Wyoming Water Resources Research Centter

Annual Technical Report

FY 2000

Introduction

None

Research Program

Basic Information

Title:	Hydrologic Impacts of Improved Irrigation Efficiencies and Land Use Changes
Project Number:	B-01
Start Date:	3/1/2000
End Date:	2/28/2001
Research Category:	Climate and Hydrologic Processes
Focus Category:	Water Quantity, Water Use, None
Descriptors:	Agriculture, Conveyance Systems, Irrigation Systems, Water Use Efficiency
Lead Institute:	University of Wyoming
Principle Investigators:	Drew Johnson, John Barnes, Bruce Brinkman, Larry Pochop

Publication

Problem and research objectives:

Star Valley is an irrigated agricultural area where irrigation systems were converted from surface to sprinkler systems between the years 1971-1974. In a previous study (Sando et al., 1985), this change was shown to have impacted the Salt River by altering return flows to the river. The net result is increased river flows in the spring and reduced river flows in the fall. Since the sprinkler conversion, land use in the area has changed. Many farms in the lower end have been subdivided and converted to other uses. The purpose of this study is to extend the methodology used by Sando et al., quantify in-stream flow savings and investigate changes in stream flows due to recent land use changes in the Valley.

Methodology:

The methodology used incorporates comparing flows in the Greys and Salt Rivers. The Greys River, due to lack of agriculture in it's drainage area, can be used as a control and flows in the Greys River can compared to flows in the Salt River where changes in land use and irrigation have occurred. Comparing flows in the Greys and Salt Rivers allows effects due to changes in land use and irrigation practices to be quantified. Changes in land use are being quantified by examining aerial photographs and Wyoming agricultural statistics annual reports. Additional information related to changes in land use will be obtained from interviews with local residents and officials.

Principal findings and significance – Project status:

Flow savings resulting from changeover to sprinkler irrigation were found to be substantial. Net annual savings due to the changeover are comparable to the total consumptive use within the region. Flow savings were related to estimated savings from reduced evapotranspiration losses. Changes of this magnitude should also influence groundwater recharge and, as part of on going work, changes in groundwater levels are being investigated for periods before and after irrigation system changeover. Although the work on quantifying the extent of land use change is still ongoing, it is unlikely that land use change to date has resulted in stream flow changes of a magnitude similar to those found for changes in irrigation practices. An alternative methodology to the one

used in the irrigation study needs to be developed that is capable of detecting these more subtle changes.

Basic Information

Title:	Development of Erosion Potential Map
Project Number:	B-02
Start Date:	3/1/2000
End Date:	2/28/2001
Research Category:	Not Applicable
Focus Category:	Models, Surface Water, None
Descriptors:	Channel Erosion, Coal Bed Methane, Stable Channel Thresholds
Lead Institute:	University of Wyoming
Principle Investigators:	Gregory Vincent Wilkerson

Publication

1. Baxter, J.C., G.V. Wilkerson, and J.H. Johnson, Oct. 2000. GIS Erosion Potential Model for CBM Water Impacts, Presenters abstracts, U.S. Geological Survey Fall Conference, Laramie, WY.
2. Baxter, J.C., G.V. Wilkerson, and J.H. Johnson, March 2001. GIS Erosion Potential Model for CBM Water Impacts, Presenters handouts, U.S. Geological Survey NAWQA Liaison Meeting, Red Lodge, MT.
3. Wilkerson, G.V., J.C. Baxter, J.H. Johnson, and J. Montgomery, Aug 2000. Presentation at the Methane Operators Group Meeting, Casper, WY.

Problem and Research Objectives:

Coal bed methane (CBM) development in the Powder River (structural) Basin (PRB), located in northeast Wyoming, has been occurring at an increasing rate since about 1990 (WOGCC, 2000). As of March 2001 about 4,900 coalbed methane gas wells were in production, about 9,600 wells have been drilled and 600 of those have been plugged, and about 10 wells are drilled every day of the week (Bleizeffer, 2001).

The process of extracting coal bed methane involves drilling a well into a coal seam and then pumping water out of the well that is mixed with the methane in the coal seam. The gas and water separate in the well and the gas is sent to a pipeline. On average, water from CBM wells is produced at a rate of 12 gpm per well (BLM, 1999).

In June 2000 the U.S. Bureau of Land Management (BLM) held public scooping meetings that would facilitate development of a new resource management plan for oil and gas development in all of Johnson, Campbell, and Sheridan counties as well as a significant portion of Converse County (Figure 1; Tollefson, 2001). The agency is looking at analyzing up to 35,000 wells in the next 10 years (although it cites projections for 70,000 wells in the lifetime of the development. Assuming that 33% of the 35,000 anticipated CBM wells are producing 12 gpm of water at a given time, surface water would be produced at an average rate of 140,000 gpm (312 cfs or 225,000 ac-ft/yr). For comparison, note that the storage capacities of Keyhole Reservoir and Lake de Smet Reservoir, in northeast Wyoming, are 340,000 acre-ft and 239,000 acre-ft, respectively.

Legally, CBM product water can be discharged on the surface only at National Pollution Discharge Elimination System (NPDES) permitted points (BLM, 1999). It is expected that much of the water will be discharged from pipelines into existing surface drainages. It is impossible to know with certainty how much CBM produced water will be discharged into surface drainages since, in some areas, water storage systems are being constructed to contain water and because there is the possibility that some of the water will be reinjected. Conversely, the estimated discharge rate for individual wells that was presented above (12 gpm) is variable—discharge rates as high as 60 gpm have been reported (PRB, 2000) and the estimated productive life of a CBM well is 10 to 20 years (BLM, 1999a). Over this time, there is great potential for CBM produced water to cause sedimentation and erosion in affected stream channels and tributaries.

