ONTARIO STREAM ASSESSMENT PROTOCOL

SECTION 6, MODULE 2

Using the Flowing Waters Information System Portal[1]

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1.0 BACKGROUND ON FWIS

The Flowing Waters Information System (FWIS) has been developed to help Ontario's flowing water practitioners to access and manage information on flowing waters. This tool offers a "one-start" approach for identifying where and what data has been collected, by whom and using which techniques/protocols. While FWIS will never hold all flowing waters data, it should hold a "core" of common data and then refer practitioners to other sources for more details that were collected by various individuals and organizations.

Data are organized by projects, and descriptions are provided to assist users in understanding why data were collected, how site locations were selected and any specific biases that might be associated with the data. This collaborative database can be used by practitioners to provide input to site specific development plans, fish management plans, state of resource reporting, and monitoring. In addition, specific shared datasets, e.g., those collected with the Ontario Stream Assessment Protocol, can provide input to predictive models for stream habitat quality and/or specific fish species presence.

The intention in Ontario is to move towards freer access to information while still protecting sensitive data and the rights of researchers to first publication. FWIS helps you locate and edit site locations where stream sampling was done, identify streams and stream reaches that have not been sampled, and track changes. Unique identifiers are assigned to site locations to ensure duplicate records are not created. Historical site codes are maintained to maintain linkages to the contributing organization's original field sheets and database records.

FWIS will be updated as new information is received and access to new records is achieved. Any practitioner working on flowing waters can access the system, but access to data will be tiered depending on the sensitivity of the information being accessed and the willingness of practitioners to co-share their information. FWIS increases access to flowing waters data while protecting sensitive data and the rights of researchers to publish.

The long term goal is to capture all types of Ontario's flowing water data and the meta-data that describes the study design considerations that influenced why and what types of data are collected from small intermittent streams to large systems like the Moose River and for both single observation and continual records. This lofty goal will be achieved in stages. A leadership team has been established that will begin the process of identifying available datasets and prioritizing efforts to make this information available. Priorities will be given to those datasets that follow standard protocols and are easiest to access first. The first phase (2008) is focusing on incorporating data from the existing HabProgs database, which includes information collected using the OSAP protocols. Note that as of 2013, benthic data collected using the OSAP protocols will be managed by the Ministry of the Environment, Environmental Monitoring and Reporting Branch. FWIS will be used to manage the stream codes and site codes and site description information and this information will be shared between the two organizations. There will be a period where this process will be manual and as such users must

be diligent to use the same stream code and site code information when entering benthic data into the Ministry of Environment, Conservation and Parks (MECP) portal and FWIS. Otherwise, matching datasets will be problematic.

FWIS can be accessed using a web browser[2] at https://www.comap.ca/fwis at which practitioners will see the opening screen (Figure A.1). At this screen the user can learn about FWIS, access a number of drop down menus for data discovery, editing data, running summary queries and reports, exporting data or collaborating. First, there are some general guidelines and functionalities that apply to the entire system that are summarized below.

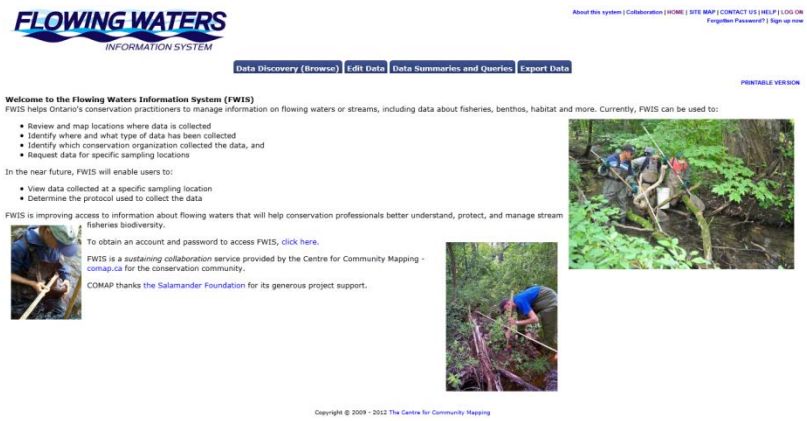


Figure 1: Opening Screen for FWIS

2.0 GENERAL OPERATING PROCEDURES

FWIS is organized into a series of "topic menus" like a book's table of contents. The top-level topic menu items are like chapter titles. Across the web site are a number of blue operational tabs that guide users to the main features of FWIS: Data Discovery; Adding data; Editing data; Summary queries and reports; and exporting data. Within each tab are several sub tasks as defined below. Once in a topic menu you can access the help guide (see below) to help make your use of FWIS more efficient and effective. The simplest way to navigate between pages is to click on the tab and if subforms are available within it, scroll to the appropriate page and click on that page. However, once users are deeper within the hierarchy of forms, other options emerge for navigating the system (see text box below).
Other options include:

Find: Like most web browsers users can speed searching by using the find feature (ctrl "f") on any page. Users should be aware that this feature only applies to the current page, (i.e., the first page of five pages of results) (see Figure 2).

[2] FWIS will work within any web browser, but users might find performance issues with some applications or conflicts as a result of firewalls within your organization. The developers have found that the system performs best when run with Mozilla Firefox or Google Chrome.

Options for returning to a previous page

1. Clicking the page ("Back") button on your browser
2. Right clicking anywhere on the page with white background and clicking "Back", or
3. Several FWIS pages include a "return to previous listing" link that will take you to the immediate previous page. This feature is very useful for moving between pages of a single sampling event (e.g., fish or channel morphology data).

Note: users can also page forward when a page has previously been visited by clicking on the forward arrow or button.

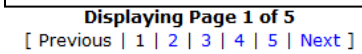


Figure 2: Number of pages in query

Save: At the conclusion of a search, users have the option of saving the results as either a SHP (shape file) or a CSV (comma separated file). These files can be downloaded by users and contain all the unique identifiers, spatial information and data associated with the query to enable users to bring the data into their own geospatial or analytical software for additional analysis. Users are strongly advised to maintain the unique "Global Unique Identifier" (GUID) that is a part of most exported files. Should any errors be found with the exported data, or if changes to stream codes or other values are required, updates to FWIS will be easier to apply within FWIS.

Memory: To assist users with queries, FWIS stores settings for queries between sessions. This feature assumes users are likely to carry out similar types of queries (areas, stream names, etc.) on independent sessions, but users must remember to click on the "reset search fields" Reset Search Fields button when settings have changed.

2.1 Background and Administration Tabs:

Background Information about the system is always present and is found on the top right corner of the website (see Figure 1 for an example). The "Home" page is accessed by either clicking on the "Home" tab on the upper right corner of every page, or by clicking on the FLOWING WATERS INFORMATION SYSTEM logo at any time. This page provides background information on the functionality and sponsors of the system. For more details on the system and what can be found in each of the modules, as well as many definitions click on the "About this system" button.

