

# Monitoring Exposed! WARM: A Database Tool to Share and Query Watershed Resources Monitoring Information

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Forest specialists and managers often lack access to monitoring information collected within unit boundaries and across administrative units. The inability to effectively use existing monitoring results has led to repeated National Environmental Policy Act (NEPA) challenges, inefficient and ineffective best management practices (BMP) application, and poor feedback for the adaptive management process. The objective of the Watershed Resources Monitoring (WARM) database is to create an electronic repository for easy storage and retrieval of various monitoring information reports relevant to individual and multiple forests. Although originally developed to address monitoring information needs in the Intermountain Region (USDA Forest Service Region 4), the application is available to all national forests. The system was initially developed as a module within the Lotus Domino<sup>1</sup> database application for Wildlife, Fish, and Rare Plants (WFRP) reporting. Now a separate module, WARM houses reports generally referred to as “gray literature,” including those produced by forest staff or partners and that do not appear in any other professional journal, book, or other library-available publication. This Forest Service Intranet-based tool allows users to locate actual monitoring information collected and documented within specific watersheds, across individual forests, or about specific management or conservation practices. Examples of database content and utility are illustrated, including an explanation of how information queried from the National Resource Information System (NRIS) and Infra<sup>2</sup> can be used and linked. Future module development may include creating an interactive map for querying and expanding support of the system and tools.

Keywords: *watershed, monitoring, data and information management*

## INTRODUCTION

Hydrology program managers in the USDA Forest Service Intermountain Region identified the need for a better way to share monitoring information among units. They acknowledged that our inability to effectively utilize existing monitoring results has led to repeated National Environmental Policy Act (NEPA) challenges, inefficient and ineffective best management practices (BMP) application, and poor feedback for the adaptive management process. These deficiencies have prompted federal agencies to propose a new regulation that compounds and exacerbates the difficulties of project planning and implementation for various watershed activities.

In response to this need, Intermountain Regional Office staff collaborated with the Stream Team, Pacific Northwest

Region and Pacific Northwest Research Station, and the Natural Resource Information System (NRIS) Water and Tools teams to prepare a project proposal for developing a tool to share monitoring information. The objective was to create a Forest Service Intranet-based system that allows users to easily store and retrieve various types of watershed resources monitoring information relevant to one or more districts, forests, or regions. The Watershed Resources Monitoring (WARM) database is the result of this effort.

## WATERSHED RESOURCES MONITORING (WARM) DATABASE

### What It Is and Isn't

The WARM database was built as a module of the Wildlife, Fish, & Rare Plants (WFRP) intranet reporting system. Using the front end development and

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M Furniss, C Clifton, and K Ronnenberg, eds., 2007. *Advancing the Fundamental Sciences: Proceedings of the Forest Service National Earth Sciences Conference, San Diego, CA, 18-22 October 2004*, PNW-GTR-689, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

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<sup>1</sup>The use of trade or firm names in this publication is for reader information and does not imply endorsement by the U.S. Department of Agriculture of any product or service.

<sup>2</sup>USDA Forest Service's Infrastructure information database

structure of the WFRP system leveraged the funding to offer users customized features including look-up tables, partnership documentation, a photo database, and querying capabilities. Another advantage of building on the WFRP system is that the platform made the module available to all National Forest System, units rather than only to those in the Intermountain Region.

The WARM module has recently been separated from WFRP, creating a stand-alone system. The intranet-based tool allows users to enter and edit monitoring reports and query the system for information collected within specific watersheds, across individual districts or forests, or related to specific management or conservation practices.

### Concept

The vision for the WARM database is that it will serve as corporate memory for monitoring information. Although there are several corporate databases in use, all of them deal with primary or factual data. These data are generally not useful to managers until they have been interpreted through some analysis process to extract meaningful assessments about a site or project. This interpreted information can now be stored in the WARM database so that authors, peers, managers, and other forest specialists have access to this assessment or monitoring information. Therefore, the WARM database bridges the gap to store interpreted information in one database that is currently not housed in other existing corporate databases (Figure 1).