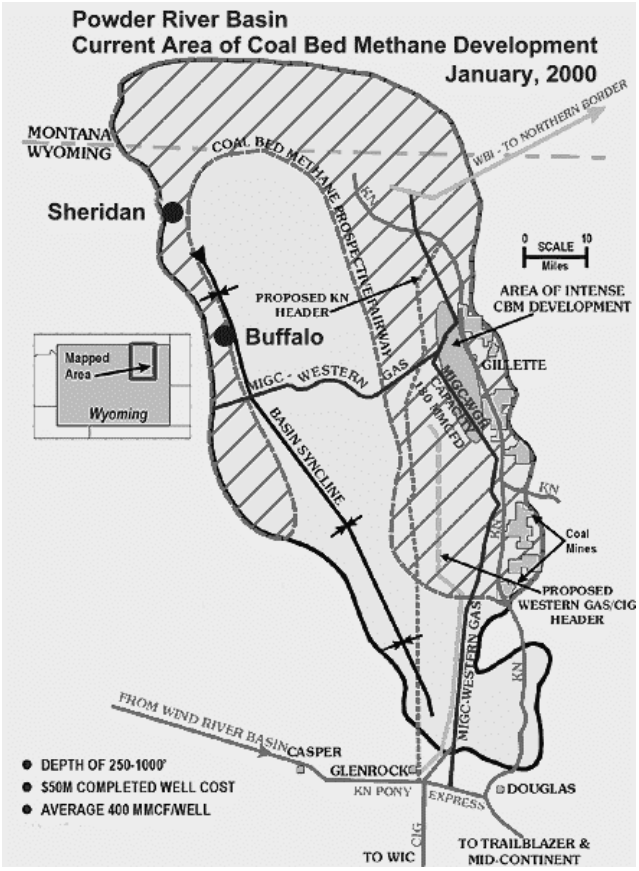

Figure 1 – Powder River Basin. Current area of coal bed methane development (PRB, 2000).

The State of Wyoming, Department of Environmental Quality (DEQ) regulates sedimentation, erosion, and other issues affecting the quality of water in Wyoming (BLM, 1999). The DEQ is also responsible for granting NPDES permits for surface discharge of produced water. Recognizing the need to manage CBM product water, the DEQ has asked the University of Wyoming to evaluate the erosion vulnerability of drainages in the PRB. **The primary objective of this study is to develop a computer program that will help DEQ policy managers formulate appropriate management decisions associated with the NPDES permitting process. This study has three components: (1) development of an analytical model for predicting the erosion potential of a channels in the PRB, (2) channel monitoring, and (3) model verification.** The computer program and all data derived from this effort will be made available to the public so that others responsible for or concerned about watersheds affected by CBM development will be able to use it to evaluate alternative CBM development scenarios.

Methodology:

Model development and implementation

An analysis of data published by the U.S. Geological Survey (Lowham, 1988) is being performed and the results are being used to develop an analytical model that yields an erosion potential index for channels in the PRB.

The analytical model will be implemented in a computer program called Erosion Potential (EP) Modeler, which will execute in ArcView, a geographical information system (GIS). A GIS environment facilitates evaluation of the input variables for the model. Input variables for the model are:

1. The point in the channel at which erosion potential is to be assessed. Identification of the point of interest is facilitated by the use of readily available U.S. Geological Survey (USGS) digital raster graphics.
2. The drainage area for the point in the channel. The computer program computes the drainage area using USGS digital elevation models (DEMs).
3. The two-year peak discharge for the drainage area, if known
4. The geographic factor for the drainage area (accounts for geographic and orographic effects on peak flows; Lowham, 1988). The program uses a digital raster map to compute geographic factors.
5. The anticipated CBM product water discharge for the drainage area

Output from the program is the pre-CBM development equilibrium channel width, the post-CBM development equilibrium channel width, and the percent change in the equilibrium channel width. The percent change in the equilibrium width is the erosion potential index. Figure 2 shows a screen capture from an EP Modeler demonstration and illustrates results obtained from the program.

Channel monitoring effort

The second component of this project consists of monitoring erosion in two channels within the Powder River Basin: Deadhorse Creek and Burger Draw. Six reaches along Deadhorse Creek and its tributaries, and two reaches along Burger Draw have been established. A survey of each reach was performed in either March or August 2000 using a Sokkia SET 3110 total station. Established reach lengths range from 500 ft to 1,200 ft. Within each reach, four to eight cross-sections were established and surveyed**.** A survey of the channel centerline was also performed. The monitoring effort consists of periodically re-surveying the reaches to determine what, if any, changes have occurred in the channel. The channel monitoring effort has thus far provided baseline data that will be compared with data to be collected in the future.

Model verification and calibration

To achieve the third objective of this study, data from the channel monitoring effort will be used to verify the reasonableness of pre- and post-CBM development equilibrium channel widths predicted using EP Modeler and to calibrate EP Modeler.

