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Bureau of Land Management & U.S. Geological Survey—Water Resources Division

1985

**PLAN**  
of work

**FOR COOPERATIVE  
HYDROLOGY  
INVESTIGATIONS**

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Preface

The Bureau of Land Management each year requires data collection and analysis and technical consulting services of its sister agency, the U.S. Geological Survey. For fiscal year 1985 services are requested of the GS's Water Resources Division.

The Plan of Work includes both Federal Coal Management Program (abbreviated CMP in summaries) and non-CMP work items. Non-CMP work items are identified by a separate BLM appropriation code included in each work item description. Agency technical contacts for the 1985 BLM/GS contract are as follows:

Bureau of Land Management

Denver Service Center  
Bruce Van Haveren (Hydrologist), Contracting Officer's Representative,  
(FTS 776-0150).

U.S. Geological Survey

Water Resources Division  
Donald A. Goolsby, Regional Energy Coordinator, Central Region  
(FTS 776-5937)  
  
Donald L. Coffin, Regional Program Officer, Central Region  
(FTS 776-5929)

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SUMMARY OF BLM FUNDS  
WATER RESOURCES DIVISION  
1985

State	4121	Soil, Water and Air	Tar Sands 4122	Total
Alabama	\$ 60,000			\$ 60,000
Colorado	105,000	74,950		179,950
Montana	135,000			135,000
New Mexico	120,000			120,000
North Dakota	50,000			50,000
Oklahoma	- 0 -			- 0 -
Oregon		30,100		30,100
Utah	212,000	75,850	12,000	299,850
West Virginia	30,000			30,000
Wyoming	93,000			93,000
Denver Service Center	30,000			30,000
TOTALS	\$ 835,000	\$180,900	\$ 12,000	\$1,027,900





PLAN OF WORK  
for  
HYDROLOGIC INVESTIGATIONS  
BUREAU OF LAND MANAGEMENT AND  
USGS WATER RESOURCES DIVISION  
Fiscal Year 1985

#### AUTHORITY

The General Agreement between the Bureau of Land Management (BLM) and the Geological Survey (GS), dated August 15, 1974, is considered the basis for this Plan of Work.

#### PURPOSE

The purpose of this Plan of Work is to specify the nature and amount of assistance to be provided by the GS to BLM during FY 85.

#### SCOPE

This Plan of Work includes hydrologic services to be provided by the GS to BLM in fiscal year 1985 in the States of Alabama, Colorado, Montana, New Mexico, North Dakota, Oklahoma, Oregon, Utah, West Virginia, and Wyoming.

The GS will provide the services, including personnel, equipment, supplies, and facilities, to conduct water resources investigations in areas designated by the BLM. Services will include installation, operation, and maintenance of surface-water gages, ground-water wells, and climate stations, water-quality data collection and analysis,

#### PROCEDURE

Fiscal year 1985 is the eleventh year of this cooperative effort. Some work that began in earlier fiscal years will be continued in fiscal year 1985, while some projects may be dropped. New studies will begin in fiscal year 1985, some of which will carry into fiscal year 1986 and beyond. Proposals will be discussed in joint meetings among the GS District and BLM State offices and the Denver Service Center. The Plan of Work is developed by the Denver Service Center after negotiations between BLM field offices to determine needs and GS field offices to determine capabilities, recommended hydrologic procedures, and for coordination with other studies conducted by the GS in other programs. The development of budgets takes into account the program needs of both agencies and funds available to meet those needs. When mutual interests are strong, funds from both agencies are applied. Funds tabulated in the work order, however, represent only those from BLM.

Field investigative procedures will be standard GS water resources investigation techniques.

## REPORTS

Reporting will generally be standard GS report procedures with some deviations that are detailed in the Plan of Work.

Annual project progress reports will be prepared by each Water Resources Division district and routed through the Central Region to the Contracting Officer's Representative (BLM). Due date for these reports will be September 30, 1985. The GS will provide the appropriate BLM State Office with a copy of each progress report.

Prior to publishing any work involving BLM funds, the GS will forward copies of the draft final project report to the appropriate BLM State Office contact for review and approval. GS will forward two copies of the published reports to the Contracting Officer's Representative (BLM) and as many copies to the appropriate BLM State Office as agreed upon mutually between GS and BLM.

## FUNDING

The BLM will provide funds to the GS to cover all authorized work listed in this Plan of Work, not to exceed \$1,027,900 in FY 85. Billing will be through Standard Form 1081, which will be current as of the beginning of the quarter during which the interagency agreement is signed. Subsequent bills will be issued at 3-month intervals except during the last quarter when bills will be submitted at 1- to 2-month intervals. An equivalency table relating BLM projects and GS projects will be provided quarterly by the GS as will an itemized listing of costs by GS project. The GS will consider this account a reimbursable account.

ALABAMA

SUMMARY OF FUNDS (FY 85)  
WATER RESOURCES DIVISION

Southern Appalachian Region

<u>Project</u>	<u>CMP</u>	<u>Funding</u>
I. Surveillance of Hydrologic Changes Resulting from Mining of Federal Coal in the Warrior Coal Field, Alabama		\$30,000
II. Watershed Modeling of Potential Federal Coal Mining Areas in North-Central Alabama		30,000
	TOTAL	<u>\$60,000</u>
Total for State of Alabama:		\$60,000

## ALABAMA

G. Curtis Jones, BLM, ESO Director (FTS 235-2833)  
Tom Hewitt, BLM, ESO Hydrology Investigations Coordinator (FTS 274-0070)  
C.A. (Jerry) Pascale, WRD District Chief (FTS 229-2957)

### I. Surveillance of Hydrologic Changes Resulting from Mining of Federal Coal in the Warrior Coal Field, Alabama

Robert Kidd, WRD Project Chief (FTS 229-2976)

Since 1976, basic data on quality and quantity of water resources provided by this project have been used for direct input in BLM's coal-lease documents. The BLM Southeastern District Office is using the data from this project in their land management documents. Emphasis on sediment data collection and development of methodology for estimating impacts by sediment from mining will enable BLM hydrologists to assess these changes that previously have not been quantitatively examined. Methodology based on regression equations generated by the project will be used to estimate probable impacts for different leasing alternatives. The "Surveillance" project also provides basic data needed to drive the Precipitation Runoff Modeling System (PRMS) model.

- A. Location: The Warrior Coal Field in Tuscaloosa, Fayette, Walker, and Jefferson Counties, Alabama.
- B. Objective: Collect and interpret basic data on water resources to aid the Bureau of Land Management (BLM) in its responsibility for preparing Environmental Impact Statements (EIS).
- C. Procedures: Utilize streamflow, water quality, ground water, and precipitation data.
- D. Report Products: All collected data will be placed in computer storage and will be published in the annual data reports entitled "Water Resources Data for Alabama." A data report will be prepared by September 30, 1985 summarizing all of the data collected during the project.
- E. Relationship to Other Studies: Interpretation of hydrology and techniques to transfer data to ungaged basin in coal-lease areas of the Warrior coal field will make use of all available data from all projects in the area. Data collected by this project is also used by the PRMS Modeling Group in Lakewood, Colorado.

F. Progress: Reports published--

Knight, Alfred L., and Newton, J.G., 1977, Water and related problems in coal mine areas of Alabama: U.S. Geological Survey Water-Resources Investigations 76-130, 52 p.

Puente, Celso, and Newton, J.G., 1979, Effects of surface coal mining on the hydrology of Crooked and Turkey Creek basins, Jefferson County, Alabama: U.S. Geological Survey Water Resources Investigations 79-91, 39 p.

Puente, Celso, Newton, J.G., and Hill, T.J., 1980, Hydrology of selected basins in the Warrior Coal Field, Alabama--A progress report: U.S. Geological Survey Water-Resources Investigations 80-22, 62 p.

Puente, Celso, Newton, J.G., and Bingham, R.H., 1982, Assessment of hydrologic conditions in potential coal-lease tracts in the Warrior coal field, Alabama: U.S. Geological Survey Water Resources Investigations Open-File Report 81-540.

Kidd, Robert E., and Hill, Thomas J., 1982, A summary of selected publications, project activities and data sources related to hydrology in the Warrior and Plateau coal fields of Alabama: U.S. Geological Survey Water Resources Investigations Open-File Report 82-913.