2.1.1 Sign Up Now

While metadata and site location information is accessible to the general public, specific datasets are not. Access to the field data is managed by a sharing strategy (see Appendix I) that is implemented through controls that are placed on individuals. Therefore users that wish to gain access to field data must access the system through a username and password. To become a user of FWIS, fill out the appropriate fields in the "Sign Up Now" page, read the terms of use page and initiate the "I agree to the terms and conditions" as defined on this page. You are required to enter ausername (your e-mail address is fine to use as a username) and a password (at least eight characters long).

A “Secret Question” and “Answer” are also required. The answer must be at least eight characters long and should not be known to anyone other than you. If you happen to forget your password, you can click on “Forgotten Password?” and the question will be displayed. When the question is answered correctly, the password can be changed from within the “Options” link.

2.1.2 Site Map:

The site map contains a complete listing of all the features in the web site and is particularly useful when you can’t find or remember where to go in the system to do a specific task.

2.1.3 Contact Us:

The FWIS managers are always looking for suggestions to improve the system and will respond to your queries for assistance when feedback is provided through this tab. Fill out the form and press “Send”.

2.1.4 Help:

Many of the common tasks and features of FWIS are described in the Help section and users are encouraged to read this section to improve their efficiency in using the system. Subject headings include: How to find information; Navigating lists; Searching forms for specific information; Keyword and map searches.

2.1.5 Log On/Log Off:

If you are not logged on, the “Log On” link is displayed and guides you to a log in form. When you are logged on, “Log off (username)” is display and allows you to log off when you are ready to leave the web site.

2.1.6 Options:

The Options link is used to manage your FWIS account settings. You can change your password, e-mail address, secret question/answer and the number of entries that are shown per page for long lists of data.

Passwords are only stored in FWIS in an encrypted form and there is no mechanism to decrypt them. As a result, FWIS does not show your current password or secret answer. Instead, a long sequence of characters and digits is shown. These characters may be shown as black circles or squares depending on your browser and whether you have asked to hide or show your password. To change your password you must first erase all of these characters (click in the field and type ctrl-a then press the “Delete” key), then enter your new password in the “Password” field and in the second password confirmation field. When you leave the password field unchanged, or the first and second (confirmation) fields don’t match, your password will not be changed.

Many pages of results within FWIS return long lists of results, such as stream codes, site codes, sampling information and so on. Initially a value of "50" results per page is set for these pages and this is usually adequate for most situations. In a few situations, it may be desirable to change the number of results per page to a higher or lower number and this number can be set using the "Results per page" drop-down menu of this page.

Please note the following important considerations for this option:

1. Within many list pages, there are links that allow you to "SAVE RESULTS AS CSV FILE" or "SAVE RESULTS AS SHP FILE." These links are not constrained by the number of results per page setting; all results that meet the constraints of the corresponding list (e.g., site codes on a particular stream, samples at a given site, etc.) are saved to the CSV or SHP file.

2. If you are using FWIS from a location with low or limited available internet bandwidth you should use care when selecting a "Results per page" setting greater than 250. Be aware that FWIS stores and uses each user's settings even when they log off, end a browsing session and return, so it is a good practice to return the "Results per page" setting to your preferred value before logging out. If you attempt to use FWIS and it appears to be taking an inordinate amount of time to display results, you may wish to interrupt the page and browse directly to the "Options" form to check, and possibly adjust this setting before you continue.

2.2 Mapping Within FWIS

There are several pages within FWIS that open additional menu item selections, or display a search form, a search form with a map, or a list of additional information for that topic.

One of the strengths of FWIS is the mapping capabilities that utilize some of the most up-to-date spatial data available. On many pages within FWIS, users have options to use the mapping features to either find or display sample sites. In most contexts, the "buttons" (usually called "tools") on the map are similar. To activate any of the buttons move the cursor over the feature until a hand appears, then "click". This section describes several general features that are available throughout the system.

2.2.1 Pan and Zoom 

On the left side of all maps is a stylized magnifying glass, a bar and a series of arrows that collectively enable users to zoom in or out (change scale) on maps, pan in eight directions (north, east, south, west, NE, SE, SW or NW - click on the arrow head) or recenter the map (click in the center of the arrow block). To initiate the pan and zoom, click anywhere on the tool and either drag or click to your preferred map view. Once either the in (+ve) or out (-ve) feature has been initiated, clicking multiple times zooms the map in that direction in a comparable way as clicking on the actual bar (e.g., 5 rapid clicks is equivalent to 5 stages on the bar). Panning can also be

accomplished by clicking anywhere within the map, holding your finger on the mouse and dragging the map in the desired direction.

2.2.2 Find a Location:

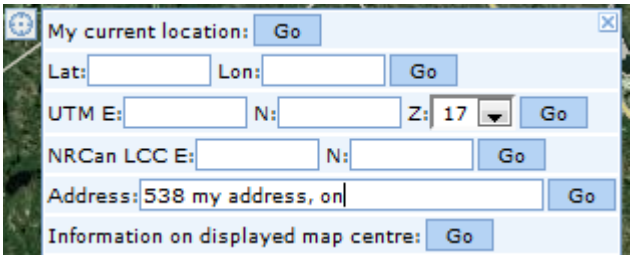


Figure 3: Find a Location window

The stylized compass opens a page that enables users to "find a location" using a variety of tools including the following options:

1.My current location – if you have provided your browser with your location, or if you are browsing from a mobile device with a built-in GPS and you have authorized the browser to access the GPS, this option will zoom and center the map to your location.

2. Geocoordinates - You can type in either latitude and longitude values, a UTM easting/northing and zone, an NRCan LCC northing and easting, or a textual description of the location (such as a nearby street address, intersection, municipality and province abbreviation, as in, "Hwy 401 and Deseronto Rd, Tyendinaga, on" – without the quotation marks). When you press "Enter" or click on the appropriate "Go" button, the map is zoomed to that location; you can then pan or adjust the map a specific sampling location and/or see whether other sites are nearby.
3. Information on displayed map centre – information for the centre of the current map view is displayed (usually latitude/longitude).

2.2.3 Choose Visible Layers

The icon that resembles a stack of pages opens a window that allows users to open various predefined or user-defined spatial layers. These layers facilitate orientation for users (e.g., a road layer); querying for pre-determined areas such as a conservation authority or watershed boundaries, etc. The mapping tool connects to a server that provides Web Mapping Services ("WMS"). WMS is an OpenGIS map image that can be displayed but not directly queried. Examples of this type of layer in FWIS include the roads layer and as a demonstration tool, the predicted fish assemblage states as defined in Stanfield (2012) (Figure 5). Vector layers provide more querying capabilities because they contain distinct boundaries (lines or polygons) that can be used to query datasets for inclusion of points within boundaries. Users can also upload their own shape files that have been generated from traditional GIS software by clicking on the "User Uploaded Layers" and navigating to a SHP, GPX or PRJ file that has been stored in NAD83 format and is less than 14 MB in size.