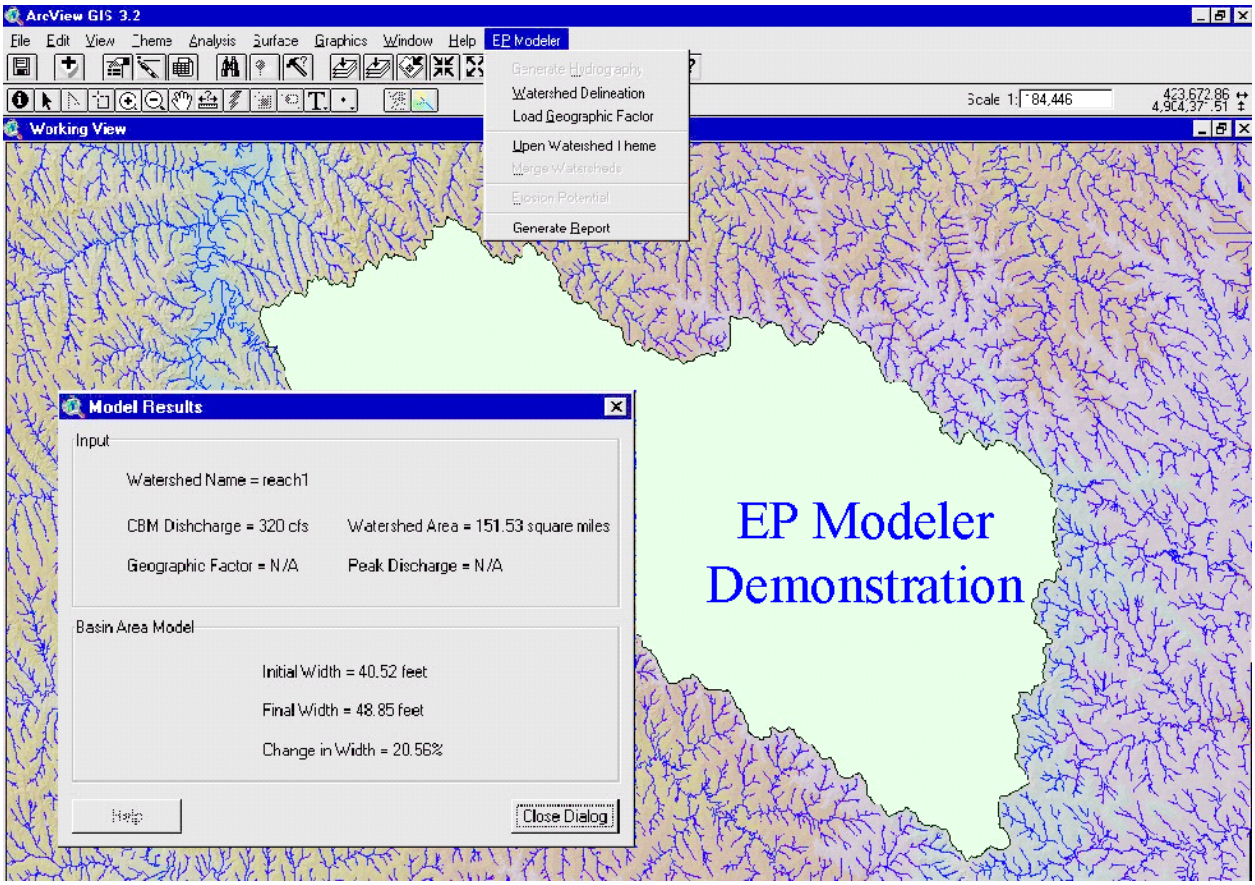

Figure 2 – Screen capture from a demonstration of EP Modeler.

Principal Findings and Significance:

Principal findings to date indicate that the data in Lowham (1988) can be used to estimate equilibrium widths for channels in the PRB. The model developed for predicting equilibrium channel widths when the two-year peak discharge for the drainage area of interest is known has a standard error of 0.41 ft in log units. The model developed for the case when the two-year peak is not known has a standard error of 0.45 ft in log units. The computer program being developed for this study, EP Modeler, is in the final stages of completion. The program, a user's manual, and technical report describing the program will be completed by the end of July 2000.

Data from field surveys performed in the year 2000 is presently (June 2001) being evaluated. Validation and calibration of EP Modeler will be performed on an ongoing basis as new data is gathered.

The model and data derived from this study are significant because it will help DEQ policy managers formulate appropriate management decisions associated with the NPDES permitting process particularly in regards to managing CBM product water. Also, since the computer program and all data derived from this effort will be made available to the public, others responsible for or concerned about watersheds affected by CBM development will be able to use it to evaluate alternative CBM development scenarios

Basic Information

Title:	Testing of Hydrologic Models for Estimating Streamflow in Mountainous Areas of Wyoming
Project Number:	B-03
Start Date:	3/1/2000
End Date:	2/28/2001
Research Category:	Engineering
Focus Category:	Hydrology, Models, Water Quantity
Descriptors:	Model Studies, Hydrologic Models, Surface Drainage, Base Flow, Instream Flow, Mountain Streams
Lead Institute:	University of Wyoming
Principle Investigators:	Bruce Brinkman, Hugh Lowham, Lawrence Ostresh, Larry Pochop

Publication

1. Brinkman, Bruce and Hugh Lowham, Winter 2001. Winter Flow Modeling for the Mountainous Areas of Wyoming, Wyoming Water Flow, Volume LXIV, Issue 1, pgs 13-14.

Problem and Research Objectives:

Introduction

When streamflow information is needed for mountainous basins, especially for low flows that occur during the winter months, there often is very little actual data available. Most gaging stations, if any, are located on streams at lower elevations out of the mountainous areas. The ideal situation for planning involving water-related projects is to have long-term data available for a streamflow-gaging station. However, economic constraints prevent the installation and operation of gages at every site where streamflow information may be needed. If a gaging station has not been operated at or near a study site, then estimates of streamflows are useful. This project is a joint research project of the Wyoming Water Development Commission, University of Wyoming, and U.S. Geological Survey to analyze flow determination methods of mountain streams in the winter months. The project officially began July 1, 2000, and currently is in phase I of a two-year study.

Objectives

The objectives of the project are:

1. To test the accuracy of various techniques for estimating monthly streamflows at ungaged sites in mountainous areas, especially during the low-flow winter period,
2. To investigate methods for improving the accuracy of current estimating techniques, and
3. To provide research and technical experience for students and professionals.

The study is constrained by having limited funds for travel and per diem. A study area close to Cheyenne and Laramie (home bases for the principal investigators and a University of Wyoming) is desirable in order to minimize travel costs.

Methodology:

Review of Potential Project Study Areas

A **Laramie Range** study site would be close to Cheyenne and Laramie, and would involve very low travel costs. However, very few long-term streamflow gages have been operated in this area.

The selected area of the **Medicine Bow Mountains** has three discontinued USGS stations, and two active stations. There are also nine University of Wyoming stations near Medicine Bow Peak that have operated on and off for a short periods of time. Colorado State University has a current project that is collecting data from some of these University of Wyoming stations. With selection of this area, travel costs will be kept low. The following streamflow stations with essentially natural flows (no major storage or diversions) have been operated in the Medicine Bow Mountains:

University of Wyoming stations

103 Sally Creek below Knight Science Camp
106 Nash Fork below Ski Area
111 Nash Fork Creek above Brooklyn Lodge
112 Telephone Creek above Mill Pond
113 Telephone Creek above Towner Lake
114 Nash Fork at Brooklyn Lake
202 Medicine bow River at Medicine Bow Guard Station
203 Turpin Creek below Reservoir
205 Medicine bow River at Orton Ranch

USGS stations

06620400 Douglas Creek above Keystone
06622500 French Creek near French
06622700 North Brush Creek near Saratoga -- **current station**
06632400 Rock Creek above King Canyon Canal, nr Arlington -- **current station**
06661000 Little Laramie near Filmore

The area of the **Sierra Madre Mountains** has seven discontinued USGS stations. Two stations currently are operated on the Encampment River and Slater Fork. The following streamflow stations with essentially natural flows have been operated in the Sierra Madre Mountains:

USGS stations

06623800 Encampment River above Hog Park Creek - **current station**
09251500 MF Little Snake River near Battle Creek
09251800 NF Little Snake River near Encampment
09253400 Battle Creek near Encampment
09253400 Slater Fork at Baxter Ranch, near Slater
09255000 Slater Fork near Slater - **current station**
09255400 EF Savery Creek near Encampment
09255900 Big Sandstone Creek near Savery
09256000 Savery Creek near Savery

Selection of Study Area

The study was discussed with Ed Snook, hydrologist with the U.S. Forest Service in Saratoga. Mr. Snook expressed interest in the study, and offered that the Forest Service might allow the investigators use of an unused Forest Service cabin during the winter months. Such an arrangement could help minimize lodging costs for sites in the Sierra Madre or Medicine Bow Mountains.