### Database Features

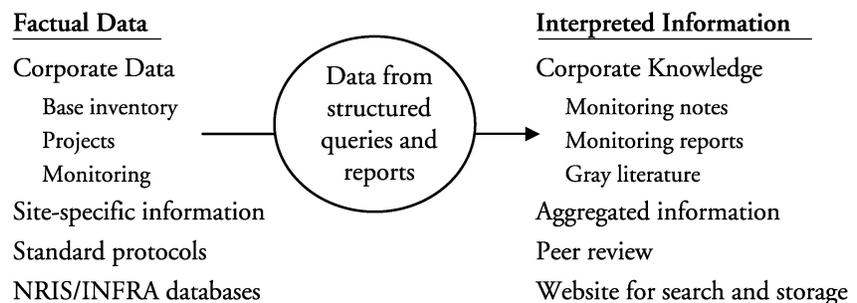
The modular design of the WARM data entry features allows users to create new reports at any level of detail desired, from a single site evaluation to an annual forest monitoring report. There are some mandatory fields that establish a basic record, while all others are optional. The structured fields each include a description accessible by clicking on the term.

**Entering or Editing Reports.** Users can create and store new or previously written reports. New reports can be generated on the spot by filling in the fields. This option is valuable for single event monitoring and brief monitoring reports. Existing reports can be stored by cutting and pasting text into the mandatory and summary fields, and creating a link to the full report (for this to work, the document must be link-accessible at least through the Forest Service Intranet). This option is best for very large or detailed reports and older ones that have good information but may take too long to enter. The linking capability reduces data entry redundancy and allows authors to reference other relevant documents, photos, or websites. By linking a photo directly into the system, it is captured as a corporate photo and is accessible by any other user through a browser tool.

All reports entered in the system are finalized (closed) upon the author's certification through an electronic signature. This step allows the author to enter information in multiple sessions, and allows others to review and provide feedback prior to indicating that the report is final. Appendix 1 depicts examples of the data entry and editing screens. The data fields supported by WARM are listed in Appendix 2.

**Querying and Reports.** WARM accommodates two forms of querying and includes a standard report. Report records can be queried to find a specific, individual report, or to find sets of reports that meet the searcher's criteria. The report query enables the user to locate a specific report by entering the geographic area of interest and selecting a report from the list generated. This option is useful if the user knows the exact report wanted. For broader searches, the query tool allows the user to search based on location (district, forest, region, state), author, topic or keyword, hydrologic unit code, and primary/secondary lithology, as shown in Appendix 3. The query tool then returns a list of reports that can be copied and pasted into the text of an email and forwarded to others for viewing. This query tool option is more versatile than report query because users can search for multiple reports meeting a set of criteria.

*Figure 1. Concept for how factual data is transformed to interpreted data for storage in the Watershed Resources Monitoring (WARM) database.*



One standard report form exists for all data entered, to maintain a consistent format across entries. Completed reports can be submitted to supervisors or partners to demonstrate accomplishments. An example report is shown in Appendix 4.

#### EXPECTED BENEFITS OF USING THE WARM DATABASE

Several benefits of using the WARM database, as identified by USDA Forest Service program managers, include improving documentation, corporate memory, and information sharing. First, by querying for information relevant to a local project, National Environmental Policy Act (NEPA) documentation is expected to improve as specialists use applicable monitoring to document rational thought processes and support best professional judgment. Second, as watershed specialists move in and out of different positions, information stored within the WARM database will serve as the corporate memory for monitoring results and will facilitate efficient adaptive management processes. Third, monitoring information will be easily shared, since any employee using a Forest Service computer will have access to all completed monitoring reports. Access to such information is expected to improve understanding of management activity effects and allow specialists to better integrate monitoring activities across forest boundaries, improving efficiencies.

