1983

Coal Hydrology Bibliography

United States Bureau of Land Management

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COAL HYDROLOGY BIBLIOGRAPHY

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W. Palmquist

U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management
U.S. Geological Survey

Bureau of Land Management
Denver Service Center
Lakewood, Colorado
September 1983
INTRODUCTION

In 1975 the U.S. Bureau of Land Management and U.S. Geological Survey began cooperative coal-hydrology investigations designed to further knowledge about hydrologic processes and improve Federal coal-leasing decisions affecting water resources. Fiscal Year 1984 marks the 10th year of the program. During those 10 years a large quantity of data have been collected, analyzed, and interpreted. A substantial number of publications resulted from this work.

A decision was made by the two agencies in 1982 to compile a bibliography on coal hydrology. This document is meant to serve as a useful reference for land managers, planners, scientists, and regulatory officials involved with coal leasing and water-resources management.

In compiling this bibliography, Geological Survey publication lists, existing Geological Survey bibliographies, and the Water Resources Scientific Information Center (WRSIC) data base were searched for pertinent Geological Survey publications that contained information relevant to the hydrology of a coal area. The WRSIC abstracts were used unedited as received from the WRSIC data base. Also included are reports of the Energy Mineral Rehabilitation Inventory and Analysis (EMRIA) program, coal leasing environmental impact statements and environmental analysis reports, and Bureau of Land Management land-use planning documents containing information about coal hydrology. Only those documents authored by either the Geological Survey or the Bureau of Land Management are included in this bibliography.

Bibliography entries are organized alphabetically by state. A general list of titles, which did not fit into a specific state section, also is included following the state listings. The bibliography covers all the major Federal coal production regions (fig. 1). A list of common abbreviations used in the references is shown in table 1.

To help meet the need for hydrologic information created by the Surface Mining and Reclamation Act of 1977 (Public Law 95-87), the Geological Survey is in the process of preparing a series of reports that broadly characterize the hydrology of coal areas nationwide. These reports, termed Coal Area Hydrology Reports, are being prepared for the coal areas shown in figures 2a and 2b. The current (1983) status of these reports is shown in table 2.

Publications listed in this document are available from the publishing agency, either the Bureau of Land Management or the Geological Survey.

Bureau of Land Management publications should be requested from the following source:

Division of Resource Systems, D-470
Denver Service Center
Bureau of Land Management
Denver Federal Center, Bldg. 50
Denver, CO 80225
Figure 1.--Federal coal-supply regions in the United States.
Table 1.--Common abbreviations and acronyms used in abstracts.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>DEA</td>
<td>Draft Environmental Assessment</td>
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<tr>
<td>DEAR</td>
<td>Draft Environmental Assessment Record</td>
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<td>Draft Environmental Impact Statement</td>
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<td>Management Framework Plan–Coal Amendment</td>
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<td>Selected Water Resources Abstracts</td>
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<td>TR</td>
<td>Technical Report</td>
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</table>
Figure 2a.—U. S. Geological Survey coal areas in the Eastern Interior and Eastern Coal Provinces.
Figure 2b.—U. S. Geological Survey coal areas in the Rocky Mountain and Western Interior Coal Provinces.
Table 2.--Status of U.S. Geological Survey coal area hydrology reports.

<table>
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*Coal areas, shown in figures 2a and 2b, are delineated on the basis of hydrologic-basin boundaries within the major coal-production regions.

Box 25425, Denver Federal Center, Denver, CO 80225

Alabama Compilation of Groundwater Quality data in Alabama
Avrett, James R.
Journal Announcement: SWARA601
All available data on the quality of ground water in Alabama, up to the date of this report, are tabulated to provide information for appraising water supplies in the state and to determine whether water use is impaired. Water-quality information was obtained by various agencies and individuals in Alabama for many years, but much of the information was not published previously. The chemical and physical character of water, the significance of these properties, and the source of various constituents are discussed. Water-quality requirements for domestic, industrial, irrigation, and recreational uses also are described in detail. A total of 3,692 chemical analyses are tabulated in the report by counties. Radioelement data for 16 sites in the state are compiled in a separate table.

Iron ores, fuels and fluxes of the Birmingham district, Alabama
With Butts and Eckel. Burchard, E. F., and Butts, Charles, 1910
Section on fuels and fluxes (p. 170-188) by Butts describes the stratigraphy and physical properties of the principal coal beds of the Warrior Coal Field. It also contains descriptions of geologic sections for the various coal beds. Coking coal analyses and information on mining methods and coal washing are also included.

Warrior coal basin in the Brookwood quadrangle, Alabama
Butts, Charles, 1935
Discusses stratigraphy, structure, general mining conditions and developments, and coal groups and analyses.

The Warrior coal basin in the Birmingham quadrangle, Alabama
Butts, Charles, 1906
Discusses stratigraphy, structure, general mining conditions and developments, and coal groups and analyses.

Description of the Birmingham quadrangle, Alabama
Butts, Charles, 1911

Description of the Bessemer and Vannider quadrangles, Alabama
Butts, Charles, 1927

WATER AVAILABILITY AND GEOLOGY IN MARION COUNTY, ALABAMA
mostly sandstones and sand and sandstone which are generally soft to moderately hard and has an iron content less than 0.3 mg/L. The average flow of water in Bibb County in 1969 was about 1.5 Mgal/d which is less than 1 percent of the quantity available.