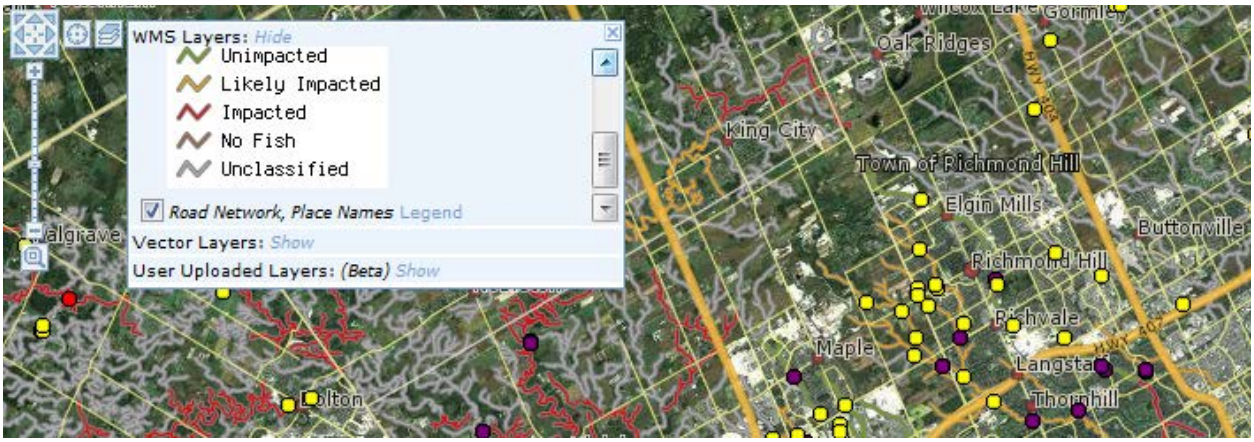


Figure 4: Clip of a section of Lake Ontario tributaries with classified stream segments from Stanfield (2012) and existing fish sample sites. Note colour of sites reflects their confidence in locations, not fish condition.

2.2.4 Save a Snapshot

The icon that looks like a camera allows the user to create a jpg of the current map that has been generated. Legends are not included in the picture and must be added by the user. It is recommended that the user save the zipped file to their local system where it can be accessed for your own use.

2.2.5 Measure Distance on a Map

A particularly useful too is the ruler that enables users to measure distances on a map. Initiate the tool by clicking on it, then click at a location on the map and move the mouse to the next location (e.g., the end or a bend in a river) and click again. Single clicks anchor the line and a double click completes the distance (see example Figure 6)

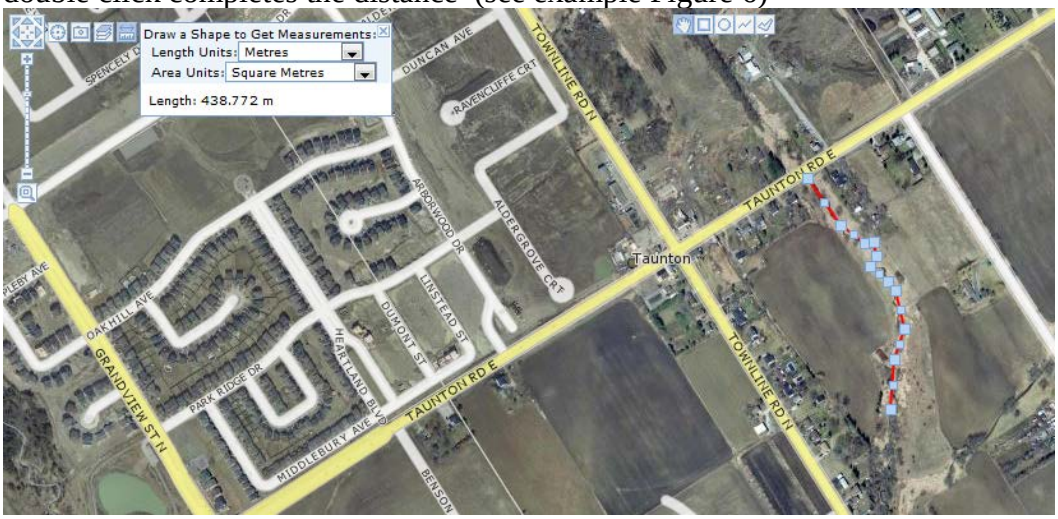


Figure 5: Example of the Measurement tool available in FWIS. Stream distance to a sample location was 439 m

2.2.6 Drawing Features for Querying:

Figure 6: Using the Line Drawing Feature to define a polygon, in this example a headwater watershed.

Several drawing features are available to assist users in defining polygons to be used for querying the database. These tools are displayed and available to use when a map is used to constrain a list of items to a desired geographical area. Predefined shapes include squares and circles that, once initiated, the user drags the mouse from a starting point to an ending point and the system reportss the area and perimeter of the polygon. The line function can be used to define any shape or polygon. Each location the user clicks the mouse on anchors a point and draws a line between points that are eventually joined into a user defined polygon (Figure 6). The hand button is clicked when drawing is completed. The new polygon can now be used for spatial queries. The arrow provides another means of accessing the vector layers described above.

2.3 Operational Tabs

Across the web site are a number of blue operational tabs that guide users to the main features of FWIS: Data Discovery; Adding data; Editing data; Summary queries and reports; and exporting data. Within each tab are several sub tasks as defined below. The simplest way to navigate between pages is to click on the tab and if subforms are available within it, scroll to the appropriate page and click on that page. However, once users are deeper within the hierarchy of forms, other options emerge (see text box below).

2.4 Data Discovery

The data discovery menu is open to the public and enables anyone to discover the metadata associated with information contained within FWIS. However for several reasons - usually the result of either sensitivity of specific data (e.g., presence of listed species) or requests for delays in making data available due to proprietary rights of publication, some data is protected and not available to the public (see Access Type below). Discovering datasets is accomplished by conducting either a tabular or spatial query that can be constrained using a number of criteria. Both approaches are required to account for sites for which the geocoordinates remain inaccurate.

With both approaches, searches can be constrained to include specific combinations of field data (e.g., sites with fish (S3.M1) and channel morphology (S4.M2) data); or only data collected by one organization or associated with specific projects, years or individual protocols. The query (see Figure 7) is additive, meaning that it will extract all the site-samples that meet the criteria

using an “and” statement. Users can also refine the search to identify data associated with specific stream names, stream codes or individual sites. Upon selection of the criteria and running of the search, a listing of the sites is generated that can then be mapped by clicking on “Find currently displayed locations on the map”. The query results can also be saved as a CSV or shape file for further analysis. Users should consider the confidence in the spatial data when interpreting the accuracy of this data (see see Site Location Validation, below). Finally, users can explore the data associated with specific sites and gain access to the mapping tools used to edit map locations.

2.5 Spatial Discovery

The spatial discovery tab enables users to use the mapping features and a variety of predefined “polygons” to select datasets that meet specific user needs. To use this feature:
1. zoom into the general area you are interested in, then
2. initiate the appropriate polygon that will dictate the boundaries of the search,
3. determine the search criteria by selecting the appropriate fields from the drop-down lists, and
4. click “Search”

Figure 7: Choosing a vector layer to query, after zooming into the general area.