Cole, E. F. In preparation. Investigation of hydrologic changes in Lake Tuscaloosa, North River Basin, Alabama resulting from coal mining. U.S. Geological Survey Water-Resources Investigations Open File Report. 68 p.

G. Distribution of Funds:

Salaries	\$25,000
Data Processing	3,000
Equipment & Supplies	<u>2,000</u>
TOTAL	\$30,000

## II. Watershed Modeling of Potential Federal Coal Mining Areas in North-Central Alabama

Robert Kidd, WRD Project Chief (FTS 229- 2976)

Small basin watershed modeling using the Precipitation Runoff modeling system (PRMS) in the Warrior Coal Field has been in progress since September 1979. The objective of the modeling project is to provide BLM field hydrologists with a tool that will permit transfer of data from gaged basins to ungaged basins and that will also assist in making predictions about the hydrologic impacts of surface mining. The BLM hydrologist will then be in a position to make interpretations and supportable recommendations to the land managers.

Transferability of the PRMS model has been accomplished in the Warrior basin for the daily mode of the model. Emphasis on the storm and sediment modules of PRMS should aid BLM in areas of limited hydrologic data and in providing hydrologic decisions with very limited time and money.

- A. Location: The Warrior Coal Field in Tuscaloosa, Fayette, and Walker Counties.
- B. Objectives: The objectives of this project are: (1) continue testing transferability of the calibrated PRMS model. (2) test transferability of the storm and sediment modes of PRMS, and (3) to apply the PRMS model to basins with lease potential for oil, gas or coal, as requested by BLM hydrologists.
- C. Procedures:
  1. A "standard" set of variables and parameters will be developed where possible based on calibration of the daily mode of PRMS in four basins.
  2. Storm mode of PRMS will be calibrated in four basins and transferability tested.
  3. Sediment data collected by the Hydrology Surveillance Project will be used to calibrate and test transferability of storm and sediment modes of PRMS.
  4. Apply the PRMS model to BLM selected basins as requested by BLM hydrologists for use in BLM documents.
- D. Report Products: Data collected through this project will be compiled and provided to BLM by September 30, 1985. In addition, an interpretive modeling report analyzing streamflow data of selected basins in the Warrior coal field will be prepared by the same date.

- E. Relationship to Other Studies: This project is closely coordinated with the PRMS Modeling Group in Lakewood, Colorado. The Modeling Group, using data from the Alabama Surveillance Project, has developed a basic model that is being used throughout the country by the U.S. Geological Survey in coal-lease areas.
- F. Progress: The daily mode of the PRMS was applied to BLM coal-lease tracts evaluated in the BLM Draft Southern Appalachian Coal Region EIS released June, 1983.
- G. Report: Kidd, R. E. and C. R. Bossong. (In review.) Daily and storm mode calibration procedures for the PRMS Model for Bear and Turkey Creek Watersheds in the Warrior Coal Field, Alabama.

H. Distribution of Funds:

Salaries	\$23,000
Data Processing	5,000
Equipment and Supplies	<u>2,000</u>
Total	\$30,000





COLORADO

SUMMARY OF FUNDS - FY 85  
WATER RESOURCES DIVISION

<u>Project No.</u>	<u>CMP</u>	<u>Watershed (4341)</u>	
		<u>Salinity</u>	<u>Other</u>
San Juan Synoptic Water Quality (CO-174-2)	\$30,000		
Regionalized Flow Characteristics (CO-171)	20,000		
Potential Impact of Coal Mining near Palisade, Colorado	40,000		
Foidel Creek Data Collection	15,000		
Salt Creek Salinity Control Project		\$22,570	
Operation of BLM Stations - San Luis			\$35,450
Hydrologic Investigation of Badger Creek			16,930
	<u>\$105,000</u>	<u>\$22,570</u>	<u>\$52,380</u>

Total for State of Colorado: \$179,950

I. San Juan Synoptic Water Quality (CO-174-2)

David Butler, WRD Project Chief (FTS 322-0302)

A. Location: Known Coal Resource Leasing area, including the Durango Coal field in part of Archuleta, La Plata, and Montezuma Counties, Colorado.

B. Objectives:

1. Collect discharge and water-quality information from small watersheds in the KCRLA.
2. Define water-chemistry of streams, identify significant concentrations of constituents, and determine areal variation of water quality in the area.
3. Regionalize the water quality of streams as a function of surficial geology, physiography, and land use.
4. Define water-quality condition of the principal bedrock aquifers in the study area.

C. Approach:

1. Conduct reconnaissances in the study area for selection of watersheds for study. Conduct a literature search and computer retrievals for water-quality information on streams and wells in the study area.
2. Measure discharge, temperature, conductance, and pH and collect water-quality samples at the selected surface-water sites during spring runoff and again in late summer during low-flow conditions. Constituents for analysis include major dissolved constituents, dissolved solids, boron, fluoride, iron, lead, manganese, selenium, and zinc.
4. Determine if surface-water chemistry can be regionalized in this area. If significant differences are found in stream chemistry, determine if geology, land use, or soil type are major influences on stream water quality.
5. Based on previous well inventories in the Durango area, select about 20 wells completed in bedrock aquifers for sampling.
6. Measure water levels and collect water-quality samples at the selected wells.
7. Combine the water-quality data collected for wells for this study with previously collected data in order to determine general water-quality characteristics of bedrock aquifers in the KCRLA.

D. Reports:

An interpretative report on water-quality characteristics of the area, to be completed in FY 85.

E. Funding:

Source - Bureau of Land Management.

	<u>FY-85 (report preparation)</u>
Salaries	\$25,000
Travel	1,500
Vehicles	1,500
Equipment	0
Laboratory	0
Computer	<u>2,000</u>
Total	\$30,000

II. Regionalized Flow Characteristics (CO-171)

James E. Kircher, WRD Project Chief (FTS 776-4886)

A. Location: Western Mountainous Region of Colorado

B. Problem: Potential for additional coal and oil shale leasing in northwestern Colorado is increasing the demand on the area's available water resources and consequently the need for quick reliable methods of predicting streamflow conditions in ungaged basins. At present, only floodflow characteristics can be predicted with fairly reliable results but a method for predicting low and medium flows has not been established. This information is essential in the preparation of EIS's for the formulation of lease stipulations, and to the establishment of legal streamflow characteristics and water-quality standards. Present U.S. Geological Survey programs to provide information on flow characteristics are aimed at hydrologic modeling and long-term data collection. Hydrologic modeling will provide water managers with flow characteristics; however, it will only provide information for specific areas rather than the broad geographic area. Long-term data collection and subsequent analyses of these data will provide accurate information on flow characteristics, but more years of data collection are required. Therefore, there is an urgent need to have a short-term study of existing data based on simplistic but acceptable techniques to provide information on streamflow characteristics.

- C. Objectives: The purpose of this study is to provide techniques for predicting low-, mean-, and flood-flow conditions in gaged and ungaged basins. The techniques will be applicable to any natural flow basin in western Colorado and designed for use by the field hydrologist without access to a sophisticated computer. The techniques will be easy to use and only a few hours will be required to compute the streamflow characteristics for a watershed analysis and can be applied to other energy development areas as demand necessitates.
- D. Approach: The approach of this two-year study will involve multiple regression and regionalization techniques. The major tasks of the study include:
1. Develop flow characteristics about observed natural streamflow conditions at active and discontinued gaging stations. This would also include nearby gaging stations within Utah, Wyoming, and New Mexico. The flow characteristics would include, but are not limited to, low-flow characteristics such as 7-day, 10-year low flow and a flow duration curve from which the mean annual discharge can be obtained.
  2. Determine easily measured basin and climatic characteristics, such as drainage area and mean annual precipitation for the gaged basins.
  3. Perform multiple regression analyses and other statistical analyses to develop relations between the respective streamflow characteristics and the basin and climatic parameters. The results will be expressed as regression equations for the selected streamflow characteristics for the study area. These equations will probably be presented based on an ephemeral- or perennial-stream classification.
  4. Prepare a user-oriented technical manual with examples of applications of the regression equations to estimate the flow characteristics.
- E. Report Products: A final report will be completed for review in fiscal year 1985 assuming availability of USGS and BLM support.