**Water Availability in Bibb County, Alabama**

The largest sources of water in Bibb County in central Alabama are Limestone, dolomite, and sand aquifers, and Cahaba and Little Cahaba Rivers. Potential sources of 0.5 Mgal/d (million gallons per day) or more per well are limestone and dolomite aquifers in topographic lows in the northern part of the county; limestone and dolomite aquifers in topographic lows and along faults in the central part of the county and sand aquifers in the southern part of the county. The total average flow of all streams in the county is about 1,260 Mgal/d of which 590 Mgal/d originates within the county. The Cahaba River at Centreville has an average flow of 1,000 Mgal/d and a 7-day low flow of about 130 Mgal/d. The Little Cahaba River near Upperyield has an average flow of 150 Mgal/d and a 7-day low of about 30 Mgal/d. Wells in the southern part of the county and central part of the county are rarely drilled deeper than 300 feet. Wells in the southern part of the county generally range in depth from 150 feet in the Cahaba River valley to 800 feet in other parts of the county. Cahaba and Little Cahaba Rivers generally have suitable chemical quality for most uses. Water from sand and sandstone aquifers is generally soft to moderately hard.

**Geology and Coal Resources of the Coal-Bearing Rocks of Alabama**

The Pottsville Formation of Mississippian age underlies most of Cullman County in northern Alabama. It consists mostly of interbedded sandstones and shales that dip southward about 40 feet per mile. The Bangor Limestone of Mississippian age underlies the Pottsville Formation and consists of coal-bearing rocks. Includes maps showing the location of coal beds in the warriors, Cahaba, and Coosa coal fields.

**Geology and Water Availability of Cullman County, Alabama**

The Pottsville Formation of Pennsylvanian age underlies most of Cullman County in northern Alabama. It consists mostly of interbedded sandstones and shales that dip southward about 40 feet per mile. The Bangor Limestone of Mississippian age underlies the Pottsville Formation and consists of coal-bearing rocks. Includes maps showing the location of coal beds in the warriors, Cahaba, and Coosa coal fields.
Mulberry Fork is the only stream in and adjoining Cullman County that have median annual 7-day low flows that exceed 2 Mgal/day. Chemical analyses of water in the county indicate the water is suitable for most uses, but iron concentration and ground water exceed 0.3 mg/L (milligrams per liter) in many places. Water use in Cullman County was estimated to average 5.6 Mgal/day in 1967. (USGS)

Hydrologic Assessment, Eastern Coal Province Area 23, Alabama Harkins, J. R., Geological Survey Tuscaloosa, AL, Water Resources Div. Geological Survey Open-File Report 80-683 (WRII, June, 1980, 76 pp, 30 Ref, 3 Append. Journal Announcement: SWA1424 The Eastern Coal Province is divided into 24 separate hydrologic reporting areas. The division is based on hydrologic factors, location, size, and mining activity. Hydrologic units (drainage basins) or parts of units are combined to form each area. Area 23 is located at the southern end of the Eastern Coal Province, in the Mobile River basin, includes the Warrior, Cahaba, and edges of the Plateau coal fields in Alabama, and covers an area of 4,716 square miles. It is underlain by the Cokes and Pottsville Formations and the pre-Pennsylvanian rocks. The Pottsville Formation contains coal beds and is overlain by the Cokes Formation in the western and southern parts of the area. The pre-Pennsylvanian rocks crop out in two northeast-southwest trending belts or ridges along and near the eastern boundary where folding and faulting is common. The outcrop of rocks along the western ridge tapers the divide between the Warrior and the Cahaba coal fields. Hydrologic problems relating to surface mining are (1) erosion and sedimentation, (2) decline in ground-water levels, and (3) degradation of water quality. Average annual sediment yield can increase by four magnitudes in surface mine areas from 20 tons per square mile per year from areas not affected by mining to 300,000 tons per square mile per year from mined areas. Sediment yields increase drastically when vegetation is removed from the highly erosive soils and from uncontrolled surface mining operations. Decline in ground-water levels can occur in and near surficial mining areas when excavation extends below the static water level in the aquifer. (USGS)

Hydrology of Area 24, Eastern Coal Province, Alabama and Georgia Harkins, J. R., and others, 1981b U.S. Geological Survey Water-Resources Investigations Open-File Report 81-1132, U.S. Geological Survey, Tuscaloosa, Ala. This discusses the hydrology of "Area 24", which includes all of the Coosa coal field and the eastern part of the Plateau coal field. Sections describe and illustrate water quality and quantity, geology, soils, land use, and data sources. Prepared to provide general information to the coal industry and Federal and State regulatory agencies.

Surface-Water Availability, Etowah County, Alabama Harkins, J. R., Geological Survey, Tuscaloosa, Ala. Alabama Geological Survey Map 118, 1972, 6 Figs, 1 Map, 1 Tab, 12 Ref. Journal Announcement: SWA0776 Basic information on the surface-water resources of Etowah County, Alabama, is presented in a map so that a quick visual appraisal of water availability can be made. The streams of Etowah County potentially will provide moderate to large supplies of water for municipal, industrial, and other uses. Two streams, the Coosa River and Big Willis Creek, are capable of yielding 38 MGD without storage, with storage, storage draining areas in excess of 100 mi have the potential of yielding 10 mgd. Many sites in the county are topographically and geologically suitable for reservoirs. Average annual precipitation is 54 inches. Average streamflow is about 1.1 Mgal per square mile. The Coosa River has an average flow of 54,000 MGD where it enters the county and 62,000 MGD where it leaves the county. Water in the county, in general, is relatively low in total dissolved solids, is of good chemical quality, and is suitable for most uses. (KNAPP-USGS)

Surface-Water Availability, St. Clair County, Alabama Harkins, J. R., Geological Survey University, AL, Water Resources Div. Alabama Geological Survey Map 148, 1980, 10 pp, 4 Figs, 1 Map, 9 Ref. Journal Announcement: SWA4105 The Coosa River, the largest source of water in St. Clair County, Ala., has an average flow of 602 Mgal/day (million gallons per day) where it enters the county and 5,800 Mgal/day where it leaves the county. In the county, the Upper and Lower Coosa, Short Creek, and Logan Martin Reservoirs, which extend along the eastern boundary of the county, have average storage capacities of 132,500 and 339,600 acre-feet, respectively. Big Canoe Creek, which flows through the northern part of the county, is the largest stream in the county other
than the Coosa River. It has an average flow of 210 Mgal/d at its confluence with the Neely Henry Reservoir. Water in streams in St. Clair County is of good chemical quality and is suitable for most uses. Water in Big Canoe Creek is generally soft, and water in the Coosa River is generally soft.