The results of these constrained spatial queries will return a listing of all the sites that meet the criteria of the query.

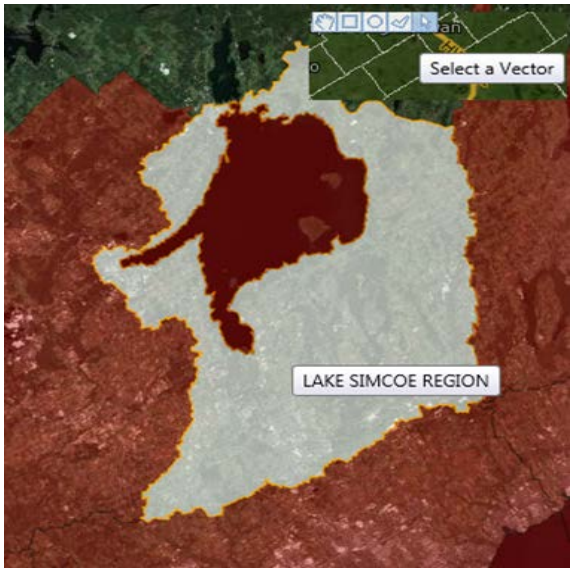


Figure 8: Spatially constrained query within the Lake Simcoe Region Conservation Authority

2.6 Tabular Data Discovery

The tabular discovery page (Figure 9) is particularly useful for searching for data that you are confident has at least one tabular field that will extract all of the site-samples from the database. To use this feature:
1. Select the criteria to be applied to the tabular search
2. Click “Search”

Tip: FWIS “remembers” past queries, so if you are developing a new query it is a good practice to reset the search fields.

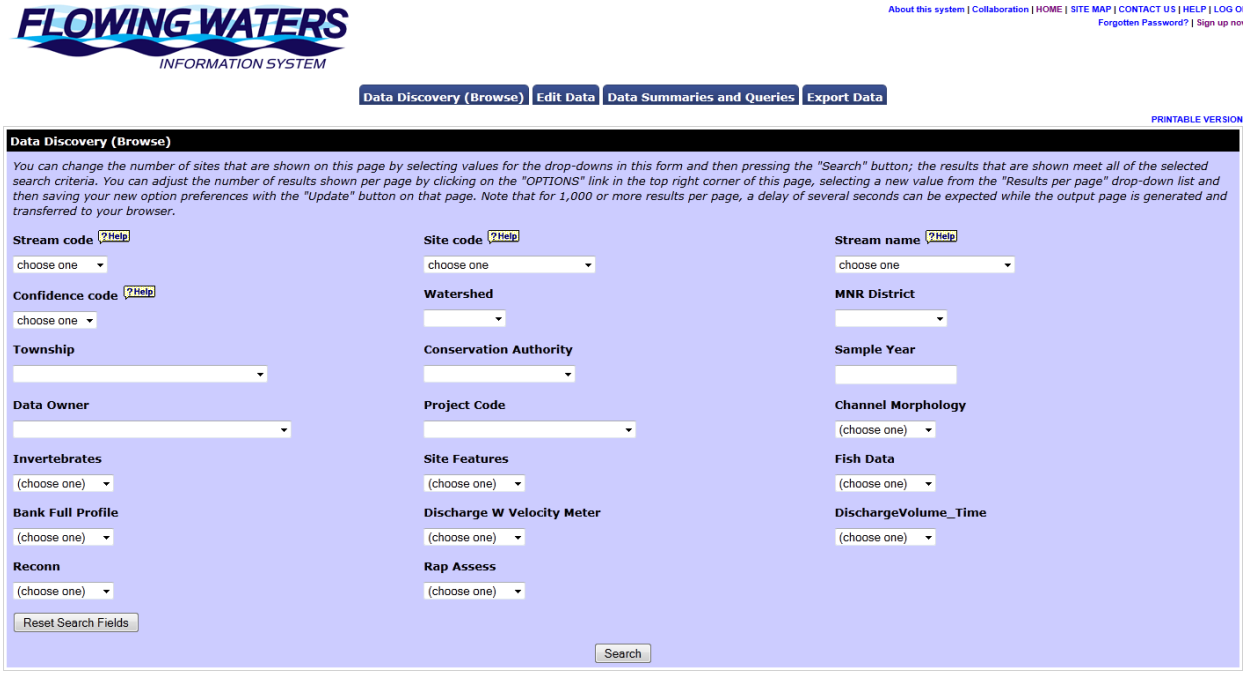


Figure 9: Tabular Data Discovery Page

3.0 MANAGING PROJECT METADATA

A key contribution of FWIS is to provide a tool for documenting the metadata associated with each project. A project defines/describes a study design that guides the collection of data and therefore articulates the assumptions that govern the interpretation of the results for a specific dataset. Over time, metadata will be recorded for all datasets in FWIS, as defined in module (S0.M1). Metadata also includes information on whether an restrictions exist on the use of specific datasets. Implementation of the metadata module will be modular as follows:

Existing FWIS Project Data:

1. Development of the data model and tools for capturing the information contained within the field sheets of the metadata module (S0.M1).

2. Population of historic project data within FWIS by the project development team. The current team has a reasonable understanding of the metadata for many of the projects currently located within FWIS and will use this to populate FWIS with draft data.
3. Project managers will be contacted to review and verify existing metadata records prior to making this information available to practitioners.

New FWIS Project Data:
Project managers will be required to complete project metadata records for all new datasets to be included in the FWIS database. Practitioners will be able to either use the FWIS portal and a variety of drop down menus to record the data or in time will be able to use the desk top application that is under development. Note that this task will be facilitated by filling out the field sheet first.

Managing the metadata records will also facilitate the inclusion of non-OSAP data in FWIS.

As metadata records are populated in FWIS the ability to query this information will be incorporated into drop down menus to enable practitioners to better understand the assumptions associated with sample data.

4.0 ADDING OR EDITING DATA

Whether adding new records or editing existing records, FWIS logs all transactions by system users, as part of the quality assurance of information. All transactions (system edits) are tracked using key identifiers that help link the stored data with future analytical tasks. This process gives confidence to project leads that data integrity is maintained regardless of user modifications. It also enables users to identify and offer suggested corrections to project managers to correct obvious data errors. The process is complicated by the distributed nature of the system that enables data to be captured from a variety of sources[3].

There are four main tasks in managing the field data that are described below: Managing Unique Identifiers for sites and samples; verifying site locations; adding data and; editing data.

4.1 Managing Unique Identifiers

Within FWIS, there is an effort to balance the needs of agencies to manage their own data identifiers with the need of researchers to ensure that landscape datasets contain spatially explicit information. To achieve this, FWIS assumes that agency data will contain unique stream and

[3] Data are obtained via historic HabProgs datasets; scannable forms software; spreadsheets, direct entry into FWIS and various desktop applications

site codes for datasets of their responsibility. This information is stored in fields called "Org stream codes" and "Org Site Codes" that enable organizations to always relate to their original data. But with over 7,000 sites in FWIS there is a reasonable probability that site codes already exist for locations where sampling is proposed or has been conducted, especially if they are near road crossings (see Figure 7). To facilitate integrated and temporal analysis it is beneficial to identify where sampling has occurred in proximity and in fact should be considered as replicates. Project managers are encouraged to use the data discovery and mapping features to determine whether a sampling location exists already that is within 40 m of the mid-point of an existing site and where sampling is intended to occur (see text box for exceptions). If no station has been sampled where sampling is to occur, then new site codes can be assigned for this new site. Otherwise we encourage users to assign the existing FWIS site code to the sample site following the principles described below.