F. Distribution of Funds:

This study is part of a larger project to evaluate the USGS data-collection network in western Colorado. BLM's share of the funding requirement of this part of the study is as follows:

Salaries	\$18,000
Travel	1,000
Computer	<u>1,000</u>
Total	\$20,000

### III. Potential Impact of Coal Mining near Palisade, Colorado

A. Location: The Rapid Creek drainage area (see figure on next page) is in Mesa County on the northwestern flank of the Grand Mesa. Rapid Creek is a perennial stream that drains directly into the Colorado River between Cameo and Palisade.

B. Objectives:

1. Compile a study bibliography
2. Describe local geology and structure (i.e., isopach maps of overburden).
3. Inventory springs, wells, streams, and reservoirs.
4. Determine relationships between hydrology and potential underground mining.
5. Report the conclusions.

C. Approach:

1. Collect all hydrologic and geologic information that would support a hydrogeologic study (i.e., mine plans).
2. Make an isopach map of overburden thickness.
3. Measure a) about 40 spring discharges.  
b) up to 15 depths to water in wells.  
c) gain-and-losses on Rapid Creek and Cottonwood Creek.
4. Locate and correctly map reservoirs.
5. Field measurements will be made of for pH, specific conductance, and temperature for water-quality samples.
6. Do a field investigation for evidence of fractures or subsidence and examine well logs.
7. Determine and describe ground-water flow systems in the Rapid Creek drainage.
8. Determine and describe potential hydrologic impacts from underground mining.

D. Report: A draft data report will be completed September 6, 1985. The final results and conclusions would be released as a Water Resources Investigations Report and completed by September 1986.

E. Costs:

Salaries	\$32,500
Equipment and Supplies	1,000
Computer	1,500
Vehicles	5,000
Total	<u>\$40,000</u>

#### IV. Foidel Creek Data Collection

Randolph S. Parker, WRD Project Chief (FTS 776-4886)

A. Location: Routt and Moffat Counties, Colorado

B. Objective: The objective is to maintain a gaging station in an area where hydrologic monitoring was initiated while watersheds were in a natural condition and where mining is now active or will commence soon. Data collected at this station can be used to compare the hydrologic environment in pre- and post-mining.

For FY 85 the monitoring program be reestablished on Foidel Creek. This will allow data collection for pre- and post-mining periods. Data on surface-water quantity and quality and area climate will be collected. These data include continuous monitoring of discharge, water temperature, specific conductance, a climate station, and two precipitation stations. Snow courses will also be maintained near the precipitation stations.

C. Report Products: Streamflow and water-quality data will be published in the annual "Water Resources Data for Colorado."

D. Distribution of Funds:

Operation and maintenance of Foidel Creek Gage (including data storage)	\$ 4,700
Water quality collection and analysis	3,300
Operation and maintenance of climate station, precipitation stations, and snow courses	<u>7,000</u>
Total	\$15,000

V. Salt Creek Salinity Control Project

Dannie L. Collins, WRD, Project Chief, (FTS 322-0302)

- A. Location: One gaging station will be operated to provide streamflow and water-quality information on Salt Creek, which flows out of Sinbad Valley in Colorado. Six stations--two on Potter Creek, one on West Gypsum Creek, one on Vermillion Creek, and two on Onion Creek--which flow out of Fisher Valley in Utah, were discontinued October 1, 1981.
- B. Objectives: The station consists of a digital water-level recorder to measure stream stage and a Manning sampler to obtain water quality and sediment samples. The stage-discharge relationship will be verified by periodic current meter and slope-area measurements. The station will be inspected biweekly with streamflow measurements and water-quality samples obtained at least monthly. This station will provide data on streamflow quantity and the chemical character of the water in this stream. Daily maximum and minimum specific conductance and stream temperature data are available from a two-parameter mini-monitor. Additionally, a recording rain gage is operated in the watershed.
- C. Report Products: Provide BLM with copies of all tabulated data as they are completed. All discharge and water-quality data will be published annually in "Water Resources Data for Colorado."
- D. Distribution of Funds:

Salaries	\$ 9,800
Travel	1,490
Equipment (includes rental costs)	4,770
Computer	660
Laboratory	5,850
Total	<u>\$22,570</u>

VI. Operation of BLM Stations in San Luis Valley

Russell K. Livingston, WRD Project Chief (FTS 323-9345)

- A. Location: Eight study sites in San Luis Valley: two reservoir sites--change in contents; four reservoir sites--inflow; and two daily streamflow sites on San Luis Creek. Recording rain gages are operated at seven sites.
- B. Objective: To determine effects of changes in land use on the runoff from the small drainage areas. Daily flow and rainfall will be tabulated for the six reservoir sites. Two streamflow sites and one rainfall site are located on San Luis Creek to monitor runoff in this area.
- C. Report Products: Data are published annually in "Water Resources Data for Colorado."
- D. Distribution of Funds (CO-050-4340-5225):

Salaries	\$27,090
Travel	4,180
Equipment	2,090
Computer	2,090
Total	<u>\$35,450</u>

VII. Hydrologic Investigation of Badger Creek

Russell K. Livingston, WRD Project Chief (FTS 323-9345)

- A. Location: Badger Creek, tributary to Arkansas River.
- B. Objective: Determine surface-water quantity and sediment yield characteristics of Badger Creek watershed at two data collection sites.
- C. Report Products: Data are published annually in "Water Resources Data for Colorado."
- D. Distribution of Funds (CO-050-4340-5225):

Salaries	\$ 9,500
Travel	2,410
Equipment	840
Computer	630
Laboratory	3,550
Total	<u>\$16,930</u>



MONTANA  
 SUMMARY OF FUNDS  
 WATER RESOURCES DIVISION

Project	CMP
I. Hydrologic Characterization	
A. Streamflow	\$ 56,000
B. Ground-Water Levels	19,000
II. Hydrologic Site Studies	20,000
III. Hydrologic Data Files	<u>40,000</u>
TOTAL	<u>\$135,000</u>
 Total for State of Montana:	 \$135,000

MONTANA

Dean Stepanek, BLM Montana State Director (FTS 585-6462)  
Peter Bierbach, BLM Hydrology Investigations Coordinator (FTS 585-6655)  
George M. Pike, WRD, District Chief (FTS 585-5302)

I. Hydrologic Characterization of Eastern Montana Coal Areas

A. Network Maintenance of Streamflow

Ronald R. Shields, WRD Project Chief (FTS 585-5496)

1. Objectives: Collect streamflow data at key locations to supplement other programs. The data is essential in defining runoff and water quality from potential impact areas, determining streamflow characteristics, and providing a data base from which future changes can be analyzed.
2. Procedure: Standard U.S. Geological Survey methods of surface-water and water-quality data collection will be used to obtain data at the following stations:

Tongue River below Tongue River Dam - Q	Redwater River at Circle-S,Q
Prairie Elk Creek near Oswego - S	Redwater River near Vida-S,Q
Nelson Creek near Van Norman-S	Armels Creek near Forsyth-Q
Rosebud Creek at mouth near Rosebud-Q,S	Tongue River at State Line - Q

S = Streamflow      Q = Water quality

3. Report Products: Basic records from streamflow sites will be submitted to BLM annually or as mutually agreed upon. Records will be published by the USGS in an annual report, "Water Resources Data for Montana." The data will be used by the USGS in preparing interpretive reports described in other parts of the work plan.
4. Relationship to Other USGS Studies: This program will supplement and be correlated with other USGS programs of streamflow data collection. Numerous other stations are operated in this area.
5. Distribution of Funds:

Salaries	\$ 34,000
Lab	5,000
Travel	9,000
Supplies	3,000
Data Processing	<u>5,000</u>
TOTAL	\$56,000

## B. Ground-Water Monitoring

Thomas E. Reed, WRD Project Chief (FTS 585-5263)

1. Location: Fort Union and Powder River Basin coal regions of eastern Montana.
2. Objectives: To provide ground-water data base from which an assessment can be made of the resource, future responses to stresses can be predicted, and pollution and supply problems can be detected and defined. This activity provides for long-term collection of ground-water data from selected observation wells. Specifically, wells monitored in CMP study sites are incorporated in this program to extend periods of data collection. In addition, selected holes drilled by industry or other agencies are cased and tested.
3. Procedures
  - a. Make water-level measurements and continue operation of water-level recorders.
  - b. Compile and analyze data.
  - c. Collect ground water samples from selected wells.
  - d. Analyze water samples.
4. Report Products: Data collected under this program will be incorporated in CMP Site Study reports and in regional evaluations. The data will be stored in automated data files for rapid retrieval.
5. Relationship to Other USGS Studies: Data collected under this activity will be used to help define premining conditions of potential lease sites, help calibrate ground water models to predict the effects of mining, and help transfer data to surrounding areas from intensively studied sites.
6. Distribution of Funds:

Salaries for Data Collection	\$10,000
Laboratory Services	1,000
Travel	5,000
Data Processing	<u>3,000</u>
Total	\$19,000

## II. Hydrologic Site Studies

Neal E. McClymonds, WRD Project Chief (FTS 585-5263)

- A. Locations: Hydrologic studies have been conducted at several locations in the Fort Union and Powder River Basin coal regions. Examples of completed studies include Prairie Dog Creek, Snider Creek, Greenleaf-Miller, and Bloomfield coal tracts. Final reports in various stages of review have been written for Corral Creek, West Otter, and Timber Creek areas. Studies have been completed in Horse Creek, Little Bear Creek, and Southwest Glendive coal areas and reports are in final preparation. Data collection and analysis is currently underway in the Pasture Creek and Fromberg-Joliet coal areas.
- B. Objectives: To collect and evaluate hydrologic data at potential coal-lease sites for activity planning in the Powder River and Fort Union coal regions. The studies are designed to compile available hydrologic information, design and implement site-specific data collection programs, and evaluate the potential hydrologic impacts of mining.
- C. Procedures: Available hydrologic data will be compiled and evaluated. Analysis of information acquired during field studies will be completed and reports describing the conclusions will be prepared for review. No field activity is planned for FY 85.
- D. Report Products: Final reports for the Pasture Creek and Fromberg-Joliet areas will be completed for release in USGS Water Resources Investigations series. Review copies will be available early in FY 85.
- E. Distribution of Funds:

Salaries	\$ 16,000
Computer Services	2,000
Report Preparation	<u>2,000</u>
TOTAL	\$ 20,000

### III. Hydrologic Data Files

Lawrence E. Cary, WRD Project Chief (FTS 585-6113)

- A. Location: Fort Union and Powder River Basin coal regions of eastern Montana.
- B. Objectives: To compile hydrologic data from existing files which could be of use to managers and scientists interested in hydrologic consequences associated with coal mining. The study is designed to locate, compile, assess, format, and store streamflow data collected by other federal and state agencies, industry, and universities. Numerous investigators have and continue to collect large amounts of hydrologic measurements which currently reside in published and unpublished reports, permit applications, and mine plans or in file cabinets.
- C. Procedures: Existing computer files of the USGS will be used to store information acquired from various sources. The data will be reviewed to determine the quality or accuracy by evaluating collection methods, record handling procedures, equipment, and quality assurance programs. Data of unreliable quality will be flagged to allow users of the files to selectively screen the information. Field checks of site locations, well depths, or other verifiable information will be made if necessary.
- D. Report Products: A report describing the location and period of record of streamflow monitoring sites will be prepared. Data from the sites will be identified and where appropriate, entered into computer files.
- E. Relationship to Other Studies: This effort will merge data from numerous sources and provide central files for all hydrologic data routinely collected by Federal, state, industry, and universities.
- F. Distribution of Funds:

Salaries	\$ 33,000
Travel	2,000
Computer	<u>5,000</u>
TOTAL	\$ 40,000



NEW MEXICO

SUMMARY OF FUNDS  
WATER RESOURCES DIVISION

San Juan Coal Region

<u>Project</u>	<u>CMP Funding</u>
Hydrologic Surveillance	\$ - 0 -
Hydrologic Modeling-Kimbeto	45,000
MFP/EIS Assistance	<u>75,000</u>
Total	\$120,000

Total for the State of New Mexico: \$120,000

## NEW MEXICO

Charles W. Luscher, BLM State Director (FTS 476-6217)  
Herb Garn, BLM Hydrology Investigations Coordinator (FTS 476-6231)  
James F. Daniel, WRD District Chief (FTS 474-2246)

### I. Hydrologic Surveillance of Coal-Lease Areas

Bob Hejl, WRD Project Chief (FTS 474-5518)

- A. Location: Coal-lease areas of San Juan and McKinley Counties located in northwestern New Mexico.
- B. Introduction: Prior to 1975, virtually no water resources information was available in the coal-lease areas in north-western New Mexico. The technical investigation (formerly EMRIA) program began in New Mexico in FY 1975 to assure adequate baseline water resources data would be available for choosing reclamation goals and establishing lease stipulations for surface mining for coal.
- C. Objectives: To (1) document hydrologic characteristics of streamflow and ground water in coal-lease areas and their variabilities in quantity and quality and (2) predict the effects of coal extraction and associated development on the water resources in northwestern New Mexico. This information will aid BLM in their operations pertaining to coal-lease stipulations and land management practices of multiple purpose uses of the public domain.
- D. Approach: Basic data collection sites were established to collect adequate water resources data under natural or present conditions to establish a baseline as to quantity and quality from which to predict the effects of surface extraction of coal and related activities. Some of the areas at or near the gaged sites will be mined in the future which will enable us to compare the measured effects of surface mining for coal on the water resources to the predicted effects.

The hydrologic data collection network consisted of four continuous record streamflow/water quality stations, seven partial-record water quality of streamflow stations, and 22 observation wells completed either in the Pictured Cliffs sandstone underlying the coal seams, in the coal seams of the Fruitland Formation, or in the overburden. There will be no data collected during FY 1985.

- E. Relationship to Other Studies: The hydrologic surveillance effort was coordinated with 15 streamflow gaging sites, 25 surface-water quality sites, 15 observation-well sites (water level and water quality), supported with USGS Federal coal hydrology funding, and 3 streamflow and water-quality sites funded by the National Park Service. Most of the sites were established October 1977. Interpretation of hydrology



and techniques to transfer data to unged drainage basin in coal-lease areas of northwestern New Mexico for BLM-CMP reports will make use of all data available from all projects in the project area.

F. Progress: Reports published--

Hejl, H. R., Jr., 1980, Preliminary appraisal of ephemeral streamflow characteristics as related to drainage area, active-channel width, and soils in northwestern New Mexico: U.S. Geological Survey Open-File Report 81-64, 15 p.

Hejl, H. R., Jr., (in press). Streamflow characteristics as related to basin characteristics in strippable coal-resource areas of northwestern New Mexico.

U.S. Department of the Interior, 1976, Resource and potential reclamation evaluation, Bisti West study site -- Bisti coal field: Bureau of Land Management EMRIA Report 5-1976, p. 69-80, F1-F16.

\_\_\_\_\_, 1981, Resource and potential reclamation evaluation, Kimbeto study area: Bureau of Land Management EMRIA Report 17-1977, p. J1-J7, L13-L18, Q1-Q19.

\_\_\_\_\_, 1981, Resource and potential reclamation evaluation, Ojo Encino study area: Bureau of Land Management Technical Investigations Report 19-78, p. C17-C20, J1-J9, Q1-Q-12.

G. Report Products and Due Dates: All data collected in the Federal Coal Management Program were published by the USGS in the annual basic data report, "Water Resources Data for New Mexico." Water resources information that has been collected in the Federal Coal Management Program and other programs in the strippable coal areas is being analyzed to aid BLM in management decisions of coal-lease areas of the public domain. The data collected from hydrologic surveillance will be summarized in the following reports:

1. Characteristics and chemical quality of shallow water-bearing units in the strippable coal areas in north-western New Mexico, draft completed June 1984.
2. Surface-water/water-quality characteristics in strippable coal areas in northwestern New Mexico, draft completed December, 1983.