One of the investigators has a cabin near Fox Park; selection of the Medicine Bow area would allow overnight stays at this cabin, helping to minimize costs.

Bruce Brinkman and Hugh Lowham (principal investigators) met on May 30 and reviewed the available streamflow data and the project approach.

Bruce Brinkman, Hugh Lowham, Larry Pochop (Director, Water Research Program, University of Wyoming), and Justin Montgomery (undergraduate student, University of Wyoming) met at the WWDC Office on July 31 and discussed the project approach and possible study areas. Justin presented Arc View maps of the Brush Creek area in the Medicine Bow Mountains. Digital coverage of vegetation, geology, and other basin features is available for this area. Based on the available digital coverage and potential low travel costs, the Medicine Bow Mountains appear to be the best choice for the project study.

Existing Data

Previous studies reviewed used streamflow data from gaged sites having essentially natural flows, measurements of basin characteristics from topographic maps, and measurements of channel dimensions from field observations. In general, drainage area, basin elevation, and mean annual precipitation are the basin characteristics that were found to be significant in the determination of the magnitude of annual and monthly runoff. This study will include these same data type as well as streamflow data from monthly measurements, and additional basin characteristics identified from color photographs and/or imagery.

Streamflow data are available for station 06622700, North Brush Creek near Saratoga, and include:

- Average annual flow (Qa)
- Mean Monthly flow
- Minimum Monthly flow
- Monthly (Q10, Q50, Q90)) exceedence values

The following basin data are available:

- Basin characteristics and channel measurements for station 06622700
- Digital topographic coverage
- Snow measurement stations nearby
- Digital files of primary vegetation
- Digital files of surface soils
- Digital files of bedrock geology
- Digital files of surface geology
- Digital files of land ownership (primarily federal)

Plans for New Data

Monthly measurements of the test site streamflows will be collected near mid-month during October through March at each of the selected ungaged sites, and at the base streamflow station/s. Channel width will be measured for each stream site during the summer months.

Basin characteristics, such as drainage area, basin elevation, mean annual precipitation, and basin slope, will be obtained in the office, from existing sources, for each of the sub-basins.

Color photographs and/or imagery will be examined to determine unique characteristics of the sub-basins that may have an influence on the magnitude of monthly runoff. For example, thermal imagery may highlight areas of significant ground-water inflows. The size of the inflow areas in relation to the size of the sub-basins may provide parameters for quantifying drainages with relatively high low-flow yields.

Field Data Collection

Bruce Brinkman, Hugh Lowham, and Justin Montgomery made a field visit to the Medicine Bow Mountains on August 14, and met with Water Hydrographer-Commissioner Jack Gibson at the North Brush Creek gaging station. Streamflow-gaging station 06622700, North Brush Creek near Saratoga, has a drainage area of 37.4 square miles and a 40-year period of record (May 1960 to current year). Eight ungaged sites were selected in the North Brush drainage basin. (See figure 1 and table 1). An additional site was selected on Mill Creek, which is tributary to South Brush Creek. The selected sites are accessible by snowmobile during winter months.

Bruce Brinkman and Hugh Lowham made a field visit by vehicle to the North Brush Creek area on October 23, and collected discharge measurements at each of the nine sites. Following a review of the data, it was determined that additional basins, with a greater diversity of basin characteristics, could help with the analysis. The nine existing sites have relatively similar basin characteristics and water yields.

Bruce Brinkman and Hugh Lowham made a field visit by snow machines on November 13 and 14. Discharge measurements were made at eight of the sites in the North Brush Creek area. Site 4 was not measured due to shortage of time and poor access conditions. A review of the US Forest Service and Colorado State University research site on air quality was made on November 14, with Allen Elsworth and other staff. Although some streamflow data are being collected as part of the research study, none was applicable to this study. Sites on Nash Fork were investigated for possible addition to the streamflow sites. A measurement was made at the discontinued University of Wyoming streamflow site, Nash Fork Creek above Brooklyn Lodge (site S-11).

Bruce Brinkman and Hugh Lowham made a field visit by snow machines on December 14. All sites except S-10 and S-11 were measured. New powder snow about 3 feet deep made access to the sites difficult. Very little ice was encountered beneath the deep snowpack.
Anchor ice was attached to the culverts, and it was cleared before the bucket measurements were made.

Bruce Brinkman and Hugh Lowham made a field visit by snow machines on January 16. All sites except S-10 were measured. The North Brush Creek drainage had about two feet of new powder snow. It was noted in the gage house that USGS/WSE personnel had measured the streamflow at site S-1 on December 15, the day after Brinkman and Lowham measured..

Bruce Brinkman and Hugh Lowham made a field visit by snow machines on February 20. All sites except S-10 were measured. The weather was partly cloudy and warm. The snow was very sugary, not set up

An attempt was made to make a field visit on March 14; however, the trip was cancelled due to heavy snow conditions. A field visit was made on March 16, and all sites were measured except S-10. Very little ice has formed at the measuring sites since the last visit. The weather was partly cloudy with light snow in the afternoon.

The April field trip to the gage at site S-1 will be coordinated with USGS to the extent possible. It is planned that concurrent discharge measurements be conducted in order to test the accuracy of the pygmy versus electomagnetic meters and the various measurement sections.