#### FUTURE DATABASE IMPROVEMENTS

Since the WARM database is a new application, there may be opportunities to improve features, templates, look-up tables, and reports. The initial vision for the database included a mapping tool that would allow users to query for reports using an interactive map and based on hydrologic unit code, latitude and longitude, or UTM

coordinates. As map querying tools continue to develop, this feature would be a desirable addition. The existing query tool could be edited to add or delete specific fields or to use look-up ranges. Existing look-up fields may contain only cursory choices, so the parent tables can be easily edited by a regional administrator. The site could also be expanded to share templates, examples, technical guides, and other databases as appropriate. Most possibilities for changes and improvements are limited only by funding availability and regional administrator approval.

#### ACCESSING THE WARM SITE

Report viewing is open to all Forest Service computer network users, with data entry and editing privileges granted as determined by the regional office or forest. Authorized network users can enter the database using their internet name and password at the following URL: <http://wodata01.fs.fed.us/fsfiles/unit/wo/wfrp/wrproject.nsf>

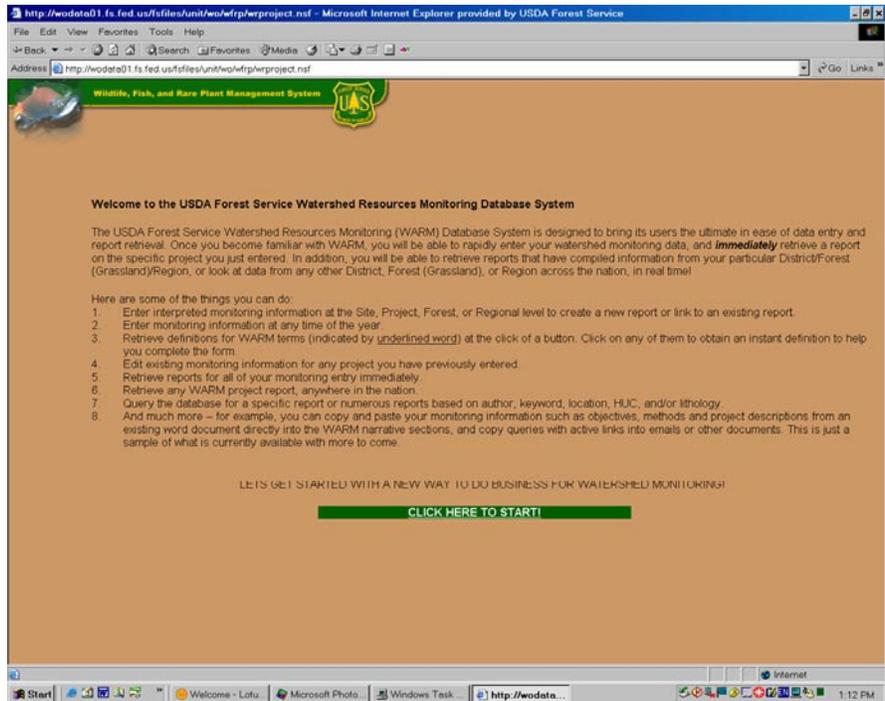
Additional instructions are available from the Intermountain Region FSWeb site, which includes how to obtain an internet password, a Microsoft PowerPoint™ slide show illustrating the features of the database, and the full documentation about the fields and look-up tables. The URL for the site is: <http://fsweb.r4.fs.fed.us/unit/bpr/watershed/fsweb/databases/databases.htm>.