Surface-Water Availability, Franklin County, Alabama


Alabama Geological Survey Map 106, 1972. 1 p. 5 Fig. 1 Map 1 Tab. 15 Refs.

Journal Announcement: SWRA 69-22

Surface-water resources are described for Franklin County, in northeastern Alabama, in a manner that provides for a quick visual appraisal of surface water availability. The County has a moderate relief and is drained primarily by Cedar and Bear Creeks. Streamflow varies considerably from one season to another. Highest monthly flows are 4 to 6 times greater than average monthly flows. Lowest monthly flows are only one-fourth to one-sixth of average flows. The average annual rainfall of 50 inches provides about 700 mgd of average runoff. The addition of 200 mgd via tributaries to Bear Creek results in a total average streamflow of 900 mgd which is about 300 times greater than actual water use in the county. Runoff from the county area is about 1,131 mgd per square mile. The water in streams generally is of a quality suitable for most uses. Cedar Creek, however, contains hard water (145 mg per liter) during periods of low flow. The temperature of water flowing in streams approaches the mean monthly air temperature and generally ranges from 3 deg C in January to 28 deg C during the summer. Temperatures of water from springs remain almost constant (15 to 17 deg C) throughout the year.

Alabama-Georgia-Tennessee

Hayes, C. W., 1895


Description of the Geologic Quadrangle, Alabama

Hayes, C. W., 1896


The southern Appalachian coal field

Hayes, C. W., 1902


Hydrology of Area 20, Eastern Coal Province, Tennessee, Georgia, and Alabama (Duplicated see Tennessee).

Hollyday, E. F., and others, 1982

Alaska

is about 53 inches or about 2,820 mgd (million gallons per day). About 1,130 mgd runs off directly into streams, and the remaining 1,990 mgd replenishes soil moisture to underground reservoirs. Potential sources of ground water are limestone, dolomite, sandstone, and chert aquifers. Wells developed in these aquifers may produce as much as 0.5 mgd per well. In some areas, wells developed in dolomite, sandstone, and chert aquifers may produce more than 0.5 mgd per well. Water from the limestone and dolomite aquifers generally is moderately hard, contains iron in excess of 0.3 mg/liter, and has a median value of 150 mg/liter dissolved solids. Water from the sandstone aquifer generally is soft to moderately hard, contains iron in excess of 0.3 mg/liter, and has a median value of 210 mg/liter dissolved solids. Potential sources of surface water in Jefferson County are the black Warrior and Cahaba Rivers, Locust Fork, and Valley, Village, Fivemile, Shakes, and Turkey Creeks. Average flows at the mouth of these streams at the point where the stream leaves the county are 4,070, 250, 1,230, 360, 100, 120, 100, and 90 mgd. (Woodard-USGS)

Surface Water Availability, Tuscaloosa County, Alabama. Knights, A. L.; Davis, M. E., Geological Survey, University, Al., Water Resources Div.; and Geological Survey, Austin, Texas, Water Resources Div., Alabama Geological Survey Map 139, 1980. 12 p. 3 Figs, 1 Tab., 13 Ref., Journal Announcement: SWRA0405 The average annual runoff of about 1,270 Mgal/d (million gallons per day), originating in Tuscaloosa County, is equivalent to 20 inches or 0.95 mgd/square mile. The Black Warrior and Sipsey Rivers, the largest streams in the county, have average flows of 5230 Mgal/d and 580 Mgal/d, respectively, where they leave the county, and median annual 7-day low flows in excess of 150 Mgal/d and 35 Mgal/d, respectively. Where the Warrior River, Big Sandy Creek, and Hurricane Creek have average flows in excess of 100 Mgal/d and median annual 7-day low flows in excess of 2 Mgal/d. Surface water generally contains less than 100 mg/l (milligrams per liter) dissolved solids, less than 10 mg/l chloride, and is soft to moderately hard. Streams having the higher hardness and the higher dissolved-solids content are in eastern Tuscaloosa County. (USGS)

Water and Related Problems in Coal-Mine Areas of Alabama. Knights, A.L.; Newman, J. G., Geological Survey, Tuscaloosa, Al., Water Resources Div., Available from the National Technical Information Service, Springfield, Va., microfiche, Water Resources Investigations 76-130, April 1977. 51 p., 22 Fig., 1 Tab., 36 Ref., Journal Announcement: SWRA1103 Water-resource problems or potential problems in Alabama resulting from surface and subsurface coal mining include erosion and sedimentation, flooding, diversion of drainage, decline in water level, land subsidence, and the degradation of water quality. The degradation of water quality in the most serious and widespread coal-mine related problem in Alabama. The pollution of water in numerous streams draining coal-mine areas has been altered drastically. The pH of water draining from mined areas commonly ranges from 2.1 to 5.0. Generally, the pH has high sulfate and dissolved solids concentrations, is hard to very hard, and may contain objectionable amounts of iron. The detrimental quality of water in some streams may persist for decades after mining has ceased. Without proper safeguards, additional mining may cause a significant deterioration in the quality of water in major streams where the more mineralized mine waters are now diluted. (Woodard-USGS)