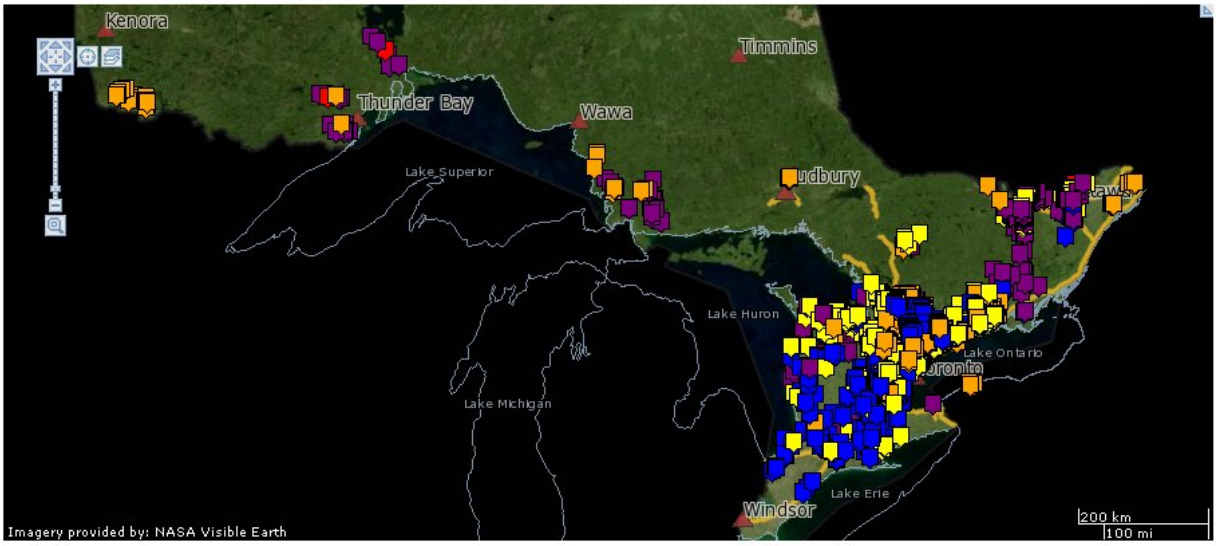


Figure 10: FWIS sample sites as of November 2012

Principle 1: Sites should be unique where they share cross-overs

In FWIS a site is defined as a location on a flowing water arc that is at least 40 m from another site that begins and ends at a cross-over. Therefore sites that share cross-overs should have the same site code. Only in special circumstances (see text box) should more than one site be

Examples of Exceptions to the 40 m proximal rule for site boundaries

1. A tributary enters a stream, since sites are located on a single segment
2. A barrier, or other feature, makes conditions different up and downstream of the feature
3. The upstream boundary of one site is the downstream boundary of another site. In many instances the straight line distance recorded in the GIS will be less than 40 m.

located within a 40 m length of river. Where these exceptions apply, users should provide a concise rationale in the comments field of the site description window for each site.

Principle 2: Stream Codes are unique for one stream

To date, users have assigned stream codes on a first come basis and this process has created situations where data has been "lumped" into larger watersheds (e.g., Credit River) while others have been split by their presence on tributaries. The presence of lumpers and splitters is only problematic in a tabular context, since queries to discover data relies on comparability of stream codes. In time, new codes will be assigned to all streams, but in the mean-time users are encouraged to think big (e.g., at least a subwatershed) when it comes to assigning stream codes to sampling areas. Use of comparable stream codes makes searching and tabular analysis much easier for everyone.

Where two organizations have either used the same stream code for a different stream or where different codes are assigned to the same stream, will require the project leads to reconcile and edit the data within FWIS to make the tabular data more consistent. Typically, the group with the most or older data will request the other dataset be changed.

Principle 3: Site codes must be unique within a FWIS stream code

Within FWIS a site code cannot be used more than once for a given stream code and while the system will accept obvious errors, (e.g., site_1; ste_1; site1; ste1) project leads are encouraged to reconcile obvious errors and omissions.

4.1.1 Determining the Uniqueness of Sample Site Identifiers

Working towards consistent tabular naming conventions is often iterative, in that users discover discrepancies through the use of the data. As such managing unique identifiers has been set up to be accessed through either the add or edit data windows. In effect, users adding new site locations are directed to ensure the new codes are consistent with the naming convention in place. Users editing data are also provided an opportunity to change codes to reflect the existing naming convention. Finally, users are encouraged to improve the system by providing brief descriptions (e.g., Tributary to the Speed River in Guelph) for the many streams that currently do not have this information as doing so will expedite the data discovery and review process.

In effect, users must determine which process to follow to ensure the sample data is stored in ways that maximize the efficiency of accessing and working with the tabular data. The scenarios are as follows:

1. The stream name exists but by description or by exploring the location of sites, you are assured that it is not the same stream – users assign a new unique stream code and brief description for the duplicate stream name.

2. A different stream name is used in the database than you have used – ideally use the stream name and stream code that others have already used. An exception occurs for names that you believe are incomplete or in error, then you are encouraged to "negotiate" with the leads on the projects responsible for these sample sites and develop consensus on a revised naming convention.

3. No data exists for this stream in the system – assign a new stream name and unique stream code for this watershed taking principle 2 into consideration for lumpers and splitters.

4.1.2 Creating New Unique Identifiers for a Sample Area

Once it has been determined that sampling data is to be entered for a new stream, open the Add/Edit Data tab and click on the Add/edit Stream Names/Codes. Click on the "Add an Entry" box and fill in the appropriate boxes (see Figure 11). Type in the stream name and use the view listing feature to ensure the stream code is unique for the database. The short description will help identify where in the province this stream is located. This feature is particularly helpful when users are trying to figure out which of the many duplicate stream names (e.g., Black Creek) is represented by which stream code. If you review the results to ensure no errors, don't forget to check the "Validated" box.