#### SUMMARY

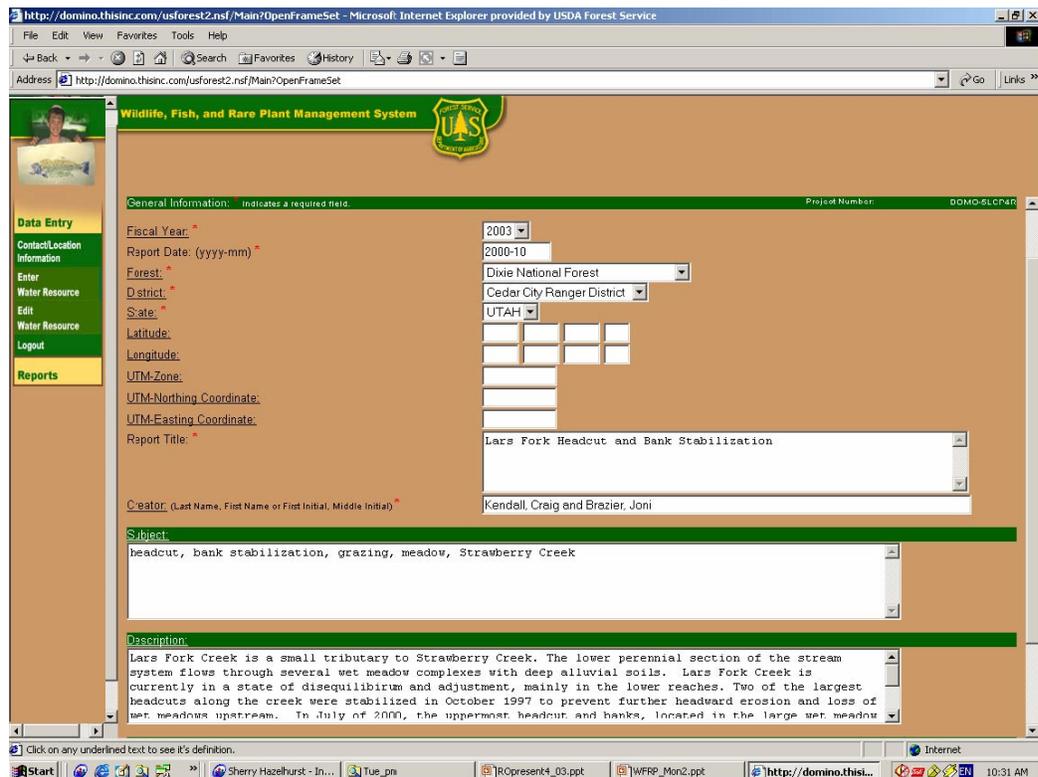
The WARM database provides a powerful tool for compiling, editing, storing, querying, and most importantly, sharing monitoring reports among Forest Service watershed specialists. If developed to its full potential, it may greatly assist in the assessment, monitoring, restoration, and management of watersheds on National Forest System lands.

*Appendix 1. Examples of Watershed Resources Monitoring data entry and edit screens.*

The initial sign-in screen will ask for your internet name and password. Once you have gained access, the following screen will appear:



The first data entry/edit screen includes most of the header information common to most documents.



The monitoring extent and purpose screens allow multiple entries for each, with a purpose identified for each extent:

**Wildlife, Fish, and Rare Plant Management System**

**Water Resource Monitoring**

Identify Purpose of **Project** monitoring extent. \* indicates a required field.

Select one, or more than one, purpose for conducting the monitoring. \*

- Baseline
- Reference
- Condition/Trend
- Implementation
- Effectiveness
- Validation
- Hypothesis Testing

**Wildlife, Fish, and Rare Plant Management System**

**Water Resource Monitoring**

Identify **Monitoring Extent:** \* indicates a required field.

Select one, or more than one, monitoring extents assessed. \*

- Site
- Project
- Forest
- Region

The first data entry/edit screen includes most of the header information common to most documents.

http://wodata01.fs.fed.us/... - Microsoft Internet Explorer provided by USDA F

**Wildlife, Fish, and Rare Plant Management System**

**Data Entry**

**Watershed Resources Monitoring**

**Monitoring Project Narrative:** \* indicates a required field.

Describe the Monitoring Project. Links to specific online documents can be made in any of the narrative boxes.

**Objective/Purpose of Monitoring Project:** Create Hypertext Link

To determine how effective stabilization methods were at preventing headward erosion, and to provide baseline information to support future effectiveness monitoring of restoration techniques and changes in land use management.

**Methods or Techniques Used:** Create Hypertext Link

Visual observaion and photos

**Constituents/Parameters Measured or Assessed:**

Riparian | vegetation communities

Select Remove

*Appendix 2. Watershed Resources Monitoring database documentation.*

## WATERSHED RESOURCES MONITORING DATABASE DOCUMENTATION

## OBJECTIVE

The objective of this database is to provide users a system for easily storing and retrieving various types of watershed resources monitoring information relevant to individual and multiple forests.

