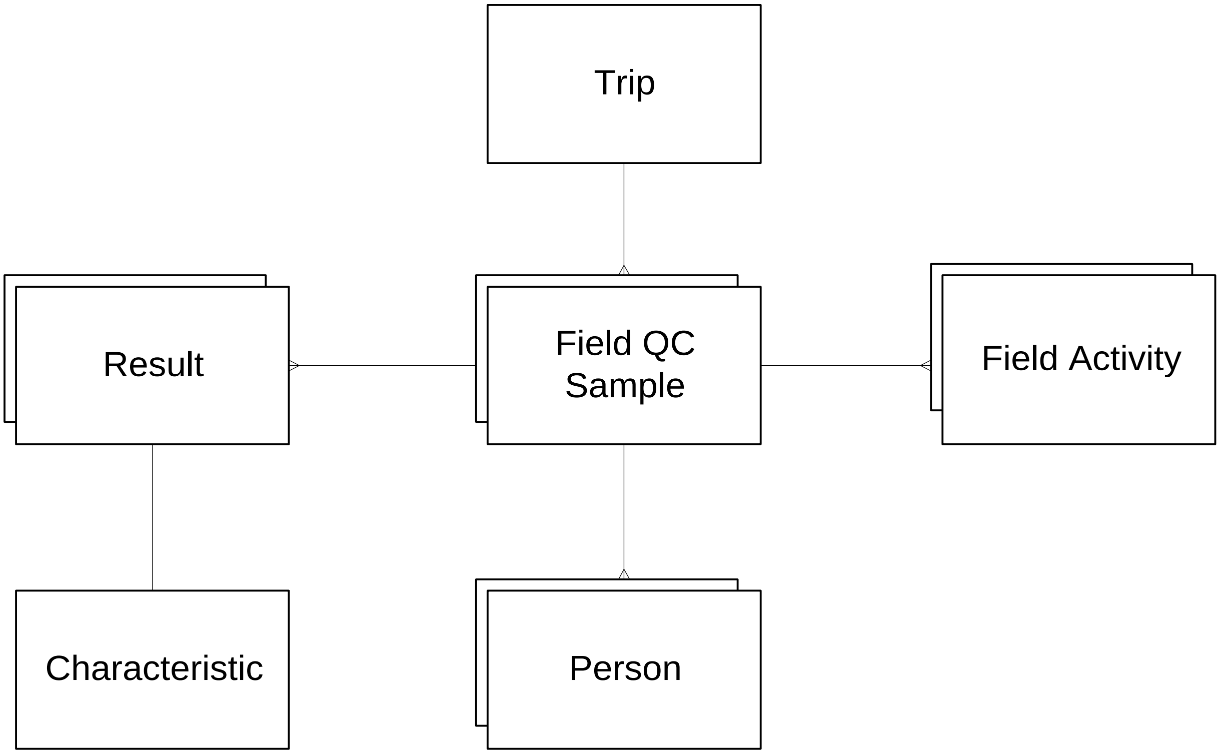
- A STFC Biological Condition group may have one or more Results (i.e., Result/Result Class Interval combinations).
- Mandatory STFC Biological Condition Result “class” fields:
  - Primary Class Descriptor - Primary biological parameter (i.e., lifestage or sex). The Primary field provides a general category around which classes will be defined.
  - Count Type.
  - Value Status.
  - Result Primary Class Descriptor Value - Define the class that was created. List of possible parameters is based on the Primary Class Descriptor that was chosen above.
  - Count.
- Optional STGS Result fields:
  - Secondary Class Descriptor - Secondary biological parameter. The selection is limited to the class descriptor that was not chosen for Primary (i.e., either lifestage or sex).
  - Result Secondary Class Descriptor Value - Further define the class that was created. List of possible parameters is based on the Secondary Class Descriptor that was chosen above. Only applicable if a Secondary Class Descriptor has been supplied.
- The Primary and Secondary Class Descriptors are the same for all results in a given class.
- Primary Class Descriptor assignment is mandatory, but Secondary is optional.
- If a Secondary Class Descriptor is entered, then the Result Secondary Class Descriptor Value must be provided.

9.0 TRIP LEVEL QUALITY CONTROL (QC) SAMPLE SUMMARY

9.1 Description

General: Quality Control Samples appear at many levels in STORET, however, the majority of QC Samples are created during a Station Visit. In addition to these Station Visit QC Samples, STORET provides for the creation and storage of QC Samples which are designed to span Station Visits during a single Trip. Reagent Blanks, Trip Blanks, and Equipment Blanks are examples of QC Samples which have a relationship to many samples collected during the many Station Visits which make up a single Trip. After the Trip and subsequent QC Sample Analysis the QC Sample to Field Sample association needs to be made to accurately describe the measurement control mechanism represented by the Trip Level QC Sample Results. Further information about QC Samples is provided in the Trip/Station Visit Summary section of this document.