H. Distribution of Funds:

Salaries (review and publish reports in preparation)

\$ 0

TOTAL \$ 0

## II. Hydrologic Modeling-Kimbeto Reclamation Study Site

Bob Hejl, WRD Project Chief (FTS 474-5518)

- A. Location: The modeling control basin with drainage area of 8.2 sq. mi. is located within BLM's Kimbeto Reclamation Study Area in northwestern New Mexico.
- B. Introduction: Initially (1975) the Federal Coal Management Program was directed to obtaining baseline water-resources information. In 1977, Congress passed the Surface Mining Control and Reclamation Act (Public Law 95-87). This act specifically addressed hydrologic impacts of surface mining, i.e., the mine plan would have to show how the hydrologic balance of the mine area would be restored to premine conditions before a plan could be approved. The Federal land manager must be certain reclamation criteria goals can be met. A drainage basin was instrumented in 1978 to collect data for the development of a predictive precipitation-runoff model.
- C. Objectives: The objectives are to develop, calibrate, and verify precipitation-runoff models for predicting surface runoff characteristics and sediment yield under various land-use conditions in the coal-lease areas in northwestern New Mexico. The emphasis will be on relating parameters used by the model to measurable physical features of a selected watershed basin to facilitate transferability of the model from an instrumented basin to uninstrumented basins.
- D. Approach: A watershed (Ah-shi-sle-pah Wash) with a drainage area of 8.2 square miles in the strippable coal-lease area in the San Juan Basin was instrumented to collect data for the development, testing, calibration, and verification of precipitation-runoff models. The instrumentation included a streamflow gaging station, an automatic pump sampler, single-stage samplers, meteorological station, five recording rain gages located for equal area distribution over the basin (T. 22 N., R. 10 W.) and two rain gages outside the basin to define regional rainfall intensities and frequencies. Water-quality data was collected from reclaimed spoil piles at three sites at the San Juan mine (T. 30 N., R. 15 W.) and three sites at the Navajo mine (T. 29 N., R. 15 W.). No data will be collected during FY 1985.
- E. Technology Transfer: The work effort in FY 1985 will be to test and verify the transfer value of the model calibrated at the intensely instrumented basin, Ah-Shi-Sle-Pah Wash, to less intensely gaged basins in and near the strippable coal-lease areas. Four small gaged basins having rainfall and runoff data are available for these verifications. The results of these verifications will be included in the report on calibration and verification of a precipitation-runoff model for northwestern New Mexico.

- F. Relationship to Other Studies: This program is closely coordinated with the Regional Precipitation-Runoff Modeling Group in Lakewood, Colorado. The modeling group in Lakewood has developed a basic model to be used in coal-lease areas.
- G. Progress: Calibration, optimization, and sensitivity analyses to refine parameter values were continued. A draft report will be completed in September 1984 documenting the calibration, optimization, and sensitivity of parameters at the AH-Shi-Sle-Pah Wash modeling basin.
- H. Report Products: A final report on calibration and verification of a precipitation-runoff model for northwestern New Mexico will be completed in FY 1985. The report will include the contents of the draft prepared in FY 1984 and results of verification and transfer value of the model.
- I. Distribution of Funds:

Salaries	\$35,000
Modeling (computer cost)	<u>10,000</u>
TOTAL	\$45,000

### III. Ground-Water Hydrology of Coal Lands in San Augustine Coal Area

Robert Myers, WRD, Project Chief (505) 646-1335, Las Cruces Field Office

- A. Location: Coal-lease area within northern half of San Augustine Coal area (French's Arroyo) and Zuni Salt Lake, located in Cibola and Catron Counties, west-central New Mexico.
- B. Introduction: Coal deposits in parts of a 125 square mile tract of land in Catron and Cibola Counties, New Mexico, are being considered by the U.S. Bureau of Land Management (BLM) for coal leasing. BLM is preparing an Environmental Impact Statement (EIS) for the area and needs hydrologic information in order to address the impacts of possible coal mining on the ground-water resources in and adjacent to the area. Existing ground-water information is not adequate to address the concerns of coal activity planning. Adequate ground-water data is vital for meeting NEPA and SMCRA compliance requirements in the coal program. Such data are also required for tract delineation and site-specific analyses preceding the EIS. The San Augustine Coal Area is one of the major coal lease areas in round two of the San Juan coal leasing program. The final EIS is scheduled for completion in January, 1987.
- C. Objectives: (1) To describe the ground-water hydrology of the French's Arroyo area in sufficient detail (using existing well control) for use in the coal activity planning and (2) predict the probable effects of coal mining and related activities on the following:
  - a. Nearby stock and domestic wells.
  - b. The quantity and quality of water in the principal aquifers (surface alluvium, Moreno Hill Formation and Dakota Sandstone).
  - c. The springs flow into Zuni Salt Lake.

This information will aid BLM in completing the second round San Juan Basin Coal EIS.

- D. Approach: Impacts from mining coal in the Moreno Hill Formation are most likely to affect the quality and quantity of ground-water resources in that formation and in the Quaternary alluvium. If wells in the Dakota Sandstone are used to provide a long time water supply for development of the coal, then some existing wells and springs that tap the Dakota may also be affected. Consequently, the proposed study will be primarily focused on identifying, measuring and selectively sampling wells in the Dakota Sandstone and younger aquifers.

Standard WRD data collection, assemblage and analytical techniques will be used. The potential effects of development on the ground-water resources of the area will be discussed. A generalized range

of effects, if any, of coal lease development on spring flow at Zuni Salt Lake will be simulated analytically. To assist in this analysis, a limited number of water samples from Zuni Salt Lake, the springs and nearby wells will be collected. These samples will be analyzed for major cations and anions, dissolved oxygen, deuterium, tritium and possibly sulfur. The isotope analyses will be used to evaluate which aquifer(s) contribute water to the springs. The Zuni Salt Lake analysis will provide an engineering estimate of potential effects and will be used to evaluate the need for additional data collection and interpretation in the Zuni Salt Lake area.

The amount of additional data to be collected by the U.S. Geological Survey (USGS) in the French's Arroyo area is not expected to be great because a considerable amount of information is already available. All data collected and/or utilized by the USGS will be publicly available. Aquifer structure, thickness and hydrologic head maps will be prepared and assumed stress-effect analyses will be made utilizing a range of analytical tools including non-equilibrium bounded and unbounded theory.

The study will consist of the following steps:

1. Review pertinent literature and assemble existing geohydrologic information from the files of the USGS, BLM, Salt River Project, N.M. Bureau of Mines and Mineral Resources, and N.M. State Engineer's Office.
  2. Select and obtain base maps and begin preparation of aquifer geology and head maps utilizing data from one above.
  3. Determine the types of additional data that can be collected within funding limits and complete field data collections. This will involve measuring of water levels, the limited collection of water samples for limited chemical analyses, performance of recovery tests on stock wells and possibly some geophysical logging with the N.M. District's logger. The Salt River Project is expected to be running additional aquifer tests at test holes drilled in the French's Arroyo area.
  4. Complete the geohydrologic maps and include all newly collected data and estimate development effects that are expected to impact the aquifers, wells and springs in the area.
- E. Relationship to Other Studies: Existing information includes lithologic and stratigraphic data from a number of coal-test holes and 10 oil-test holes, and the potential for obtaining water-level, water quality, yield and transmissivity data from 25 stock and domestic wells. Aquifer-test data area available from two recently drilled hydrologic test wells--one in the alluvium and one in the Dakota Sandstone (Ground-water Planning Division, 1983). Previous studies deal almost exclusively with the geology of the region. No studies of the hydrology of the French's Arroyo area, other than the

aquifer tests mentioned above, have been made. Bradbury (1967, 1971) includes information on the saline water hydrology of Zuni Salt Lake. An unpublished report by San Filippo (1982) includes useful information on the geology of French's Arroyo and Zuni Salt Lake.

WRD is currently conducting ground-water studies of the Zuni Indian Reservation (NM77-225) and the Acoma and Laguna Pueblos (NM83-246, 345). A study of the general hydrology of Cibola County (NM80-230) has recently been completed by WRD. A study of Catron County (LNM81-233) was initiated in 1981 by WRD, but is progressing slowly because of funding cuts. The WRD Catron and Cibola Counties studies were programmed to provide only a general picture of the hydrology.

The Salt River Project has been test-drilling the coal deposits on State leases in the French's Arroyo area and plans to do additional hydrologic monitoring in the area. Information from the hydrologic testing program on the Salt River Project can be used by WRD in making its coal mining impact analysis. The New Mexico Bureau of Mines and Mineral Resources is also doing some geohydrologic work on State lands in Catron County. Coordination between the Bureau of Mines and USGS will be maintained.