This intranet-based website allows users to locate actual monitoring information collected within specific watersheds, across individual forests, or about specific management or conservation practices.

## DATA ENTRY SCREENS AND FIELDS (Screen titles indicated by gray, shaded lines)

**General Information:**

**Fiscal Year:** Required

**Report Date:** Required (Format yyyy-mm)

**Region:** Required (automatically populated from your initial log-in information)

**Forest:** Required (may be automatically populated from your initial log-in information)

**District:** Required (may be automatically populated from your initial log-in information)

**State:** Required (may be automatically populated from your initial log-in information)

**Location Coordinates:** Latitude/Longitude may be entered in degree/minutes/seconds or decimal degrees (make selection). UTM coordinates may also be used to record location: enter Zone, Northing coordinate, and Easting coordinate for a complete record.

**Report Title:** Required

**Creator:** Required (Format: Last Name, First Name or First Initial, Middle Initial)

The person(s) or organization(s) responsible for making the content of the report.

**Subject:** Keywords, key phrases, or classification codes that describe the topic of the report.

**Description:** An account of the content of the resource, which may include an abstract, table of contents, reference to a graphical representation, or free-text account of the content.

**Partnership or Non-Partnership Project:** (Select one)

**Identify Partners:**

Partners may be selected from an existing list. An extensive partner list exists; however, if a new partners needs to be added, contact your regional administrator.

**Identify Monitoring Extent:**

Select one, or more than one, monitoring extent assessed. (Required)

- **Site:** photo point, reach, station, plot
- **Project:** e.g. restoration, road obliteration, road maintenance/upgrade, range, recreation, prescribed fire, wildfire, vegetation management, wildlife, multiple projects
- **Forest:** e.g. forest plan, cumulative effects, species viability
- **Region:** e.g. regional plan, cumulative effects, species viability

For each selection above, Identify Purpose:

### Identify Monitoring Purpose:

Select one, or more than one, purpose for conducting the monitoring. (Required)

- **Baseline:** To characterize single or multiple constituents or parameters at a specific point in time.
- **Reference:** To characterize constituents or parameters over a period of time to serve as a basis for comparison.
- **Condition/Trend:** To determine changes in single or multiple constituents or parameters over a specified period of time, generally greater than 10 years.
- **Implementation:** To determine if the measure, practice, project, or plan was put in place as recommended/required.
- **Effectiveness:** To determine if the measure, practice, project, or plan accomplished intended/specified goals.
- **Validation:** To determine if assumptions made were correct.
- **Hypothesis Testing:** To test an unproven theory.

### Monitoring Project Narrative:

Describe the Monitoring Project: Links to specific online documents can be made in any of the narrative boxes.

\*Note: to avoid retyping text you have already written, you can simply copy text from an existing Microsoft Word document and paste it in many of these data entry fields.

**Objective/Purpose of Monitoring Project:** Clearly state your monitoring project objectives or purpose. A few sentences are all that is necessary. Number them if you like.

**Methods or Techniques Used:** State methods, protocols, or techniques you used to accomplish the monitoring project.

**Constituents/Parameters Measured or Assessed:** This is a three-level list of parameters from which you may select up to any 15. Selections can be made at any of the levels depending on the need to specify. To add parameters, please contact your regional administrator. The following headings are the first level from which the individual parameters are grouped:

- Air Quality
- Best Management Practices
- Climate/Precipitation
- Fisheries Habitat
- Riparian
- Soils
- Species (communities, population, individuals)
- Stream Channel Morphology
- Water Quality/Quantity
- Wetlands

**Monitoring/Sampling Frequency:** Select one item as listed from the following lookup terms: continuously, two or more times a day, daily, weekly, monthly, annually, seasonally, after storms, biennially or greater, randomly, other.

**Monitoring Duration:** Select one item listed from the following lookup terms: one time, one season, 2-3 seasons, one year, 2-5 years, 5 or more years.