Elements of the Water Resources Situation in Alabama. Knowles, D. B.; Barksdale, W. C., Geological Survey, University, Al., Available from NTIS, Springfield, Va. 22151 as PB-214 181. Price $3.75 printed copy; $1.45 cents microfiche, December 1969 (revised August 1970). 28 P., Journal Announcement SWRA0620 The water-resources situation in Alabama has many facets ranging from water supply to waste disposal, from floods to droughts, and from navigation to recreation. Within this wide range of topics two common elements have been selected for consideration—factors intimately related to the hydrologic cycle, and significant areas wherein the knowledge and data are inadequate. A discussion of the hydrologic cycle provides a background of understanding. This is followed by a discussion of the types of data and studies that are required for a better understanding of water related problems with recommendations for needed supplemental or additional studies. Most water-resources problems relate in one way or another to the availability of water. Problems of water supply cover much of the water-resources field and are not restricted to the availability of water for domestic, industrial, or agricultural purposes. Under this concept, water for operation of navigational locks, drainage of the reporting of field data, and support of fisheries all become water-supply problems. It is in this broader sense that water-supply problems and the knowledge and data needed for their solution are discussed. (See also W73-12315) (Woodard-USGS)

The map abstract of Water Resources: Alabama. Lineback, N. C.; Pringle, L. B.; Turnage, M. E., Geological Survey, University, Al., Map Abstract No.2, 1974. 105 P., 108 Fig., 14 Ref., Journal Announcement: SWAO602 Water resources data for Alabama were presented in a generalized areal form for the entire state. Maps delineating counties, population distribution, physiographic provinces, and river basins were presented. Other maps indicated the variability of
Drought on by the construction of the Tennessee-Tombigbee waterway were presented. The study area includes all of Sumter County and parts of Colbert, Lauderdale and Pickens Counties adjacent to the Tombigbee River. Land use is not limited to crops, pasture, forest, and related industries. Substantial supplies of surface water and groundwater are available and should encourage economic development. Sand and gravel are available for construction; abundant chalk and clay are available for use as lightweight aggregate. Energy sources in this area have not been fully developed. A coal-fired stream plant provides electricity to surrounding areas and a narrow band of lignite that has not been developed occurs in Sumter County. This area has the potential to become more productive; therefore, information was provided on the area's positive characteristics and its limiting factors were enumerated so that development will be accomplished in an orderly and efficient manner. (Scott-ISWS)


Journal Announcement: SWA0317

With population increases in this country urban and industrial expansion is anticipated as being quite dramatic. The role of environmental geology in contributing to the necessary planning is discussed with attention directed toward areas in northwest Alabama. The results of the investigations are envisioned as furnishing planners with a comprehensive, detailed, practical study of which can be used to plan for orderly urban and industrial growth. Lauderdale, Colbert, and Franklin Counties were the site of the first environmental investigation. A brief outline of which is included. Information concerns hydrology, associated resources, geology and engineering geology. Quantities of potential surface and groundwater are mentioned; and discussion is given to the quality (expressed in accordance with dissolved solids). The urban and industrial areas mentioned also in shoals area, is briefly described in terms of population concentration. Three roughly drawn areas are seen from a geological and physiographical viewpoint, and detailed geologic maps are indicated as being available and extremely valuable in planning. In the muscle shoals area, it is concluded, 84 per cent of the slopes are gentle enough to present no difficulties for any type of planning. Finally, the importance of engineering capacity is discussed. The bearing capacity of the soil is mentioned because it determines types and sizes of footings necessary for various kinds of construction. In this regard is consideration of flood plains, drainage, soil classifications, mapping of sink holes, and soil thickness.


Journal Announcement: SWA0319

The environmental data necessary to plan for development

The analysis of acid mine drainage in the Appalachian Region reveals that the water quality is generally reported to be soft and satisfactory for domestic use. The principal sources of two large reservoirs in Walker County—Lewis Smith Lake, with a total storage of 1,670,700 acre-feet, and Bankhead Reservoirs with a total storage of 94,100 acre-feet, Blackwater Creek near Manchester has an average flow of 196 mgd. The chemical quality of water in streams in Walker County is relatively uniform and the water is suitable for most uses. Water use in Walker County was estimated to be 6 mgd in 1966. Groundwater sources are expected to supply about 15 percent of the water used in the county.

Flood Frequency of Small Streams in Alabama


Journal Announcement: SWR41209

Equations have been developed for estimating future floods for 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals on natural streams in Alabama with drainage areas of 1 to 15 square miles. One equation for each recurrence interval applies statewide. The equations were developed by multiple regression analysis of flood magnitudes obtained from both observed peak discharges and synthetic discharge data generated with a calibrated rainfall-runoff model and physical basin characteristics. The regression analysis indicated that drainage area and main channel slope are the most significant basin characteristics affecting flood frequency and magnitude. Those characteristics can generally be determined from topographic maps.