Plans for Analysis

After the first season of monthly measurements have been collected at the ungaged sites, comparison of the collected data will be made with estimates of long-term monthly streamflow using the following techniques:

- Relation to concurrent daily mean discharges at station 06622700 to determine long-term monthly mean flow (Riggs, 1969; Parrett and Cartier, 1990, and Lowham, 1986, p. 35)
- Equations developed by Misalis, Wesche, and Lowham (1999)
- Equation developed by Lowham (1988) for mean annual flow, with monthly flows estimated on basis of relative proportion of monthly flow for streamflow station 06622700

The first step is to determine what features of mountainous basins can be easily identified and defined from current data. Elevation, elevation change (slope), basin orientation, percent of basin exposure to direct sunlight, vegetation type, percent of vegetation cover, and surface soil types, are the easier features to identify from existing maps. The next level would be to look at precipitation and geologic maps to determine additional features that may have been studied and documented in the past.

Principal Findings and Significance:

Example analysis

The concurrent-measurement method estimates streamflow at ungaged sites by correlating with concurrent discharges at a nearby gaged site. The gaged and ungaged sites should be in the same general area and have drainage basins that are hydrologically similar. Measurements of streamflow are made near mid-month at each selected ungaged site and are correlated with concurrent streamflows at the nearby gaged site. The relation between the streamflows at the two sites is then used to transfer the long-term monthly streamflow characteristic at the gaged site to the ungaged site.

Because the concurrent-measurement method uses actual discharge measurements to determine estimates of monthly flow, it is considered to be relatively accurate. For this study, it will serve as the base for which the other estimating techniques will be compared to determine their relative accuracy.

Relations developed by Misalis, Wesche, and Lowham (1999) show the regression equation using basin characteristics, $Q = 0.77446\ DA^{.729}$ for determining October mean monthly flow at ungaged sites in the Medicine Bow Mountains (p 109), and equation $Q = 0.00351\ DA^{.891}p^{1.57}$ for ungaged sites in mountainous regions throughout Wyoming. (DA = drainage area, in square miles; p = mean annual precipitation for the basin, in inches

The equation developed by Lowham (1988) for estimating mean annual flow in the Mountainous Region of Wyoming, using drainage area and mean annual precipitation for the basin, is $Q_a = 0.013\ A^{0.93}PR^{1.43}$. (A = drainage area, in square miles; PR = mean annual precipitation for the basin, in inches). Using the procedure described by Lowham (1988, p. 40, 41), the October mean monthly flow at station 06622700 is 14 cfs, which is 2.3 percent of the mean annual flow times 12 months.

The studies by Misalis, Wesche, and Lowham (1999) and Lowham (1988) also present equations using channel width to estimate streamflow. These equations are not examined as part of this progress report, but they will be included in the study analysis.

Based on results of the October measurements, it appears that the nine selected sites on North and South Brush Creeks have relatively uniform basin characteristics and streamflow yields. An additional site on the east side of the Medicine Bow Mountains was added in order to gain more variability in basin characteristics. The site is located at a station formerly operated by the University of Wyoming.