**Primary Lithology:** Terrestrial Ecological Unit Inventory (TEUI) label most closely corresponding to one of the following: igneous extrusive, igneous intrusive, sedimentary, metamorphic, undifferentiated, unconsolidated, unknown

**Secondary Lithology:** Terrestrial Ecological Unit Inventory (TEUI) label most closely corresponding to one of over 400 types listed, e.g. Actinolite-Epidote Marble to Wyomingite.

**Land Type Association (LTA):** Description: Terrestrial Ecological Unit Inventory (TEUI) label corresponding to the landscape scale description.

**Hydrologic Unit Code(s):** The hydrologic unit(s) in which the monitoring was conducted. At least a 3rd-level HUC should be listed, and at least one HUC is mandatory. HUC levels 1-6 should correspond to USGS data standards. HUC levels 7-9 may be forest assigned, as no data standards exist for these levels.

**Results Summary:** State your results here.

**Report Peer-Review Status:** Reports may or may not be reviewed, depending on many factors including the resource(s) being addressed, issues, importance, uniqueness of data, monitoring plan, analysis rigor, etc. None = no peer-review. Local Review = at least one specialist at the district or forest has reviewed report for content, analysis, and accuracy. Broad Review = review from both a forest specialist and at least one other source, e.g., another forest, regional office, Washington Office, university, research group, or other credible scientist.

**Contact Name/Phone/Email:** List the name and contact information for the creator or data steward for this report.

**Links to Full Report and/or other information:** Internet or Intranet Web addresses with associated documents, maps, graphics, or presentations e.g. monitoring plan, forest plan, environmental analysis, ecosystem assessment, biological analysis, hydrologic condition assessment, total maximum daily load analysis or implementation plan, GIS map, Powerpoint presentation. Attachments should be in commonly accessible formats, e.g., Microsoft application files, HTML, PDF, MIME.

**Add Graphic Attachments:**

1. Select the file to attach (if separate from a previously linked report):
2. Enter an optional caption for the graphic (limit 50 characters):
3. Attach graphic to form:

Graphics may be attached elsewhere via links. However, those attached here will be printed in the report. Those linked will need to be accessed through the link. Graphics can also be retrieved from the master file by browsing with new captions added for your project. Graphics previously added may be deleted in the editing process.

### Certification of Data Validation

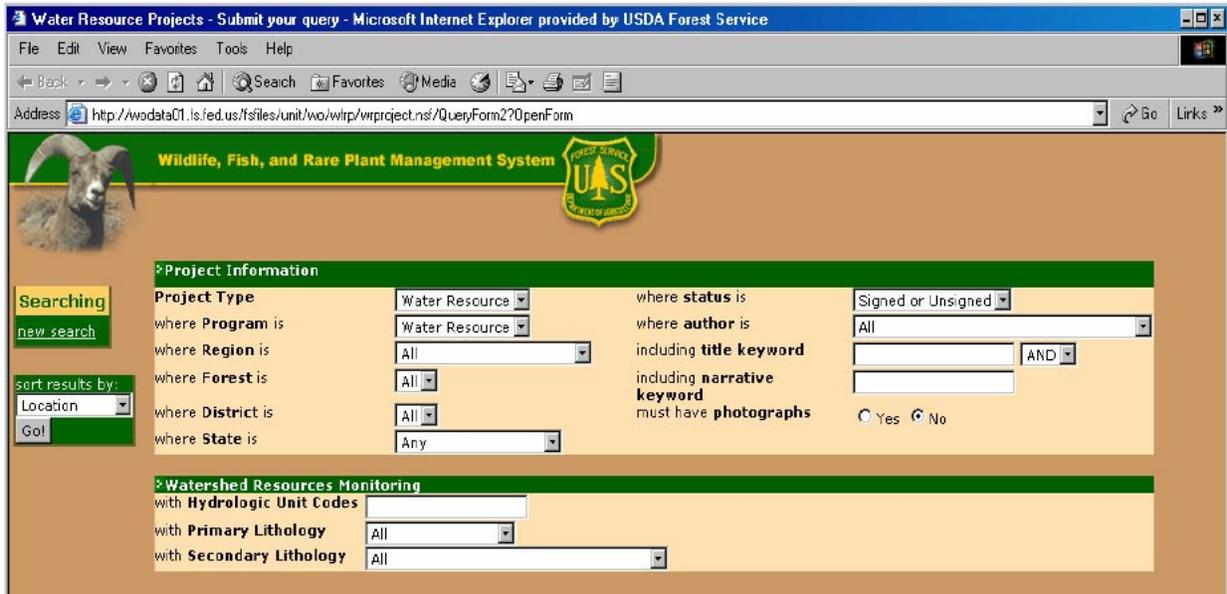
Your signature is required prior to final data being entered into the database. This signifies that information on the form is accurate and based on project work plans, monitoring data, published literature and other information available at the District of Forest Office.