9.2 Functional Diagram



- A Trip may have one or more Field QC Samples.
- A Field QC Sample may have one or more Persons assigned.
- A Field QC Sample may have one or more Field Activities assigned.
- A Field QC Sample may have one or more Results.

- A Result may have one Characteristic assigned.

9.3 Business Rules

9.3.1 Field QC Sample

- A Trip may have one or more Field QC Samples defined.
- Before QC Samples can be recorded for a given Trip, the Trip must have at least one Project assigned.
- You may create an unlimited number of QC Samples.
- Mandatory fields:
  - ID - Code that identifies the Field QC Sample within the database. This code must be unique within the Trip.
  - Type - Type of QC Sample (e.g., Trip Blank).
- Optional fields:
  - Name - The Organization-defined name of the Field QC Sample.
  - Creation Date - Date upon which a QC Sample was created.
  - Creation Time - Time which a QC Sample was created.
  - Creation Time Zone - Code that represents the time zone for the QC Sample Creation Time.
  - Sample Volume/Unit - The total volume of material that comprises the Field QC Sample.
  - Comments - Any further information about the QC Sample.
- All fields are modifiable.
- Date requirements:
  - Date field must have the following date format: MM-DD-YYYY.
  - Time field must have the following format: HHMM.
  - Time must have an associated time zone value and vise versa.
  - A time cannot be provided without a date.
- Any one of the QC Samples that were prepared for the Trip can be assigned to any or all of the Samples collected during the Trip.

9.3.2 Field QC Sample Method and Storage

- There are no mandatory QC Sample method and storage requirements.
- Optional fields:
  - Container Color - The color of the container (e.g., clear).
  - Container Type - The type of the container (e.g., plastic bottle).
  - Container Size/Unit - The size of the container.
  - Method and Reagents Used - Any further information concerning how the Field QC Sample was created.

  - Comments - Any further information about the handling, transport, and storage of the Field QC Sample.
- The user may choose from a list of predefined Organization Field QC Sample Default Profiles, enter each field manually, or a combination of the two.

9.3.3 QC Sample Results

- A QC Sample may have an unlimited number of Results.
- QC Sample Results can be any Non-Biological Regular Result (i.e., Chemical, Physical, Text, and Permitted Value [PV]). See Regular Results business rules for details.
- A Result is associated to a Non-Taxa Characteristic that is “valid for QC” Samples.

9.3.4 Field Activity QC Sample Assignment

- Any one of the QC Samples that were prepared for the Trip may be assigned to any or all of the Samples collected during the Trip. This assignment is critical in preserving the value of the information collected during environmental monitoring.

9.3.5 Field QC Sample Person Assignment

- The list shows who created which QC Samples. One QC Sample may be associated to one or more “active” Personnel defined in the Organization. This list may be sorted according to the QC Sample ID or the people who created the Samples.