North Brush Creek Watershed

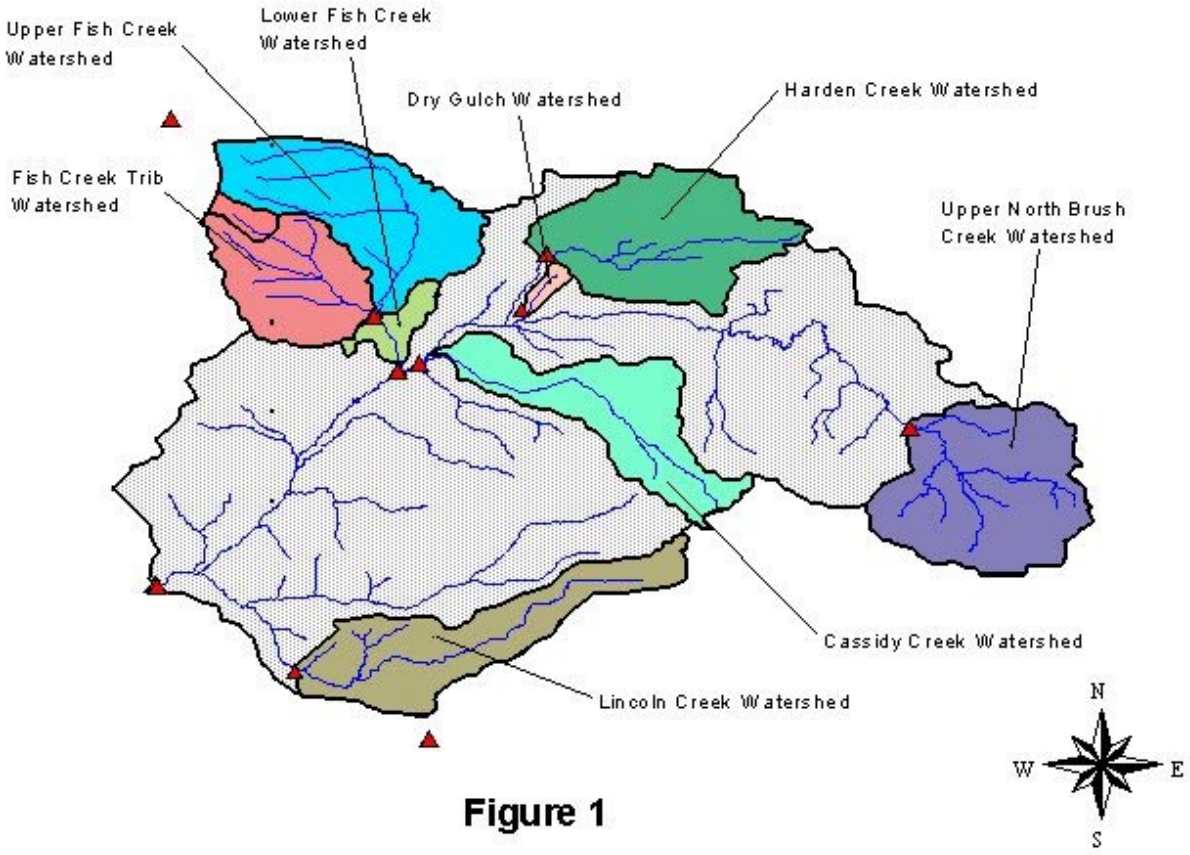

Figure 1

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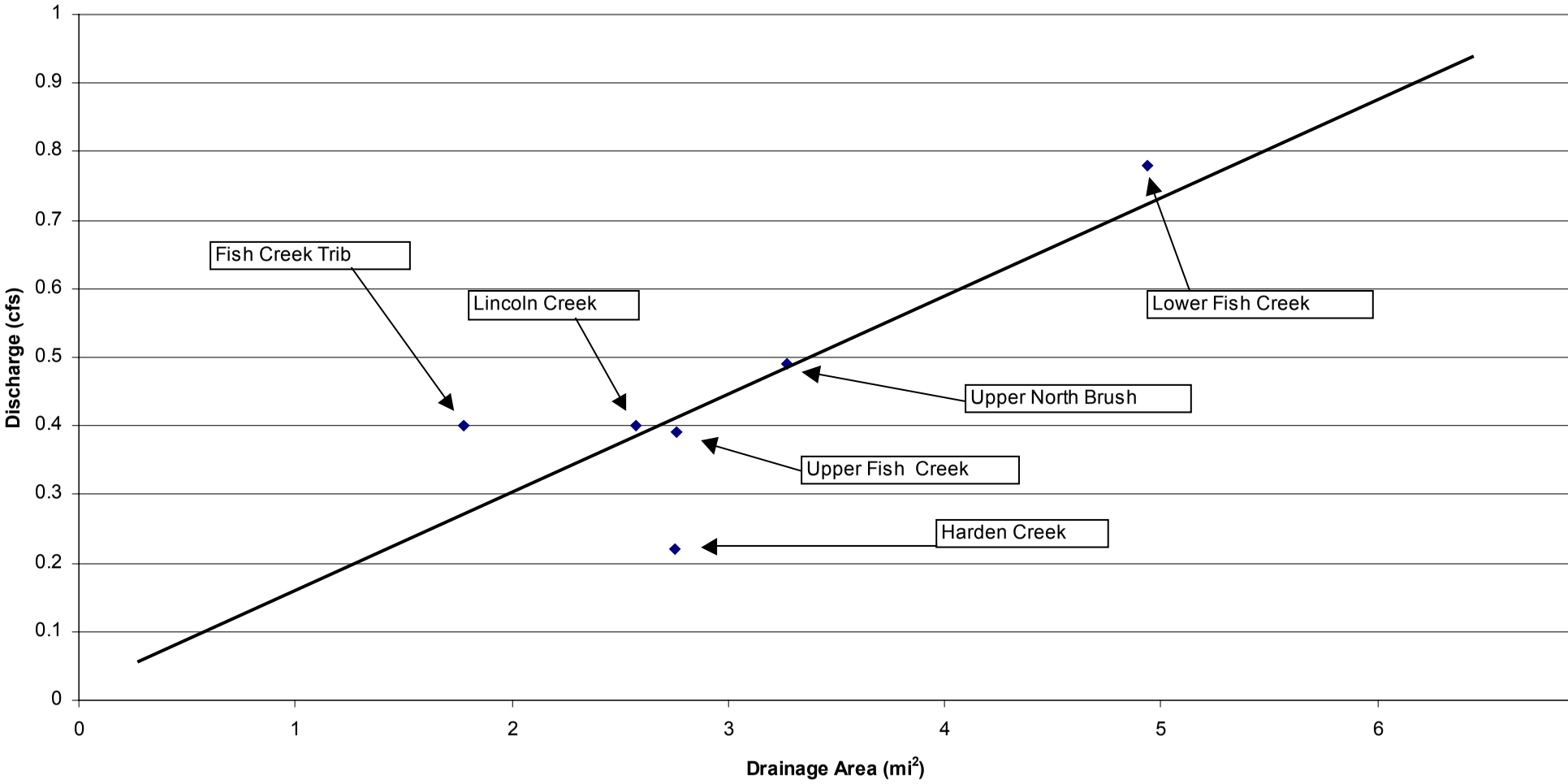
Figure 2. - October Discharge vs. Drainage Area