Select the “Save and Sign Final Data” button if you have completed entry and review.

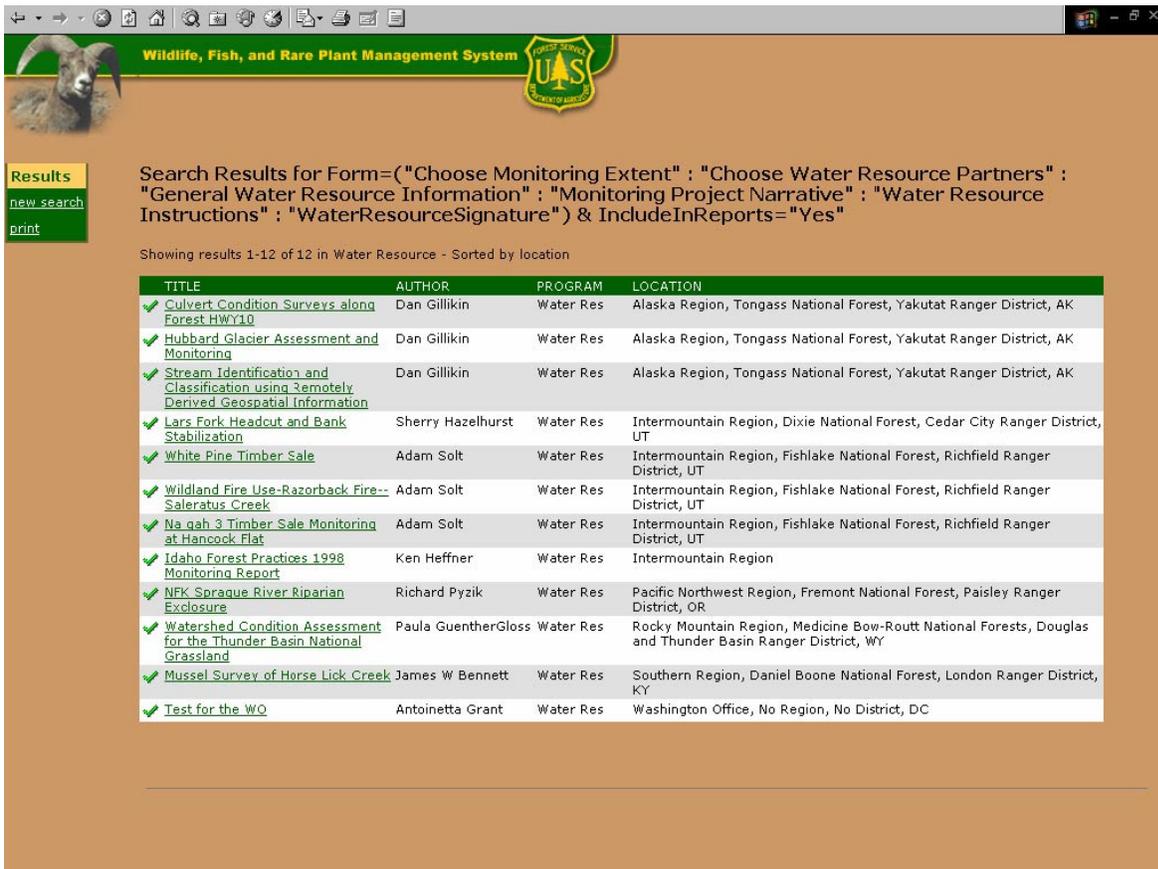
Select the “Keep Data for Later” button to store provisional information until such time as it has been completed.