Effect of Surface Coal Mining on the Hydrology of Crooked and Turkey Creek Basins, Jefferson County, Alabama


Journal Announcement: SWR41320

Streamflow and water quality were monitored from October 1975 through May 1977 to determine the impact of surface coal mining on the hydrology of Crooked and Turkey Creek basins in Jefferson County, Alabama. The basins are in the northeast part of the Warrior coal field. Coal is and has been mined from the Blue Creek, Mary Lee, and Newcastle coal beds in the Mary Lee group. Results show water-quality degradation, increased sediment yields, and increased flow in most tributaries draining mined areas. The impact of mine drainage and sediment yield from mined subsurfaces on water in the main stem where the water is excessively hard. The coker formation is tapped by only a few wells in the county, and the alluvium in the low lying areas of the Bluff Warrior river provides a limited amount of water to only a few wells. The water is generally reported to be soft and satisfactory for domestic use.
of Turkey Creek was small due to the alkalinity of the water in the creek and to dilution ratios that ranged from 130 to 1300. Mine drainage has affected the quality of water in Crooked Creek. The dissolved solids concentration in water downstream from the mined area was as much as 7 times greater than that in water in unmined parts of the basin. The sediment yield to Crooked Creek was lower in the mined area than in the unmined segment of the stream. The lower yield is due, in part, to the trapping of sediment in sediment ponds in the mine and in a swamp downstream from the mine. (USGS)

Hydrology of Selected Basins in the Warrior Coal Field, Alabama—A Progress Report

Punter, C. J.; Newton, J. U.; Hilla, T. J.


Geological Survey, Water-Resources Investigations 80-22, March, 1980. 62 p. 18 Fig. 20 Tab. 23 Ref.

Journal Announcement: SWRA1411

Hydrologic data are being collected in four basins in the Warrior coal field in Alabama to provide baseline information to aid in determining the effect mining will have on water resources. Basins monitored are in two different geologic and hydrologic environments. Two basins are underlain predominantly by relatively impervious lithified rocks in the Pottsville Formation of Pennsylvanian age. The two remaining basins are underlain predominantly by unconsolidated permeable rocks in the Coker Formation of Late Cretaceous age. Wells yield from the Pottsville Formation generally range from 0 to 0.3 liter per second, whereas well yields from the Coker Formation generally range from 0.3 to 6.4 liters per second.

Stream flow distribution reflects seasonal precipitation. Storm runoff is characterized by sharply concentrated flows of short duration that rapidly recede in low-flow conditions. Streams draining basins underlain chiefly by the Pottsville Formation frequently go dry, whereas those draining basins underlain chiefly by the Coker Formation have well sustained low flows. Water in the Pottsville Formation is slightly acidic and moderately hard to very hard. Dissolved solids concentrations ranged from 170 to 268 milligrams per liter. Water in the Coker Formation is soft, far less mineralized, and more acidic than water in the Pottsville. Surface water is generally soft, acidic and low in dissolved solids concentrations. Water in streams draining basins underlain chiefly by the Pottsville Formation was slightly more mineralized and less acidic than water in streams draining the Coker Formation. (USGS)

Hydrology of Potential Mining Areas in the Warrior Coal Field, Alabama

Punter, C. J.; Newton, J. U.; and Sibina, W. W., Jr., 1981


Assessment of Hydrologic Conditions in Potential Coal-Lease Tracts in the Warrior Coal Field, Alabama

Punter, C. J.; Newton, J. U.; and Sibina, W. W., Jr., 1981


The hydrology of four potential coal-lease tracts in the Warrior coal field is assessed. Local and regional data are used to describe streamflow characteristics, surface-water quality, and ground-water availability and quality. Climatic, physiographic, hydrologic, and land-use data were analyzed by regression to derive estimates of specific conductance and other constituents such as hardness, dissolved solids, and sulfate loads. Impacts that will result from future mining are defined and methods used to estimate these impacts on surface water quality are described.

Hydrology of Area 4, Eastern Coal Province, Pennsylvania, Ohio, and West Virginia. (Duplicated see Ohio, Tennessee, and West Virginia)

Roth, D. K.; Engelke, M. J., Jr., and Others, 1981


Water Availability, Shelby County, Alabama

Shambaugh, V. M.; Harkins, J. R.


Journal Announcement: SWRA1405

The largest sources of ground water in Shelby County, Ala., are limestone and dolomite aquifers which are potential sources of about 0.5 Mgal/d (million gallons per day) per well. The most favorable well sites are in valleys or low topographic areas and their lower reaches in the county are each capable of providing water at the rate of 10 Mgal/d or more without storage. The county has an average annual precipitation of 54 inches of
which about 20 inches runs off in streams. The 20 inches of runoff is equivalent to 800 Mgal/d or 1.0 Mgal/d per square mile. Ground water is of suitable chemical quality for most uses, but water from some sources may be objectionable for certain uses because of hardness or iron content. Surface water is of suitable chemical quality for most uses, but water use in the county in 1969 was estimated to be 5.6 Mgal/d, which is insignificant when compared to the total available supply. (USGS)

Methodology for Hydrologic Evaluation of a potential surface mine

Shown, L. M., and Others, 1982

Lobolly branch basin Tuscaloosa County, Alabama, 93 P., W.R.D. 82-50.

WATER RESOURCES AND GEOLOGY OF WINSTON COUNTY, ALABAMA

WAHL, K. O., HARRIS, W. J., and JEFFERSON, P. O., GEOLOGICAL SURVEY, UNIVERSITY, ALA.

ALABAMA GEOLOGICAL SURVEY BULLETIN 97, 1971, 51 P., 10 FIG., 6 PLATE, 7 TAB. 25 REF.