10.0 AUTOMATED DATA LOGGER SUMMARY

10.1 Description

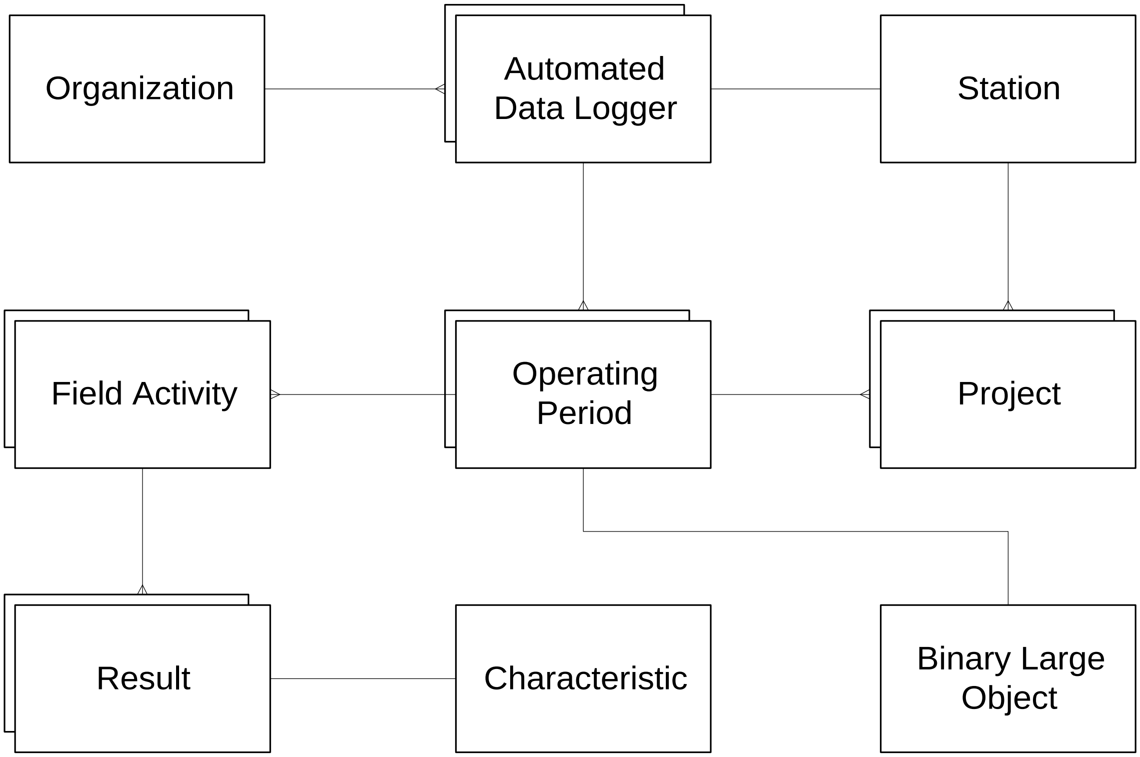
General: Ths Section describes the deployment and installation of fixed Automated Data Loggers. A fixed Automated Data Logger differs from a Portable Data Logger in that data are not associated with a Trip and Station Visit. Fixed Automated Data Loggers are installed at stations, and visited from time to time to collect data, or perform maintenance such as battery changes, or probe cleaning and replacement. Any interruption in the continuous operation of the Automated Data Logger should be considered a visit. The time between visits is recorded as an Operation Period. The data collected from the device during these visits represents an Operating Period worth of data. A single installation may have many Operating Periods and each Operating Period may be assigned to one or more Projects.

Installations: Information is recorded about the Installation which does not change for the life of the Installation. If a new Automated Data Logger is installed at the same location, a new Installation should be created. The data associated with the Automated Data Logger Installation includes Installation ID, Medium, Install Date, Station ID, Sampled Matrix, Installation Date/Time, Removal Date/Time, Data Recorder Make, Data Recorder Model, Data Recorder Serial Number, and Installation Comments.

Operating Periods: Each Operating Period is independently defined. The probes on the Automated Data Logger each represent a different characteristic. The probes may be changed to collect different characteristics for each Operating Period on a given Installation. The data associated with the Automated Data Logger Operating Period includes Log File Name, Start Date and Time, Stop Date and Time, Sampling Interval, at least one Project Assignment, and Calibration Information/Comments.

Results: Monitoring Activities may be created for every logger probe scan. The Monitoring Activities and associated Results values may be stored directly into the database. The creation of the Monitoring Activities is done automatically based on the Start Date/Time, Stop Date/Time, and recording Interval established for the Operating Period. Results are stored for each probe/characteristic for every recording Interval. Alternatively, a single electronic file (e.g., PDF, TXT) may be stored providing the Monitoring Activity and Result data. Electronic file storage offers a simpler approach, and depending on the stored format, may permit subsequent retrieval of the information into other software (e.g., spreadsheets) for analysis. The disadvantage to electronic file storage is that some analyses, such as those which examine data across many installations or operating periods, may be difficult or impossible to perform. This broader view of data analysis may be easier to perform via direct storage of individual result values in the database.

10.2 Functional Diagram



- An Organization may have one or more Automated Data Loggers.
- An Automated Data Logger may have one Station assigned.
- A Station may have one or more Projects assigned.
- An Automated Data Logger may have one or more Operating Periods.
- An Operating Period may have one Binary Large Object.
- An Operating Period may have one or more Field Activities.
- A Field Activity may have one or more Results.
- A Result may have one Characteristic assigned.

10.3 Business Rules

10.3.1 Automated Data Loggers

- An Organization may have one or more Automated Data Loggers defined.
- An Automated Data Logger may have one Station assigned.
- The list of available Stations are those Stations that have a Project assigned.
- Mandatory fields:

- Installation ID - An ID that is unique within the Organization’s list of Automated Data Logger installations.
- Medium - The Medium that the Automated Data Logger monitors.
- Station - The Station where the Automated Data Logger was installed.
- Install Date - The date that the Automated Data Logger was installed.