Appendix 3. Example of Watershed Resources Monitoring query tool screen.

The query tool was adapted from the Wildlife, Fish, and Rare Plants database and adapted for our use in Watershed Resources Monitoring:



An example of query output follows. The individual reports can be accessed by clicking on the title links.



*Appendix 4. Example Watershed Resources Monitoring report.*

**Lars Fork Headcut and Bank Stabilization  
Cedar City Ranger District  
Dixie National Forest  
USDA Forest Service, Intermountain Region**

**Brazier, Joni and Kendall, Craig  
2000-10**

**Description:** Lars Fork is a small tributary to Strawberry Creek. The lower perennial section of the stream system flows through several wet meadow complexes with deep alluvial soils. Lars Fork Creek is currently in a state of disequilibrium and adjustment, mainly in the lower reaches. Two of the largest headcuts along the creek were stabilized in October 1997 to prevent further headward erosion and loss of wet meadows upstream. In July 2002, the uppermost headcut and banks, located in the large wet meadow complex less than 1/4 mile upstream from headcut #1 & #2 were sloped back using a backhoe. The headcut and channel were armored with rock, and banks were covered with erosion cloth. Clumps of *Carex* were transplanted from the wet meadow to the creek bottom with the backhoe. A solar-powered electric fence was put up around the area to protect it from trampling and grazing until vegetation can get re-established. The site was monitored in October 2000 using visual observation and photos.

**Keywords:** headcut, bank stabilization, grazing, meadow, Strawberry Creek

**Hydrologic Unit Codes:**

160300010103

**Report Peer-Review Status:** Local Review

Monitoring Extent	Purpose
Project	Baseline Implementation Effectiveness

**Objective/Purpose of Monitoring Project:** To determine how effective stabilization methods were at preventing headward erosion, and to provide baseline information to support future effectiveness monitoring of restoration techniques and changes in land use management.

**Methods or Techniques Used:** Visual observation and photos

**Constituents/Parameters Measured or Assessed:**

Stream Channel Morphology bank characteristics/stability  
Riparian vegetation communities

**Primary Lithology:** Unknown

**Secondary Lithology:** Alluvium

**Land Type Association:**

**Monitoring/Sampling Frequency:** annually

**Monitoring Duration:** 2-5 years

**Results Summary:** Up to this point, headcut stabilization seems effective. Vegetation from work done on headcut #1 and #2 in 1997 is slowly re-establishing, and the headcuts do not appear to be migrating. It is unknown at this time how effective the soil barriers will be in preventing high flows from flowing around the armored headcuts. Cattle broke through the electric fence protecting the upstream headcut, and some trampling of erosion cloth on the banks occurred. Some vegetation was noticed starting to sprout through the cloth when the site was checked on October 25, 2000. It is too early to tell how effective this project is at preventing further headward erosion. Some of the willow cuttings had sprouted new growth when checked on October 25. It is too early to tell how successful all of the cuttings have been at getting established.

**Photographs**



Figure 1: PP #7. Looking upstream on main channel (7/2000)

**Contact Name/Phone/Email:** D2 Hydrologist, Joni Brazier, [jobrazier@fs.fed.us](mailto:jobrazier@fs.fed.us), 435-865-3238

**Links to Full Report and Other Information:** On file at D2 Watershed Files; also included in 2000 Watershed Monitoring Results, Dixie National Forest (hard copy and CD). All photos attached to full report. [http://fsweb.r4.fs.fed.us/unit/bpr/watershed/fsweb/inventory\\_monitoring/DNFLarsCk2000.doc](http://fsweb.r4.fs.fed.us/unit/bpr/watershed/fsweb/inventory_monitoring/DNFLarsCk2000.doc)