North Brush Creek Primary Vegetation

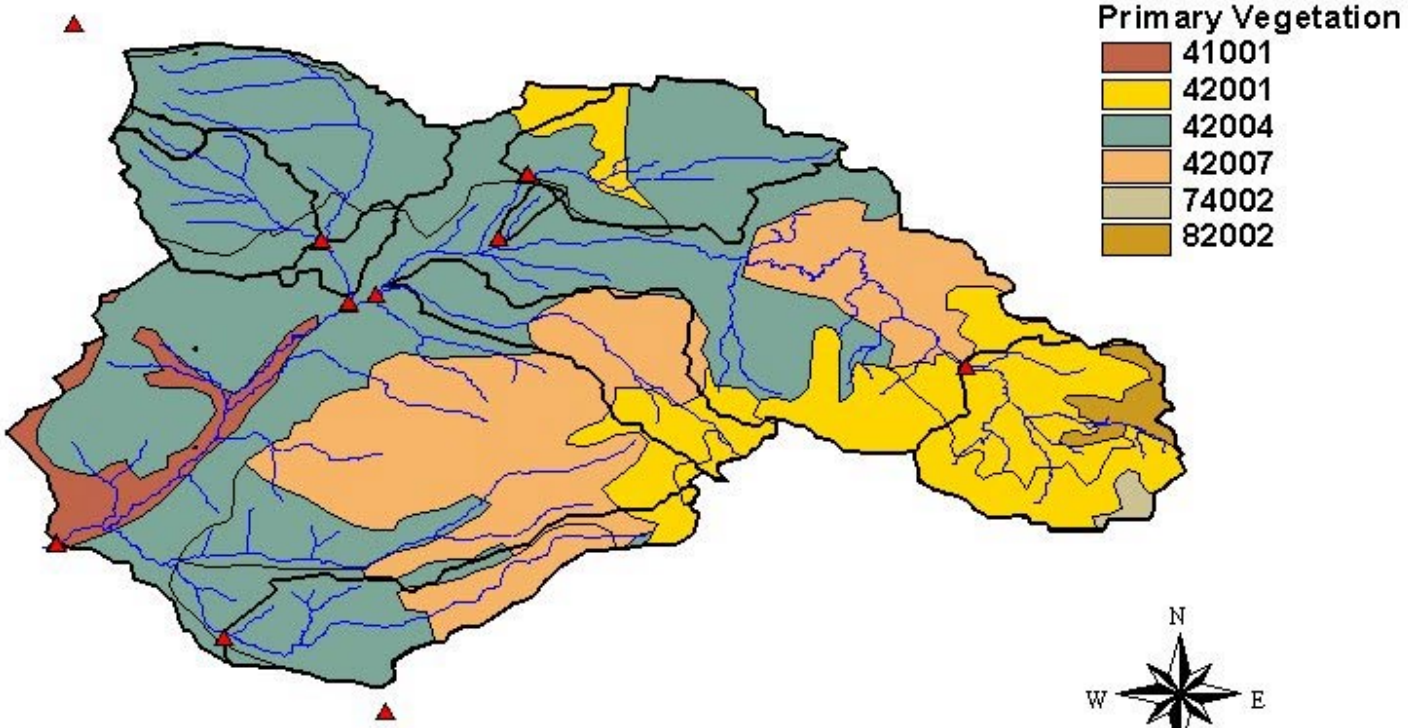


Figure 3

North Brush Creek Surficial Geology

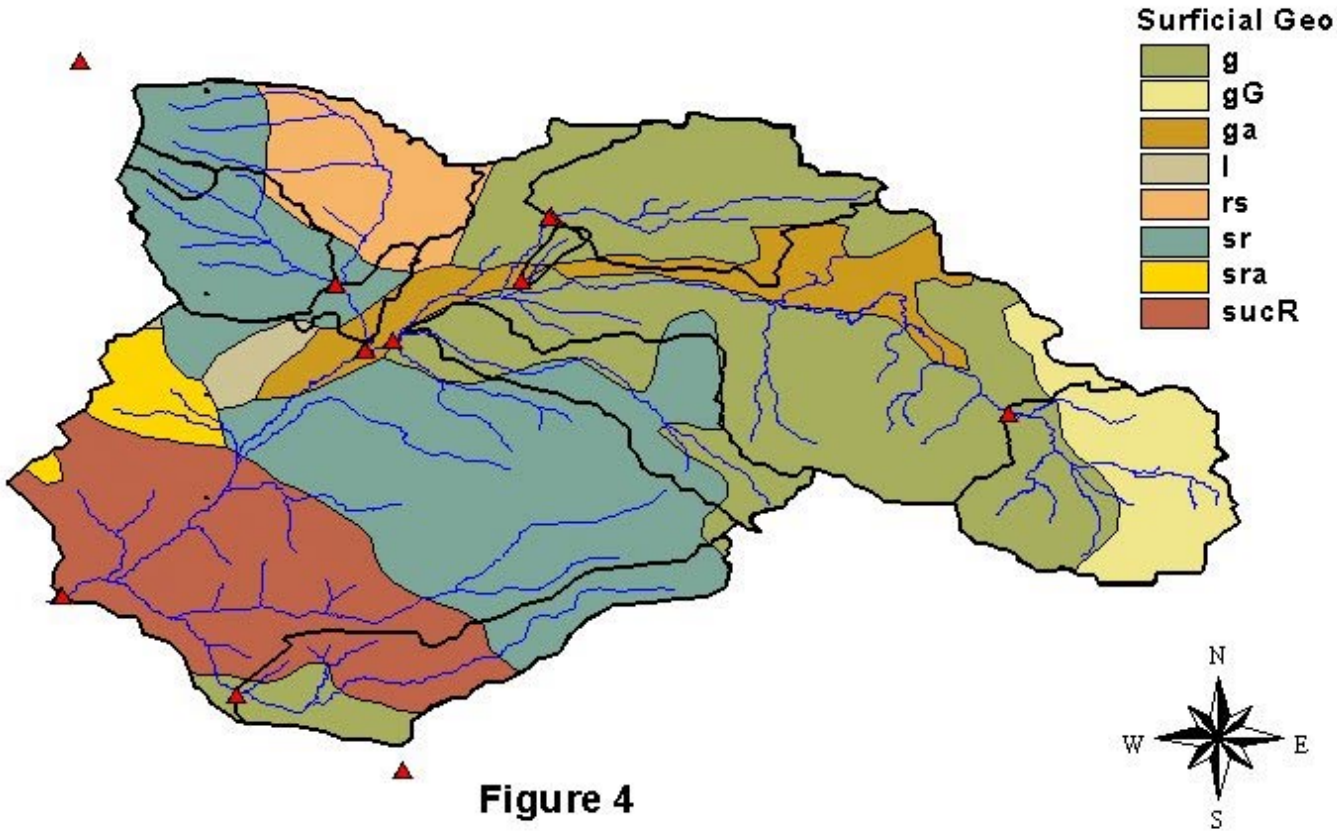


Figure 4

North Brush Creek Soils Map

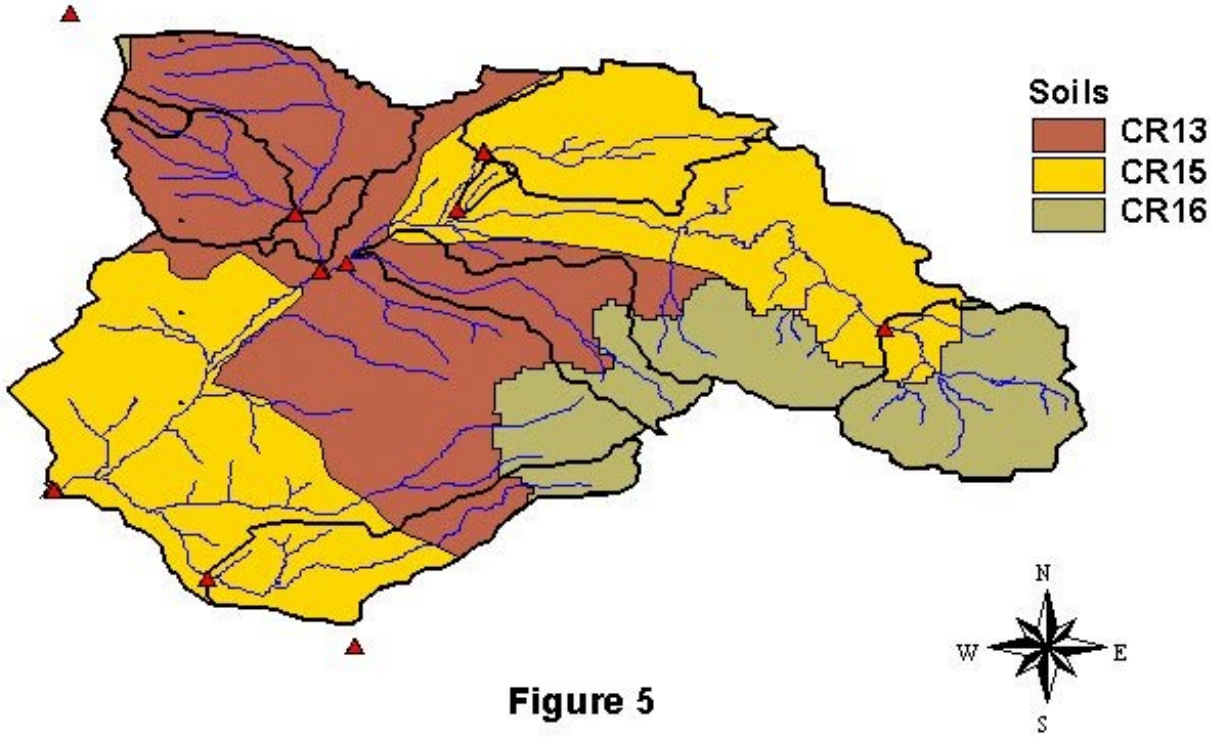


Figure 5

Table 1.—Summary of streamflow sites

Site		Latitude	Longitude	Basin area
		(deg min sec)	(deg min sec)	(sq mi)
S-1	06622700 N. Brush Cr nr Saratoga (gage)	41 22 13	106 31 14	37.4
S-2	Lincoln Creek	41 21 19	106 29 44	2.57
S-3	Mill Creek	41 20 37	106 28 17	
S-4	Fish Creek at upper site	41 25 06	105 28 52	2.37
S-5	Unnamed trib to Fish Creek	42 25 06	106 28 53	1.78
S-6	Fish Creek at lower site	41 24 30	106 28 37	4.94
S-7	Cassidy Creek	41 24 34	106 28 23	
S-8	Unnamed trib	41 25 07	106 27 16	0.15
S-9	Harden Creek	41 25 43	106 27 00	1.54
S-10	N.Brush Creek at upper site	41 23 54	106 23 04	2.23
S-11	Nash Fork Creek abv Brooklyn Lake Lodge			2.1

Information Transfer Program

Basic Information

Title:	Product Accessibility and Dissemination for the Water Research Program at the University of Wyoming
Start Date:	3/1/2000
End Date:	2/28/2001
Descriptors:	Information Dissemination, Water Resources Data, Water Library
Lead Institute:	University of Wyoming
Principle Investigators:	Dennis Feeney, Larry Pochop

Publication

Problem and Research Objectives:

In the west, water is critical to survival. Data and information concerning this resource are very valuable. However, unless information developed from research is easily obtained, all of the effort and expense of collecting, analyzing, and reporting the information is of little use. Therefore, the objective of this project is to establish an efficient and effective way to disseminate the data and information developed by the Water Resources Program.

Methodology:

This is an ongoing project. To continue to meet our objective, the following tasks were successfully completed:

- **Development of the Water Resources Program Web Site**

We developed and maintain a web site for the Water Resources Program. You can view this web site at the following URL:

http://www.wrds.uwyo.edu/wwrp/

We use this site to disseminate information about the Water Resources Program, and eventually to host the reports and products developed by the Program's researchers. To date, we have used the site to post the Program's Request for Proposals, contact information, useful links, and announcements, such as the Announcement/Request for Proposals for the Fiscal Year 2001 National Competitive Grant Program authorized by section 104(g) of the Water Resources Research Act of 1984, as amended.

- **Report given to Program's Priority and Selection Committee**