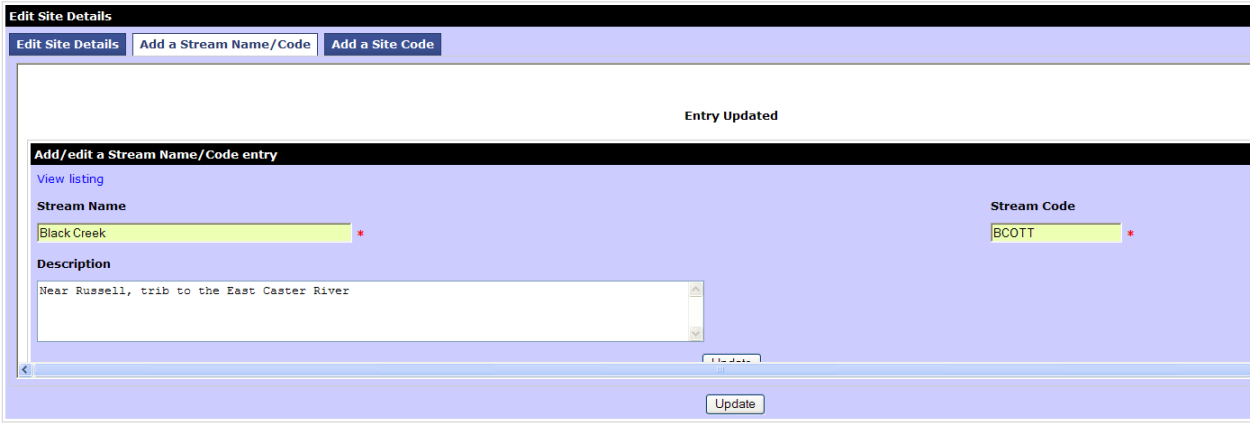


Figure 11: Window for assigning or editing stream names and stream codes

4.1.3 Modifying Existing Stream Names, Stream or Site Codes

Through spatial and or tabular queries determine which unique identifiers need to be changed (see text box for example). To edit an existing stream name, stream code or site code, click on the "Edit Data-Validate Sites.

Step 1: Navigate to the existing sample event for the site record

Step 2: Click on the edit box  and

Step 3: Choose either the add/edit stream names/code or Add/edit Site Codes box by either scrollingon the page or by typing in all or part of a name into the box that is in error, navigate to the desired unique identifiers and review/revise and update the record.

Step 5. If you are authorized, click the validated box.

4.2 Adding a New Sample Event

A sample event is an application of a module at a sample site. It must have a valid start date and be attached to a site with valid coordinates. Users establish sampling events by either uploading uploading the information from other sources (i.e., scannable forms, desktop application etc.), or by clicking and populating the "Add Sample Event" window. Navigate to the appropriate sample site and fill in the following meta data fields: Project Name; organization name; type of sample event(s) or data types collected; the sample event date; sample number and access type. Users assign access categories for their data at this stage. The access type categories are defined in Table 1.

Establish the appropriate stream and site codes as above, remembering to provide short descriptions of where both are located. Next, initiate the "Validate Sites" feature and navigate to the newly created site and click on the edit data button. This will initiate a window to develop the mapping coordinates information for the site. Fill in each box on the page that is white following the methods of Site Description (S1.M3). The greyed boxes will be populated once the site location is created and the update button is clicked. Navigate to the map at the bottom of the page and use either the zooming features and/or geocoding or by typing the coordinates, place a dot on the map where the bottom of the site is located. Hit the update button to send it to the database.

4.3 Site Location Validation

Knowing that the geocoordinates for a sample site accurately reflect its location can often be a critical component for spatial analysis. To assist users confidence codes are assigned to each site that indicate their status with respect to location validation. Representatives from organizations review the location of sites that their crews have established to ensure the mapping coordinates shown are reasonably accurate and the various codes indicate the status of this process. The codes and represented colours of sites on FWIS maps are as follows:

1. C1 - Corrected

Corrected and verified by project leads or their representatives and the FWIS data manager

2. C2 - Corrected Pending
   Corrected and verified by project leads or their representatives but not the FWIS data manager.
3. C3 - Uncorrected
   Field coordinates are applied but have yet to be verified by project leads or their representatives, but the location appears to be in correct location.
4. C4 - Unknown
   Information is missing that would enable the site location to be verified OR site coordinates taken from historical data
5. C5 - Contested
   Represents a temporary designation that is triggered by either the domain expert or an agency representative indicating that they disagree with the current location of this site. This designation triggers action of both representatives to attempt to resolve the location of this site.

Understanding the various types of coordinates for a FWIS site

Within FWIS one set of **Mapping** coordinates are assigned to a site as an enduring attribute of a sample site. These are intended to direct surveyors to the approximate location where sampling is conducted and are typically "snapped to a water layer to facilitate GIS analysis. **Corrected sample coordinates** are associated with sample events and so can vary from ear to year as station boundaries move with the dynamic characteristics of cross-overs. **Sample** coordinates represent the values collected using a GPS or other device while in the field. The confidence rating is only assigned to the mapping coordinates. Note that the mapping and corrected coordinates can be similar.

Managing Site Location Amendments by other users

One advantage of communal data is that any user can help improve the database by moving site locations that are currently obviously in the wrong location (i.e., the "dot" is not on the stream). When a user moves a site location it triggers a message to the database custodian to verify the correction. The database custodian will ask the project administrator to accept or reject this amendment before the correction becomes permanent.

4.4 Editing Existing Mapping Coordinates

To edit the mapping coordinates users initiate the "Validate Sites" feature and navigate to the appropriate "Edit Site Map Location". Within this window are the unique identifiers and a series of coordinates that reflect different mapping coordinates for the site, i.e., uncorrected, Sample

Corrected and FWIS mapping coordinates. A map shows the surrounding area associated with the coordinates. If the mapping coordinates indicate anything less than a code 2 review the site and if necessary move it to the correct location. Toggle the FWIS mapping coordinates so that it is "on".

This window also provides an opportunity to correct the "Sample" mapping coordinates, which in sites that have been sampled on multiple occasions can differ substantially in dynamic streams. Many agencies now track these differences using GPS in concert with site markers (See S1.M3). If the location of the site also reflects the corrected sample coordinates toggle that switch as well. Note that if the site has been already corrected (C1 or C2) based on historic locations of sampling DO NOT CHANGE THE MAPPING COORDINATES AGAIN. Rather make sure that only the corrected sampling coordinates are changes prior to updating the records.

5.0 ENTERING SAMPLING EVENT DATA

Data for new sampling events can be entered as follows.