- F. Progress: Base maps were prepared, a literature review was completed, and existing geohydrologic information was assembled in FY 1984.
- G. Report Products and Due Dates: A summary report of the geohydrology of the French's Arroyo coal lease area and the probably hydrologic impacts will be prepared. The first draft of the report will be available to BLM in December, 1985 and the final report by late FY 1986, or according to the EIS time schedule, whichever is later.
- H. Distribution of Funds: The study will carry through to FY 1986 for data collection and report preparation. The total cost of the study for this time period is \$137,000. Incremental funding for FY 1986 will be contingent on funding availability.

FY 1985 costs: Salaries (11 WM's)	<u>\$75,000</u>
TOTAL	\$75,000

NORTH DAKOTA

SUMMARY OF FUNDS  
WATER RESOURCES DIVISION

Project	CMP FUNDS
Hydrologic and Geochemistry Data Base for Coal Areas in North Dakota <u>50,000</u>	
	TOTAL      \$50,000
Total for the State of North Dakota:    \$50,000	

NORTH DAKOTA

Dean Stepanek, BLM Montana State Director (FTS 585-6462)  
Peter Bierbach, BLM Hydrology Investigations Coordinator (FTS 585-6655)  
L. Grady Moore, WRD District Chief (FTS 783-4601)

I. Hydrologic and Geochemistry Data Base for  
Coal Areas in North Dakota

Larry Briel, Project Chief (FTS 783-4607)

1. Objectives: To provide a data base of hydrologic and geochemical information prior to, during, and after mining operations. These data would be available from computer storage through a variety of selection descriptors
2. Approach: Hydrologic and geochemical data related to energy development are being collected by numerous State and Federal agencies in North Dakota. Much of the data are being put into dead storage owing to lack of interest, money, or manpower to catalogue and make the data available for management decisions. This project would set up a computerized data base to store and make these data readily available. An initial canvas would be made of the agencies to find out the kinds of data that are available and the availability of the data to the general public. The data base would be built to accommodate the data that are available. The data would be coded into this computer data base with access built into the system.
3. Relationship to Other Closely Associated Non-BLM Funded Activities: The USGS has several projects with State and Federal agencies that collect hydrologic and geochemistry data. The North Dakota Public Service Commission and the State Universities have programs that involve data collection. There could be a mutual interest in a comprehensive data base.

4. Distribution of Funds:

Salaries	\$ 36,000
Travel	9,000
Computer	<u>5,000</u>
TOTAL	\$ 50,000

5. Reports: The computer-stored data would be available for the costs of retrieval. An Open-File Report describing the data base and access will be prepared and submitted for review by August 31, 1985.



OKLAHOMA

SUMMARY OF FUNDS  
WATER RESOURCES DIVISION

Western Interior Coal Region

Project	CMP Funds
Hydrologic Modeling	
Coal Creek near Lehigh	\$ - 0 -
TOTAL	\$ - 0 -
Total for the State of Oklahoma: \$ - 0 -	

## OKLAHOMA

Charles Luscher, BLM State Director (FTS 476-6217)  
Herb Garn, BLM Hydrology Investigations Coordinator (FTS 476-6231)  
James H. Irwin, WRD District Chief (FTS 736-4256)

### Hydrologic Investigations and Modeling

#### A. Introduction

Purpose and Scope: BLM is responsible for assessing the probable water resources impacts and reclamation capabilities of any area under Federal jurisdiction in which surface coal mining might occur. To meet this responsibility, a variety of hydrologic data are required. In Oklahoma, these data are being provided by: (1) hydrologic monitoring in selected areas, and (2) hydrologic modeling of Coal Creek Basin near Lehigh.

#### B. Reports

Listed below are reports from various areas of the southeastern Oklahoma Coalfield for projects conducted in cooperation with the BLM and other cooperators.

Marcher, M. V., Bergman, D. L., Stoner, J. D., and Blumer, S. P., 1981, Preliminary appraisal of the hydrology of the Blocker area, Pittsburg County, Oklahoma: U.S. Geological Survey Water-Resources Investigations Report 81-1187, 48 p.

Marcher, M. V., Bergman, D. L., Stoner, J. D., and Blumer, S. P., 1983, Preliminary appraisal of the hydrology of the Rock Island area, Le Flore County, Oklahoma: U.S. Geological Survey Water-Resources Investigations Report 83-4013, 35 p.

Marcher, M. V., Bergman, D. L., Stoner, J. D., and Blumer, S. P., 1983, Preliminary appraisal of the hydrology of the Red Oak area, Latimer and Le Flore Counties, Oklahoma: U.S. Geological Survey Water-Resources Investigations Report 83-4166, 38 p.

Marcher, M. V., Huntzinger, T. L., Stoner, J. D., and Blumer, S. P., 1983, Preliminary appraisal of the hydrology of the Stigler area, Haskell County, Oklahoma: U.S. Geological Survey Water-Resources Investigations Report 82-4099, 37 p.

Slack, L. J., 1983, Hydrology of an abandoned coal-mining area near McCurtain, Haskell County, Oklahoma: U.S. Geological Survey Water-Resources Investigations Report 83-4202, 117 p.

Slack, L. J., Blumer, S. P., 1984, Selected physical and chemical characteristics of water in coal-mine ponds, eastern Oklahoma, June to November 1977-81: U.S. Geological Survey Open-File Report 84-446, p., (in press)

Marcher, M. V., Bergman, D. L., Slack, L. J., Blumer, S. P., and Goemaat, R. L., 1984, Hydrology of Area 41, Western Region, Interior Coal Province, Arkansas and Oklahoma: U.S. Geological Survey Water-Resources Investigations Open-File Report 84- (in review)

Tortorelli, R. L., 1984, Application of USGS Precipitation-Runoff Modeling System to selected basins in Southeast Oklahoma Coalfield: U.S. Geological Survey Water-Resources Investigations Report 84- (in preparation)

Blumer, S. P., 1984, Hydrology of the Coal Creek Study Area, Coal County, Oklahoma: U.S. Geological Survey Water Resources Investigations Report 84- (in preparation)

### C. Distribution of Funds

None. No funding will be received from the BLM during fiscal year 1985. Reports listed as "in preparation: will be completed in fiscal year 1985.



OREGON

SUMMARY OF FUNDS  
WATER RESOURCES DIVISION

<u>Project</u>	<u>Total (6333)</u>
Operation and Maintenance of Stream Gages	\$20,400
Sediment Sample Analysis	<u>9,700</u>
TOTAL	\$30,100

Total for State of Oregon: \$30,100

OREGON

William G. Leavell, BLM State Director (FTS 429-6251)  
Bill Brookes, BLM State Hydrologist (FTS 429-2253)  
L. B. Laird, WRD District Chief (FTS 429-2010)

I. Operation and Maintenance of Four Stream Gages

- A. Location: Packers Gulch near Cascadia, Ore. (14185880);  
Tucca Creek near Blaine, Ore. (14303200);  
East Fork Lobster Creek near Alsea, OR (14306340)  
Star Gulch near Ruch, OR (14362250)

B. Product Output:

1. Data from these gages will be entered into WATSTORE and published in the annual report "Water Resources Data for Oregon."
2. BLM Districts will be provided a primaries and a year-end station analysis for these gages.

C. Distribution of Funds:

O & M of Four gages @ \$5,100	\$20,400
TOTAL	\$20,400

II. Sediment Sample Analysis

- A. Procedure: Analysis of approximately 950 water samples for suspended sediment concentration

B. Product Output

1. Data will be entered into WATSTORE
2. Lab sheets (analytical results) will be provided to the Salem District BLM.

C. Distribution of Funds:

Salaries	\$9,700
TOTAL	\$9,700

UTAH  
 SUMMARY OF FUNDS  
 WATER RESOURCES DIVISION

Unita-Southwestern Utah Coal Region

Project	CMP	4341	4122
I. Cooperative State Programs (UT-1, 3, and 4)		\$50,150	
II. Sediment and Trace-metal Transport to Scofield Reservoir by Streams in the Pleasant Valley Coal Resource Area, Central Utah (UT-160)	\$112,000		
III. Discharge and Chemical Quality of Water from Selected Springs in Parts of Juab, Millard, and Utah Counties, Utah (UT-164)		25,700	
IV. Hydrologic Evaluation of the Castle Valley Ridge and Alkali Creek Coal-lease Areas, Utah	100,000		
V. Publication of Hydrologic Maps for the Sunnyside Tar Sands Area			\$12,000
TOTALS	\$212,000	\$75,850	\$12,000

Total for State of Utah: \$299,850

UTAH

Roland Robison, BLM State Director (FTS 588-5311)  
Boyd Christensen, BLM Hydrology Investigations Coordinator (FTS 588-3120)  
Ted Arnow, WRD District Chief (FTS 588-5663)

I. Cooperative State Programs (UT-1, 3, and 4)

Russell W. Cruff, Project Chief (FTS 588-5663)

- A. Objective: To determine the sediment, salinity, and discharge of selected streams in Grand, San Juan, and Uintah Counties.
- B. Approach: Operate and maintain sediment, water quality, and gaging stations during FY 84.