C Optional fields:
- Matrix - Select a sample matrix that further defines what the Automated Data Logger monitors.
- Install Time - The time that the Automated Data Logger was installed.
- Removal Date - The date that the Automated Data Logger was removed.
- Removal Time - The time that the Automated Data Logger was removed.
- Make - The manufacturer’s make for the Data Recorder.
- Model - The model or model number for the Data Recorder.
- Serial Number - The Data Recorder’s serial number.
- Comments - Any additional description about the Data Recorder or installation process.

C The user may add, update, or delete Automated Data Loggers.

C The list of Automated Data Loggers is sorted by Installation ID.

C Date Requirements:
- All date fields must have the following format: MM-DD-YYYY.
- All install time fields must have the following format: HH:MM:SS.
- Time must be less than 24:00:00.
- Time cannot be entered without an associated date.
- Removal Date must be after Install Date.

10.3.2 Operating Periods

C An Automated Data Logger may have one or more Operating Periods.

C Mandatory fields:
- Log File Name - The name or identifier of the file that contains the data from the Operating Period.
- Start Date - The Start Date (i.e., the date of the first scan or of the first array interrogation) for data recording. This field defaults to the Data Logger Install Date.
- Start Time - The Start Time (i.e., the time of the first scan or of the first array interrogation) for data recording.
- Stop Date - The Stop Date (i.e., the date of the last scan or of the last array interrogation) for data recording.
- Stop Time - The Stop Time (i.e., the time of the last scan or of the last array interrogation) for data recording.
- Interval Hours - The hours portion of the time that elapses between probe/sensor interrogations.

  - Interval Minutes - The minutes portion of the time that elapses between probe/sensor interrogations.
  - Interval Seconds - The seconds portion of the time that elapses between probe/sensor interrogations.
- At least one of the hours, minutes, or seconds fields must be filled to create an Operating Period; a combination of all three fields may not always be needed.
- Optional Fields:
  - Calibration Info/Comments - Any additional comments related to the Operating Period.
  - Automated Logger Data File - A file, document, or graphic that contains the Data Logger readings/information for the current Operating Period. Valid file types are Portable Document Format (PDF), Joint Photographic Experts Graphic (JPEG/JPG), Bitmap (BMP), Graphic Interchange Format (GIF), and Text (TXT).
- The Calibration Info/Comments field is modifiable.
- The Automated Logger Data File is modifiable.
- An Operating Period must be unique by Start Date or Start Time within the Automated Data Logger.
- An Operating Period must have at least one Project assigned.
- The list of Available Projects includes all Projects assigned to the Station chosen for the Automated Data Logger.
- An Operating Period may be represented as one or more Field Activities, a single Automated Logger Data File, or a combination of both.
- Date Requirements:
  - All date fields must have the following format: MM-DD-YYYY.
  - All install time fields must have the following format: HH:MM:SS.
  - Time must be less than 24:00:00.
  - Time cannot be entered without an associated date.
  - End Date must be after Start Date.

10.3.3 Field Activity Creation

- The Field Activity Creation process (if requested) is done automatically.
- The number of Field Activities created is based on the Start Date/Time, Stop Date/Time, and Interval of the Operating Period.
- Each Activity serves as a single reading with the occurrence of each reading based on the number of Sampling Intervals that can occur from start to end of the Operating Period.
- Each Created Field Activity (or reading) consists of the following:
  - Activity ID - A derived sequence number from 1 to N, where N is the determined number of Field Activities to be created.
  - Activity Type - Set to “Data Logger”.

  - Category Type - Set to “Automated Measurement”.
  - Medium Type - Same as the Medium of the Automated Data Logger.
  - Start Date - Date upon which a reading began.
  - Start Time - Time when a reading began.
  - Matrix - Same as the Matrix of the Automated Data Logger.

C Once Field Activities have been created for an Operating Period, no additional Field Activities may be created for that Operating Period.

10.3.4 Results

C If an Operating Period has Field Activities defined, then each Field Activity can have one or more Results.
C Each Result is associated to a Characteristic of type, subcategory Data-Logger Probes.
C Characteristic selection can be made from a pre-defined Char Group or by individual selection.
C Each Field Activity will contain the same number of Results.
C When a Characteristic is selected, it creates a Result for each Field Activity in the Operating Period.
C The list of Results/Characteristics have the same order (result sequence numbers) for each Field Activity associated with the Operating Period.
C Operating Period Chars/Results can be added or removed at any time.
C Deleting a Char/Result will delete that row from each Field Activity.
C The Results associated with Operating Period Field Activities may be either Chemical or Physical. See the Regular Results business rules for more information.