- Select the "Add/Edit Data / Step 2: Add Sample Events" navigation link. The main "Sampling" listing is displayed. Click on "Click here to add a new sampling event record." (just above the sampling search form).
- A list of sampling events is displayed; click on "[Add an entry]" (at the top of the listing) to add a new sampling event. Figure A.12 shows the initial sample event form that must be filled in:

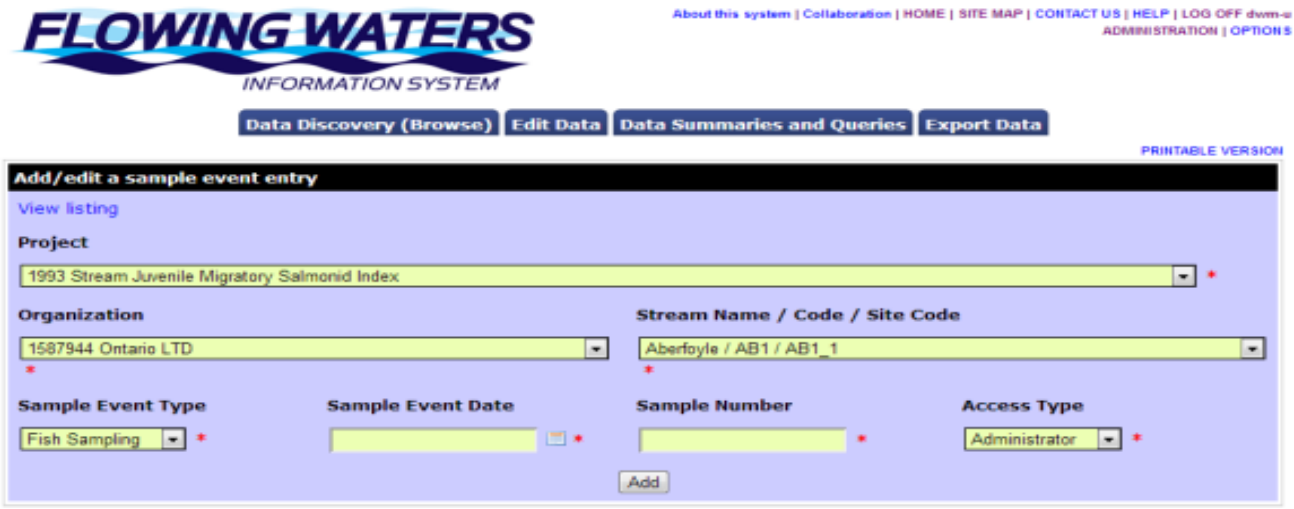


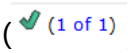
Figure A.12: Initial Sample Event Form

- Assign a sample event for every module that is applied to the site for **each date**. Note, application of a module on a different date will require its own unique sample event.

- When all fields are filled in, click on the “Add” button and the results of the sample event addition are shown.
- To add the details of the sampling activity, return to the “Edit Data / Step 2: Edit Sample Events” navigation link, locate the new entry in the sample event listing and follow the steps described above (Section 4.0 – Editing Sampling Event Data).

5.1 Adding/Editing Sampling Event Data

Once a sample event is established for a site, data can be added or edited within the system. The process is in effect the same, acknowledging that data can be received within FWIS from multiple entry points. Regardless of whether users use the FWIS interface or some other device to enter data, it must be verified and validated.

Data entry/editing is initiated by navigating to the appropriate sample event and clicking on either the green check mark (for a sample event) or blue bracketed numbers for replicate datasets (). This activity will open a data entry/editing screen that provides access to whatever data is already in the system. Users then either enter new data where gaps exist, or review each data record for both completeness and accuracy. Make use of the drop down windows wherever possible in the reviewing process and it is recommended that after each correction, the update button is hit. Note, this task is essential on a web based database to “commit” the data to the system. If users simply hit back or refresh or any other button, the data will not be committed and the changes will be lost. For many of the field sheets data are split between pages to facilitate data viewing and in recognition of data organization within the system. Access these various sections of the field sheets by toggling on the individual pages (e.g., Channel Widths or Individual Fish in Figure 12).

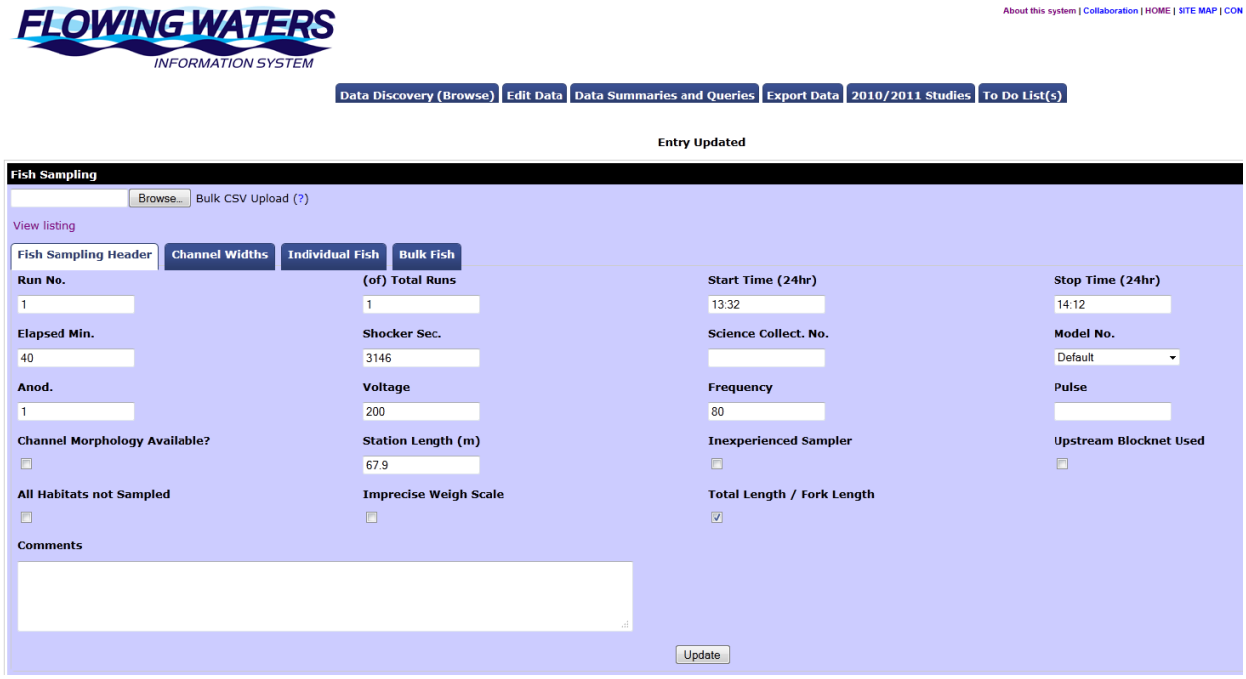


Figure 12. Example data review page for fish sampling.

5.2 Validating Sample Event Data

For quality assurance FWIS tracks the status of data as it proceeds from being raw and unverified to be reviewed and validated by the project lead. Users can decide to access data based on the following criteria that are assigned by the project leads or their designates.

Category	Description
Unverified	Information has been entered into the system without verification by a qualified representative of the project
Verified	Information has been reviewed and corrected by a representative or designate of the project organization but has not been reviewed by the project lead
Validated	Information has been reviewed by the project lead or their designate and is deemed to reasonably accurately reflect the field observations.

Data that is uploaded to FWIS is assigned a default code of unverified unless a project lead confirms that the data has indeed been verified and the database custodian would then convert this to verified. Next users with review authority must review each sample event for completeness and correct/validate that the data is accurate. Reviewers sanctioned to validate data should be familiar with the data collection rules (i.e., the protocols) to ensure that appropriate findings are stored. This classification process is accessed on each data entry/editing screen as a drop down list. Users will be reminded to assign an appropriate code if

editing has occurred and users attempt to save the record without first assigning a validation code.