Journal Announcement: SWRA6519

WATER RESOURCES DATA FOR WINSTON COUNTY, ALABAMA, SHOW QUANTITY AND QUALITY OF SURFACE AND GROUNDWATER AS RELATED TO THE GEOLOGY AND WATER USE. THE BANGOR LIMESTONE AND THE POTTSVILLE FORMATION ARE THE TWO MAJOR SOURCES OF GROUNDWATER. THE BANGOR LIMESTONE CONSISTS OF ABOUT 400 TO 550 FEET OF LIMESTONE AND SHALE. WATER-BEARING OPENINGS OCCUR PRIMARILY IN THE UPPER 25 TO 50 FEET, WHICH IS A POTENTIAL SOURCE OF 25 TO 50 GPM. WATER FROM THE BANGOR GENERALLY IS MODERATELY HARD TO HARD AND LOW IN IRON CONTENT. THE POTTSVILLE FORMATION CONSISTS OF 1,200 FEET OF SANDSTONE, SHALE, AND COAL. INDIVIDUAL WELLS PRODUCE FROM LESS THAN 5 TO ABOUT 75 GPM. THE WATER RANGES FROM SOFT TO HARD AND IS OF GOOD CHEMICAL QUALITY EXCEPT IN PLACES WHERE THE IRON CONTENT MAY BE OBJECTIONABLE. MOST OF THE STREAMS DRAINING WINSTON COUNTY ORIGINATE WITHIN THE COUNTY. THE AVERAGE FLOW INTO LEWIS SMITH LAKE IS APPROXIMATELY 670 MGD. SIPSEY FORK, THE LARGEST ARM, HAD A MAXIMUM RECORDED FLOW OF 48,400 CFS NEAR FALLS CITY. THE TOTAL USE OF WATER IN WINSTON COUNTY DURING A PEAK DEMAND PERIOD WAS ABOUT 1.2 MGD IN 1965. GROUNDWATER SOURCES ACCOUNT FOR ABOUT 75% OF THE WATER AND SURFACE WATER SOURCES ACCOUNT FOR 25%. (WOODARD-USGS)

GEOLOGIC MAP OF WALKER COUNTY, ALABAMA

WAHL, K. O., O'NEAL, D. M., GEOLOGICAL SURVEY, TUSCALOOSA, ALA.

ALABAMA GEOLOGICAL SURVEY, UNIVERSITY, MAP 123, 1972, 1 SHEET.

Journal Announcement: SWRA6815

THE GEOLOGY OF WALKER COUNTY, ALABAMA IS SHOWN ON A MAP SCALED ABOUT 2 MILES TO 1 INCH. THE ENTIRE COUNTY IS UNDERLAIN BY THE POTTSVILLE FORMATION OF PENNSYLVANIAN AGE. THERE ARE A FEW OUTCROPS OF THE CRIMER FORMATION OF CRETACEOUS AGE IN THE

Alabama

NORTHWEST PART OF THE COUNTY, STREAM VALLEYS HAVE TERRACE DEPOSITS AND ALLUVIUM. THE POTTSVILLE FORMATION, THE PRINCIPAL AQUIFER IN THE COUNTY, IS 1,000 TO 1,200 FEET THICK AND CONSISTS CHIEFLY OF SANDSTONE AND SHALE. THE POTTSVILLE ALSO CONTAINS BEDS OF COAL WHICH HAVE BEEN MINED THROUGHOUT THE COUNTY. (KNAPP-USGS)

Sediment load of streams in the region, J0 Schneider, W. J., and Others, Water Resources of the Appalachian Region, Pennsylvania and Alabama

Waltz, J. W., 1965


Map showing average annual sediment yield in tons per square mile for north-central Alabama and other regions. Includes brief discussion of sediment load in streams.

MINERALS AND WATER, BUTLER COUNTY, ALABAMA

GEOLOGICAL SURVEY OF ALABAMA, UNIVERSITY, ALA.

GEOLOGICAL SURVEY OF ALABAMA, UNIVERSITY, ALA.

GEOLOGICAL SURVEY, UNIVERSITY, ALA.

ALABAMA GEOLOGICAL SURVEY BULLETIN 188, 1967.

Journal Announcement: SWRA6804

THE WATER RESOURCES OF BUTLER COUNTY, ALABAMA ARE DESCRIBED AS PART OF A REPORT ON THE GEOLOGY, MINERAL RESOURCES, AND WATER RESOURCES OF THE COUNTY. GROUNDWATER EVALUATION IS BASED ON RECORDS OF 188 WELLS AND 3 SPRINGS. THE PRINCIPAL AQUIFERS ARE SAND BEDS IN THE EUTAW, RIPLEY, AND NANAFALA FORMATIONS, AND LIMESTONE BEDS IN THE CREEKTOWN FORMATION, OF UPPER CRETACEOUS TO CENOZIC AGE. A MAP AND CROSS SECTION INDICATE MAXIMUM DEPTHS NEEDED FOR WELLS THAT WILL PRODUCE 0.5 MGD. DEPTHS NEEDED FOR DOMESTIC WELLS ARE ALSO MAPPED. WATER FROM THE RIPLEY FORMATION IS GENERALLY SOFT, AND WATER FROM THE OTHER AQUIFERS RANGES FROM SOFT TO HARD. IRON AND HARDNESS CONTENTS ARE SHOWN ON MAPS. AVERAGE RUNOFF IS 19 IN. OR 0.9 MGD PER SQ MI. MANY OF THE STREAMS IN THE WESTERN PART OF THE COUNTY ARE INTERMITTENT. IN THE NORTHWEST THE WATER IS MODERATELY HARD DURING FLOOD FLOW AND HARD DURING LOW FLOW. IN THE EAST THE WATER IS MODERATELY HARD DURING FLOOD FLOW AND MODERATELY HARD DURING LOW FLOW. IN OTHER PARTS OF THE COUNTY SURFACE WATER IS SOFT. ALL STREAM WATER HAS LESS THAN 15 PPM CONTENT CHLORIDES. (KNAPP-USGS)

Water Resources Data for Alabama, Published annually since 1975.