C. Distribution of Funds

UT-1 Collection of streamflow records.

Floy Wash	\$ 4,630
Indian Creek	4,630
Cottonwood Creek near Green River	4,630
Bull Creek	4,630
Montezuma Creek	10,630
Subtotal	<u>\$29,150</u>

UT-3 and 4 Collection of chemical quality, and sediment records.

Floy Wash	\$ 4,200
Indian Creek	4,200
Cottonwood Creek near Green River	4,200
Bull Creek	4,200
Montezuma Creek	4,200
Subtotal	<u>\$21,000</u>

TOTAL \$50,150

- D. Report Products: Information will be included in annual basic data report. BLM may request data directly if needed.



II. Sediment and Trace-metal Transport to Scofield Reservoir by Streams in the Pleasant Valley Coal-Resource Area, Central Utah (UT-160)

Doyle W. Stephens, WRD Project Chief (FTS 588-5654)

- A. Location: Pleasant Valley and Scofield Reservoir area of Central Utah.
- B. Objectives: Determine sediment and common trace-metal loads in selected streams in the Pleasant Valley coal resource area. Determine trace-metal loads entering Scofield Reservoir and their effects on reservoir geochemistry. Determine if coal mining, coal washing, and associated timber clear-cutting in Eccles Canyon have increased loads compared to the nearby undisturbed watershed of Boardinghouse Canyon Creek.
- C. Approach: Monitor and compute sediment loads at existing gaging stations on Mud (Pleasant Valley) and Fish Creeks at points of inflow to Scofield Reservoir. Maintain a gaging station on Boardinghouse Canyon Creek as a control watershed to be compared with data from Eccles Canyon where extensive timber cutting and coal-related activities are underway. Analyze for the types and weights of metal oxides attached to sediment samples in order to compute trace metal loads. Predict effects of present and future sediment and trace metal transport into Scofield Reservoir on reservoir geochemistry.

D. Distribution of Funds:

Salaries	\$ 96,950
Vehicle and transportation	1,300
Maintenance of Boardinghouse Canyon, Eccles, and Mud Creek gaging stations	400
Per diem	450
Chemical analyses	8,300
Drafting and printing	2,300
Boat rental	300
Computer services	<u>2,000</u>
Total	\$112,000

III. Discharge and Chemical Quality of Water From Selected Springs in Juab, Utah, and Millard Counties, Utah (UT-164)

D.E. Wilberg, Project Chief (FTS 588-5654)

- A. Location: Parts of Juab, Utah, and Millard Counties, Utah
- B. Objective: Collect hydrologic and geologic data on 75 to 85 selected springs; summarize and interpret these data in a report for BLM that will facilitate a BLM evaluation of the springs as water supplies and as potential water rights.
- C. Approach: The project will be done during November 1, 1983, to January 31, 1985, in two phases.

The first phase will consist of assembling available data from the files of the BLM, USGS, and State agencies, if they have any relevant data, and planning of field work. BLM will identify springs to be included in the study and furnish us with any data they have on them. The USGS files will be searched for data on the springs and any data available from other agencies will be obtained. A set of topographic maps will be assembled, at the largest scale available, that show all the springs. A plan for fieldwork will be prepared that includes visits (two if possible) to each of the springs.

The second phase will be field collection of data. Each spring will be visited at least once and preferably twice--once during the probable high-flow period (March through May or June) and once during low flows (July or August through January). One visit to each spring to collect a sample must be completed by June 30, 1984. The first visit will include determination of exact location, collection of a sample for chemical analysis, measurement of flow, determination of geologic source and the reason for ground-water discharge at that location (if possible), and collection of any other data needed for the ground-water site inventory file. The second visit would be to collect any data not obtained on the first visit, measure flow, and determine the specific conductance of the water. If any large difference in conductance is noted between the first and second visits, the water will be resampled for analysis.

D. Distribution of Funds:

Salaries	\$ 19,200
Computer time	200
Report printing	<u>6,300</u>
TOTAL	\$ 25,700

- E. Reports: Two tables will be prepared--one which will list all the spring records, including discharge measurements, and the second which will include all the chemical analyses. These tables will be completed by September 30, 1984, and will be furnished to BLM for

their use until the final report is prepared. A draft of the final report will be submitted for technical review by December 31, 1984, and it will be transmitted for USGS Regional and Headquarters review (with a copy to BLM for their review) by February 28, 1985. The report will be printed as a USGS Water-Resources Investigation and printed copies will be available in July, 1985 depending on the time used by review, revision, and printing.

IV. Hydrologic Evaluation of the Castle Valley Ridge and Alkali Creek Coal-Lease Areas, Utah

Project Chief, (FTS 588-5654)

- A. Location: Coal leases in the Wasatch Plateau and Book Cliffs areas in Carbon and Emery Counties, Utah.
- B. Objectives: Collect hydrologic and geologic data in and near the coal-lease areas which have been designated by BLM as priority areas in their coal-lease program. These data will enable the following pre-mining aspects of the local hydrology to be characterized:
1. Surface-water flow, variability in flow, quality, and fluvial-sediment production.
  2. Geologic units and their water-bearing characteristics, and identification of geologic structure that may influence hydrology.
  3. Recharge, movement, and discharge of ground water; ground-water quality; and ground water in storage.
  4. Potential effects on the pre-mining hydrologic system of coal mining in and near the coal-lease areas.

Completion of these objectives will allow BLM to evaluate several water issues that were identified in past environmental impact statements as having insufficient analysis because of deficiencies in data.

- C. Approach: The study will be done during the period October 1, 1984 to January 31, 1987 using the following techniques and collecting the following types of data:
1. Measure streamflow in and near the lease areas periodically and correlate flow with that for nearby gaging stations. Estimate average and peak flows using techniques and regression relations developed in the BLM/USGS program. Sample surface water for chemical analysis and periodically for sediment content.
  2. Field evaluation of the water-bearing characteristics of geologic units and hydrologic effects of geologic structure (supplementing available geologic maps with limited field investigations). One test hole will be drilled and tested in each of the project areas if funds are sufficient. Tests will include determining the water level in each hole, taking a water sample, and attempting to determine hydraulic conductivity of the water-bearing material.
  3. Identify sources of ground-water recharge, directions of movement, and points or areas of discharge. Make seepage runs on streams to identify areas of ground-water recharge and discharge. Make a complete inventory of springs and wells in and near lease areas.

Use any available ground-water head data to estimate directions of movement. Sample water from springs and wells for chemical analysis. Estimate saturated thickness of geologic units and the volume of ground water in storage.

4. Using available hydrologic and mine-plan data, make qualitative estimates of the potential hydrologic effects of mining.

D. Distribution of Funds:

Salaries and benefits	\$ 50,000
Travel	9,000
Vehicles	7,000
Supplies and equipment, base maps	3,000
Drilling and testing 2 test holes	25,000
Chemical analyses	5,000
Computer services	1,000
	<hr/>
Total	\$100,000

- E. Reports: A final report on the lease will be prepared for submission to the WRD Regional Office (preliminary copy to BLM for comments) by January 31, 1987.