6.0 UTILIZING THE SUMMARY AND REPORTING CAPABILITIES

A strength of a communal system for information management is the ability to develop canned queries and reports that can be used collectively. FWIS is employing a multi-faceted approach to develop approaches that meet users needs that include canned queries that can be accessed through the FWIS interface. As time permits and users needs expand the list of canned queries and reports will expand, and therefore this section will focus on general procedures for accessing the features, saving outputs and printing off reports. Details of each query, that is how it operates, will be made available on the website. These features are accessed by clicking the "Data Summaries and Queries" Tab and selecting one the drop down tabs. Each tab initiates a different feature. For example:

Fish Sampling by Site: provides a means to search for the distribution of specific species and to map/export the data.

Fish Sampling Summaries: provides a summary of fish catches for a sampling event standardized to effort and sample area.

Channnel Structure: provides a variety of summary statistics of the channel morphology data (S4.M2 of OSAP) as defined in the OSAP compendium manual (Stanfield 2002).

Priority future queries will generate summaries for discharge, slope, headwaters, and rapid assessment surveys crest stage gauges. Use the drop down menus and searching capabilities to refine the queries. Once completed, users can either print off the report or create a pdf for email transmission[4] (Figure 13).

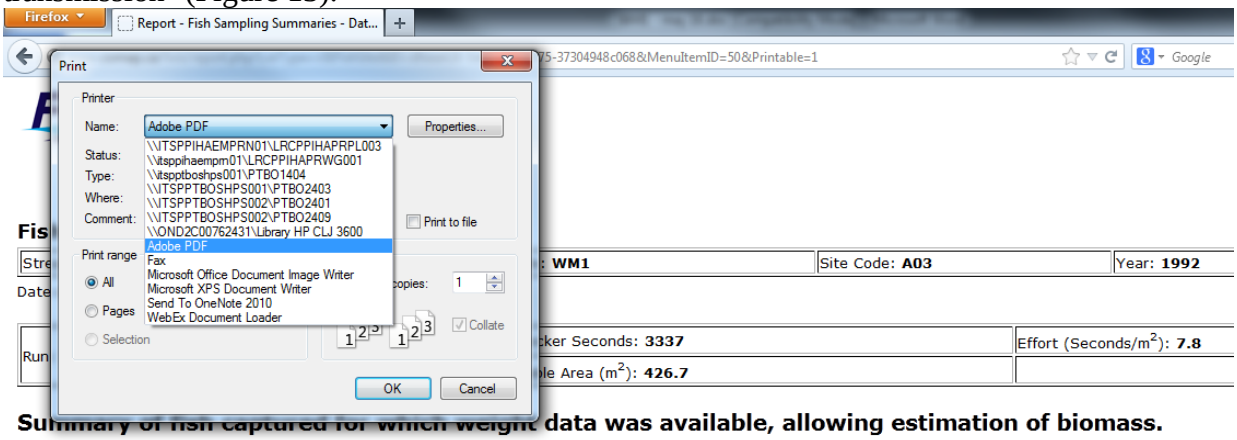


Figure 13: Printing or saving reports and Query Summaries

Another feature that is being built into the query process is a measure of quality assurance. For example, if data is present within a dataset that does not meet the criteria for an attribute a

[4] If using Firefox: click on the Firefox home button; click on print and either print the report, or if you have adobe use the drop down window to choose Adobe pdf and create a pdf version of the report.

message is generated for the user that indicates that errors exist in specific records that should be reviewed/corrected (Figure 14).

Figure 14: An example of an error message from the channel morphology summary query.

Finally, in the near future, the existing queries will be adapted to enable users to generate summary statistics for list of sites that can be determined through either spatial or tabular queries. This feature will be an important means to facilitate analysis of larger datasets.

Reports are also available for individual sample events, where appropriate. This is particularly useful for sharing information about site locations. Users can either create a pdf of the site description page or they can set up a site and use the mapping features to direct samplers to the exact location where sampling is to be carried out. To activate this feature, navigate to the site idenfitifaction form, zoom to the appropriate level of detail desired and then click on the "printable version" button. Then either print or generate apdf version of the report, as described above.

7.0 EXPORTING DATA

Data can be exported from multiple locations from within FWIS, following the data acquisition guidelines discussed in section 2. But, not all data is immediately accessible and some is restricted. A process has been established to maximize data access while still recognizing the various needs of users and need for restrictions. It does not mean that data will not be made available, rather that certain restrictions exist that users and the database custodian must adhere to when sharing data. To facilitate this process, datasets are assigned codes by the project managers or the database custodian (Table 1) and depending on the criteria and the datasets being requested, additional actions may be initiated upon a request to access data. The specific actions are guided by a data sharing strategy that was developed by a multi-agency task team (see Appendix I for a synopsis).

Table 1: Data Access Categories

Category	Description
Open	Information could be accessed by all interested parties without any notification of data custodian
Proprietary	Access is restricted for a five year window to enable publication of findings. Users can request access through the project lead
Permission Required	Custodians have requested that permission be obtained from the data custodian prior to release of data
Restricted	Access to some or all of the data is restricted and can only be provided with a signed data sharing agreement.

Users or the database custodian assign the appropriate level of access to each dataset at the sample event tab. Classification of all data collected within a project will be feasible once the

meta data module is operational. In the mean-time project leads must assign one of the 4 categories to a project dataset at the sample event stage (see: adding/editing a sample event above).

Once datasets have been selected for export, click on the "save data as either csv or shp file. The csv file format is directly compatible for use in spreadsheets and for analysis in programs such as "R"[5]. Saving the data as a .shp enables it to be readily uploaded into GIS software for additional spatial analysis. Future options will include the capabilities to export the data in a structured database format to make it readily useful in software such as Access or MySql. With all data exports, and for all uses of the data, practitioners are reminded that an acknowledgement of the data sources is expected whenever it is used in a publication or presentation.

8.0 TIPS FOR USING FWIS

FWIS works with any operating system and internet browser, but users have found Mozilla Firefox to be the most trouble free internet connector. It can be downloaded from https://www.mozilla.org

FWIS is limited by the speed and bandwidth of your internet connection, so please be patient; sometimes internet connections can be busy and the connection slower than at other times. Try not to over click. Respect a "busy indicator" or spinning wheel on your page to see whether the system is working on your request before you click again!

There are several options for zooming in on maps and the most efficient approach is to create a box around the area you wish to zoom to. You can also click several times to change scale more rapidly than if you click once and wait to see what happens.

Clicking multiple times on the mouse after clicking on either +ve or –ve zooms the map in relation to the number of clicks you make.

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[5] R is a freely downloadable statistical analysis software that requires input data be in csv format: (www.r-project.org/)

developed several of the data models for FWIS. Harold also led the scannable form experiment, along with a lot of help from data scanners. Ian Ockenden coordinated an external group on behalf of SOSMART that developed the data sharing strategy. Brian Bezaire, Scott Jarvie and Helen Ball deserve special thanks for providing continual input on direction to the project. Over the years a large number, (too many to list) of people participated in committees, working groups and test teams to provide guidance to the development of FWIS. To all of you thank you.

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