All proposals for the Water Resources Program are reviewed by a Priority and Selection Committee. This is a group of federal and state representatives that give initial approval as to which proposals qualify for funding. Earlier this year, we made a presentation to the Priority and Selection Committee emphasizing the importance of proper data dissemination to the overall Water Resources Program. The Committee agreed and funded our project for another year.

- **Distribution of Information through Water Library**

The Water Resources Data System's Water Library collects and maintains publications on water, particularly Wyoming water issues. The Library provides physical and bibliographic access to various publications that have been produced by federal and state government agencies, student research and other sources. The Water Library exists to provide current and historical information on regional water issues, maintain and expand the Wyoming Water Bibliography on the Internet (a search-based catalog of the locations and holdings of regional water publications) and provide access to these publications. Our patrons include students, faculty members, government employees and the public.

The Water Library began as a small collection of materials that was used by the Wyoming Water Resources Center. Today, thanks in large part to funding by the US Geological Survey, this comprehensive collection of more than 18,000 documents is an exceptional resource for individuals desiring more in-depth information on the state's water resources. The Water Library web page is now online. We have added a link to the new web page from the WRDS homepage:

http://www.wrds.uwyo.edu

Click on the first link under Online Data Products and Services. We are working at making more and more of the collection available online.

We will house in the Library all of the data and information developed under the Water Resources Program which will further increase the viability of the collection. Researchers with the Water Resources Program use the Water Library for their secondary data collection. Additionally, the Water Library continues to employ one University of Wyoming student who works approximately 10 to 15 hours per week during the fall and spring semesters, and approximately 25 hours per week during the summer.

The Water Resources Data System (which includes the Water Library) is the single largest repository of water and climate data and information in the State of Wyoming. Our database and library collection will continue to grow thanks again in large part to the US Geological Survey's Water Resources Program.

USGS Summer Intern Program

Student Support

Student Support					
Category	**Section 104 Base Grant**	**Section 104 RCGP Award**	**NIWR-USGS Internship**	**Supplemental Awards**	**Total**
Undergraduate	3	0	0	0	3
Masters	3	0	0	0	3
Ph.D.	0	0	0	0	0
Post-Doc.	0	0	0	0	0
Total	6	0	0	0	6

Notable Awards and Achievements

None

Publications from Prior Projects

None