V. Publication of Hydrology Maps for the Sunnyside Tar Sands Area

K. L. Lindskov, Project Chief, (FTS 588-5654)

A. Objective: Prepare and distribute hydrologic maps.

B. Location: Sunnyside Tar Sands Area

C. Distribution of Funds:

Salaries	<u>12,000</u>
TOTAL	\$12,000



WEST VIRGINIA  
 SUMMARY OF FUNDS  
 WATER RESOURCES DIVISION

Project	Funds
I. Hydrologic Modeling of Small Streams in the Coal Areas of Appalachia	<u>\$30,000</u>
Total for West Virginia:	\$30,000

## WEST VIRGINIA

Curt Jones, BLM ESO Director (FTS 235-2833)

Tom Hewitt, BLM Hydrology Investigations Coordinator (FTS 235-2868)

David H. Appel, WRD District Chief (FTS 930-5131)

### I. Hydrologic Modeling of Small Streams in the Coal Areas of Appalachia

John T. Atkins Jr., WRD Project Chief (FTS 930-5130)

- A. Introduction: Maximum development of coal as a source of energy will require the mining of Federal reserves in Appalachia. The development will be accompanied by environmental changes that will impact water resources. As part of the Federal Coal Leasing Program, the Bureau of Land Management is required to incorporate into leasing decisions (1) an assessment of hydrologic impacts that could result from mining, and (2) stipulations on mining and reclamation procedures that will minimize resulting impacts. In anticipation of this mining, a regional assessment of hydrologic conditions (flow regime, water quality, and basin water-balance relationships) and changes caused by coal mining is needed to aid Federal managers in planning and implementing optimum development of Federal coal reserves in Appalachia.
- B. Location: Study sites are small basins (generally less than 10 mi<sup>2</sup>) with similar topographic, geologic, and hydrologic settings, and varying land-use characteristics in West Virginia, Kentucky, Virginia and other coal areas of Appalachia. Principal basins under study include Gilmer Run, Horse Camp, Collison, Drawdy, and Brier Creeks (in Randolph, Pocahontas, Nicholas, Boone, and Wyoming Counties in West Virginia, and East Fork Little Sandy River and Wood Creek in Lawrence and Laurel Counties, Kentucky).
- C. Objectives: The primary objective is to develop a predictive methodology useful to BLM for describing the hydrologic system and for assessing the impacts of mining in ungaged areas under Federal mineral ownership in the coal-producing areas of Appalachia. The objective requires the accomplishment of calibrating and verifying the USGS Precipitation-Runoff Modeling System (PRMS) for simulating streamflow under various climatic and land-use conditions.
- D. Procedures: Complete model calibration and verification simulations to achieve acceptable synthetic streamflow in seven small basins in West Virginia and two small basins in Kentucky. Model testing is based on available data that ranges from 2 to 5 years in duration and that was collected as part of other hydrologic studies conducted by the USGS. The basins will represent active underground-mined areas, combination surface and underground-mined areas, and undisturbed control areas. A final project interpretive report presenting model calibration and test results will be prepared by September 30, 1985.



- E. Report Products: Study data are stored in USGS computer data files and are available to other agencies and organizations. An interpretive report presenting model calibration and testing results in small unmined and mined basins will be available for distribution in FY 85 as a Water Resource Investigation Series report. A second interpretive report presenting final study findings will be prepared and will be available for review in September, 1985.
- F. Relationship to Other USGS Studies: This project benefits from and supplements other programs in the West Virginia District. An example is project WV-152 which consists of monitoring climatic and hydrologic data in mined and unmined basins in the Big Sandy-Tug Fork basins of Virginia, West Virginia, and Kentucky. These sites serve as test cases for comparing model applications and transferability to ungaged areas. Other similar studies in Indiana, Pennsylvania, Kentucky, Ohio, Maryland, Virginia, Tennessee, and Alabama will benefit from mutual exchange of information between the programs.
- G. Distribution of Funds:

Salaries	\$27,700
Travel	500
Data Processing	1,500
Equipment and Supplies	300
TOTAL	<u>\$30,000</u>



WYOMING  
DISTRIBUTION OF FY 85 CMP FUNDS

Water Resources Division

Project	CMP Total
I. Hydrology of Coal Spoils	\$43,000
II. Hydrologic Impact of Mining for Preference Right Lease Areas, Powder River Basin, Wyoming	<u>50,000</u>
TOTAL	\$93,000

Total for State of Wyoming: \$93,000

WYOMING

Hillary A. Oden, BLM State Director (FTS 328-2326)  
Cliff Franklin, BLM Hydrology Investigations Coordinator (FTS 328-2079)  
Richard M. Bloyd, WRD District Chief (FTS 328-2153)

I. Hydrology of Coal Spoil Piles, Eastern Powder River Basin, Wyoming

L. R. Larson and Dave Naftz, WRD Project Chiefs (FTS 328-2153)

- A. Location: Eastern Powder River Basin, Wyoming
- B. Objectives: A principal concern of the hydrologic impact of coal mining in the western states is the effects of coal mining on ground-water quality. The objective of the study is to utilize existing techniques for predicting chemical quality of water in spoils.
- C. Procedures: A literature review will be made to evaluate: 1) techniques that are being used to sample and analyze water in spoils of other western states, and 2) the aquifers in the areas of mining, and how changes in water quality may affect them.

Samples are being collected in overburden where saturated spoil is present. Water samples are also being obtained from the spoil. The overburden samples will be analyzed by paste extract, mineral analyses and column leaching. The resulting data will be used to predict the effects of the coal spoil on ground-water quality. Existing spoils water-quality data and overburden data will be compiled and statistically analyzed for statewide trends. Furthermore, geochemical path modeling will be utilized to project long-term water quality in spoils.

- D. Report Products: A report summarizing the data will be prepared in FY 85. An interpretive report is planned for FY 86.
- E. Distribution of Funds:

Salaries	\$ 26,000
Travel	1,000
Laboratory	<u>16,000</u>
TOTAL	\$ 43,000

II. Hydrologic Impact of Mining for Preference Right Lease Areas, Powder River Basin, Wyoming

Pamela B. Daddow, WRD Project Chief (FTS 328-2723)

- A. Location: Northeastern Wyoming.
- B. Objective: Ground-water impacts of mining in Preference Right Lease Areas (PRLA) will be evaluated for the leasing decision process. Possible impacts from surface, underground, and in situ coal gasification mining methods include destruction of wells on the PRLA, loss of flowing wells and springs near the PRLA, loss of recharge to subirrigated land, disruption of the local ground-water system during mining, changes in recharge and discharge both during and after mining, and changes in water quality after mining.
- C. Procedures: Cross-sections of each area will relate the zone disturbed by mining to the completion zones of wells, springs, recharge and discharge areas to determine if the wells, springs, and recharge and discharge areas will be affected by the proposed mining. If water-level data are available, the direction of ground-water movement can be shown. Using available estimates of transmissivity and storage, the limits of water-level drawdowns can be estimated in terms of distance from the PRLA.
- D. Report Products: The report will be published in the Water-Resources Investigations Series.
- E. Distribution of Funds:

Salaries	\$ 35,000
Travel	6,000
Computer costs	8,000
Equipment	<u>1,000</u>
TOTAL	\$ 50,000



DENVER SERVICE CENTER

SUMMARY OF FUNDS (FY 85)  
WATER RESOURCES DIVISION

<u>Project</u>	<u>CMP Funding</u>
Coal Hydrology Summary	\$ 30,000
Total for Denver Service Center:	\$ 30,000

DENVER SERVICE CENTER

Delmar D. Vail, Director (FTS 776-6452)  
Bruce Van Haveren, Hydrologist (FTS-776-0150)  
Donald A. Goolsby, WRD Regional Energy Coordinator (FTS 776-5925)  
Linda J. Britton, Project Leader, WRD Colorado District (FTS 776-4886)

I. Coal Hydrology Summary

- A. Location: Nationwide
- B. Objective: Summarize the significant accomplishments of the USGS Federal Coal Hydrology Program and BLM Coal Hydrologic Investigations since 1974.
- C. Procedures: A task force has been formed to plan and coordinate the project. Each WRD district office has been asked to summarize significant accomplishments in coal hydrology for several subject areas. Both USGS and BLM authors have been selected to write individual sections of the report.
- D. Reports: The product of this effort will be a USGS Professional Paper. A draft of the paper will be completed by March 31, 1985; publication is slated for late-1985.
- E. Distribution of Funds:

Salaries	\$ <u>30,000</u>
Total	\$ 30,000









**Summary**

**Plan of Work**

**Alabama**

**Colorado**

**Montana**

**New Mexico**

**North Dakota**

**Oklahoma**

**Oregon**

**Utah**

**West Virginia**

**Wyoming**

**Denver Service  
Center**