Water resources data for Alabama consist of records of stage, discharge, and water quality of streams, stage and content of lakes and reservoirs; and water levels in wells. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alabama. (USGS)
This statement assesses impacts of leasing a maximum of 78.27 million tons of marketable Federal coal in 26 tracts in Fayette, Tuscaloosa and Walker Counties, northwest-central Alabama. The coal is in the nearly flat-lying Pennsylvanian Pottsville Formation in the broad, dissected Warrior Coal Field plateau in the Warrior Synclinal Basin. Most tracts are in 1- to 5-mile-square headwater areas of intermittent streams that have eroded steep-sided gorge-like valleys into the plateau, leaving nearly level bottoms between narrow flat ridgetops. Annual runoff is 18 to 24 inches from about 54 inches of annual precipitation. Most of the Federal coal would be mined underground to great enough depths to eliminate subsidence. Underground mining would impact about 38,000 acres of potential coal aquifers in addition to the 150,000 acres being, or to be, disturbed by mining of non-Federal coal. Surface mining of the remainder of the Federal coal would impact about 18,000 acres of near surface aquifers. Within, or near the tracts, 164 wells obtaining small quantities of good quality water from poor aquifers above the coal would be prone to removal, increased mineralization, or lowered water levels. Ground water impacts will occur in the vicinity of the mines and will have no significant impact on the regional ground water system. Mineralization of surface drainage will increase progressively and peak approaching or even exceeding 2,000 milligrams per liter of dissolved solids in 10 to 12 years before beginning its slow return to baseline conditions. Impacts on base flow will be local and long-term and after the accompanying impact on water quality will be positive.
use according to the type of use is discussed, and estimates are given for the amounts used. Water-use categories include domestic, irrigation, livestock, seafood processing, oil and gas development, petrochemical processing, pulp mills, hydroelectric, coal processing, steam electric, mineral processing, sand and gravel mining, and fish-hatchery operations.

(HOODWARD-USGS)

HYDROLOGIC RECONNAISSANCE OF STREAMS AND SPRINGS IN EASTERN BROOKS RANGE, ALASKA—JULY 1972

CHILDERS, J. M.; SLOAN, C. E.; MECKEL, J. P.,

GEOLoGICAL SOuRY, ANcHarOGE, ALASKA, WATER RESOURCES Div.

BASIC-DATA REPORT, 1973. 25 P. 20 FIGS. 1 TAB. 6 REF.

Journal Announcement: SWRA0622

ESTIMATES OF BANKFULL DISCHARGE AND MAXIMUM EVIDENT FLOOD PEAK DISCHARGES USING SLOPE-CONVEYANCE METHODS WERE MADE FOR SELECTED STREAMS IN THE EASTERN BROOKS RANGE, ALASKA, BASED ON FIELD OBSERVATIONS. FLOOD DISCHARGES FOR 2-YEAR AND 50-YEAR AVERAGE RECURRENCE INTERVALS WERE ESTIMATED FOR THE SAME SITES USING REGRESSION EQUATIONS THAT RELATE FLOOD DISCHARGE TO BASIN PHYSICAL AND CLIMATIC CHARACTERISTICS. DISCHARGE, TEMPERATURE, AND SPECIFIC CONDUCTANCE OF SELECTED SPRINGS WERE MEASURED DURING THE RECONNAISSANCE AND WATER SAMPLES WERE COLLECTED FOR CHEMICAL ANALYSIS. ALL BUT ONE OF THE SPRINGS DISCHARGED FROM LIMESTONE BEDROCK OR ASSOCIATED COLLUVIAL AND TYPE AND HAS LOW TOTAL DISSOLVED SOLIDS. DISCHARGE, AT TIME OF MEASUREMENT, RANGED FROM ABOUT 4 TO 36 CFS AND TEMPERATURE RANGED FROM ABOUT 3 TO 9C.

(WOODWARD-USGS)

Bibliography of Reports by Members of the U.S. Geological Survey on the Water Resources of Alaska 1870 Through 1976

FEUHLER, A. J.; REED, K. M.,

GEOLoGICAL SURvY, AnchorAge, AK, Water RESOURCES Div.

Open-File report 77-687, 1977. 112 P.

Journal Announcement: SWRA1109

This bibliography lists publications prepared by members of the U.S. Geological Survey and published either by the Survey or by other agencies and organizations between 1870 and the end of 1975. The titles included are those whose primary topic is hydrology, water resources, or other aspects of water in Alaska. Related subjects, such as geology, included in many of these reports. (WOODWARD-USGS)

Effects of Placer Mining on Hydrologic Systems in Alaska—Status of Knowledge

MADISON, R. J.,

GEOLoGICAL SURvY, AnchorAge, AK, Water RESOURCES Div.

Available from the DFSS, USGS, Box 25425, Denver Fed. Ctr., Denver, CO 80225; paper copy $3.50, microfiche $3.50.


Journal Announcement: SWRA1419

This report briefly summarizes the current state of knowledge regarding placer mining in Alaska. A review of literature indicates that nearly all of the significant information on the effects of placer mining on the hydrologic system in Alaska is referenced in the available reports. Analysis of the addition of sediments, as well as other indirect changes that generates, appears to be the primary impact of placer mining on Alaskan streams. Other potential water-quality effects that should be considered are: increases in organic loading in the stream system; increases in minor element content; potential for acid drainage; and impacts on fish and other aquatic biota.

Existing information is adequate to define parameters that may be affected by placer mining but inadequate to quantify changes resulting from an individual mining operation or to accurately predict the magnitude or duration of the impacts. Additional studies that could improve the knowledge of the effects of placer mining include: short-term assessments, using available photographic information and existing hydrologic records, to document historical changes and active placer mining features; short-term studies using empirical sediment-transport formulas to estimate the effects of placer mining activities; and river quality assessments of selected basins affected by placer mining. (USGS)

Hydrologic Reconnaissance near Fourth of July Creek, Seward, Alaska

NELSON, G. L.,

GEOLoGICAL SURvY, AnchorAge, AK, Water RESOURCES Div.


Journal Announcement: SWRA1421

The 1.3-square-mile alluvial fan of Fourth of July Creek, Seward, Alaska, is being developed as an intensive study area for future. Fourth of July Creek is a glacier-fed stream that occupies a braided channel near the middle of the fan. The presence of glacial flow during the summer and low discharge during the winter make streamflow a poor source of water for municipal and industrial use. Water infiltrates the fan from streams and precipitation and recharges an unconfined alluvial aquifer. Average recharge is 40-50 cubic feet per second and ground water flows toward the coast where it discharges in springs and a 0.3-mile gaining reach of the creek. Properties and concentrations of all measured chemical constituents of water samples from two wells were less than the maximum amounts recommended for drinking water. Both the aquifer and the overlying unsaturated materials are coarse grained. The coarse-grained materials are poor filters and make the aquifer

Alaska

Alaska
susceptible to pollution by contaminants disposed of or spilled on the alluvial fan. Avalanches may block the creeks and cause flooding by directing streamflow into new or abandoned channels. (USGS)

Results of Exploratory Drilling at Point Mackenzie, Alaska, 1981

Patrick L.


Journal Announcement: SWRA1500

The Matanuska-Susitna Borough anticipates industrial development near Point Mackenzie, Alaska. Because little hydrologic information is available for the area, the Borough contracted for the drilling of two test wells. It was found that: both wells penetrated unconsolidated stratified clay, silt, sand, and gravel; each well penetrated a shallow unconfined and deeper confined aquifer; the water levels in the wells rise and fall with the tides; the chemical analyses indicate that the water quality meets the Alaska Drinking Water Standards, except for slightly high levels of manganese and pH; and the potential for saltwater intrusion should be evaluated as part of future studies. (USGS)

Data from a Hydrologic Reconnaissance of the Beluga, Peters Creek, and Healy Coal Areas, Alaska

Scully, D. R.; Krumhardt, A. P.; Kernodle, D. R.


Geological Survey Open-File Report 80-1206, 1980. 34 p. 1 Fig. 1 Table.

Journal Announcement: SWRA1412

Data are tabulated from a hydrologic study of the Beluga, Peters Creek, and Healy coal areas in Alaska from July 1975 to June 1979. These include streamflow and water-quality data for all three areas, groundwater data for the Beluga and Healy coal areas, and information from springs in the Beluga coal area. Results of analyses of samples of the benthic invertebrate community in the Beluga area are also included. (USGS)

Hydrologic Reconnaissance of the Beluga, Peters Creek, and Healy Coal Areas, Alaska

Scully, D. R.; Krumhardt, A. P.; Kernodle, D. R.


Journal Announcement: SWRA1510

Alaska

The Beluga, Peters Creek, and Healy coal areas in Alaska were studied during 1975-1978, with major emphasis on surface-water hydrology and water quality. In the Beluga coal areas, mean annual discharge is estimated to range from 2.2 to 3.4 cubic feet per second per square mile of drainage area. The 7-day low flow with a 10-year recurrence interval is estimated to be 0.3 to 0.6 cubic feet per second per square mile. The surface waters are calcium bicarbonate type; have low concentrations of nutrients; and at times, may contain dissolved iron and manganese in concentrations in excess of U.S. Environmental Protection Agency recommended limits. The pooled diversity index of the benthic invertebrate community ranges from 2.93 to 4.06. No ground-water wells have been drilled in the present mining areas. Water quality of streams in the Peters Creek coal area is similar to that of the streams in the Beluga coal area. No attempt is made to define streamflow characteristics in the Peters Creek coal area due to poor correlations with nearby gaging stations. In the Healy coal area, streamflow characteristics are dissimilar between the two major basins studied. Lignite Creek is estimated to have less yield than Healy Creek. Studied tributaries of Healy and Lignite Creeks contain waters with a dissolved solids range of 111 to 636 milligrams per liter and have calcium and bicarbonate or magnesium and bicarbonate as principal ions. Iron and manganese concentrations are high at some times, the concentrations of sodium and chloride increases significantly in the lower reaches of Lignite Creek. (USGS)

Index of Streamflow and Water-Quality Records to September 30, 1978, Southwest Alaska

Stilly, P. J.


Journal Announcement: SWRA1405

This report, which is one of a series of reports for Alaska, lists gaging stations in southeast Alaska at which streamflow and water-quality data have been collected by the U.S. Geological Survey. Included are a hydrologic subregion map of southeast Alaska and a table listing the types of data collected and periods of record. (USGS)

Index of Streamflow and Water-Quality Records to September 30, 1978, Southeast Alaska

Stilly, P. J.


Index of Streamflow and Water-Quality Records to September
30, 1978, Southwest Alaska
Still, P. J.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver,
CO 80225, Price: $2.00 in paper copy, $3.50 in
p, 1 Fig, 1 Tab., Journal Announcement: SWRA1405
This report, which is one of a series of reports for
Alaska, lists stations in southwest Alaska, at which
streamflow and water quality data have been collected by
the U.S. Geological Survey. Included are a hydrologic
subregion map of southwest Alaska and a table listing the types
of data collected and periods of record. (USGS)

Index of Streamflow and Water-Quality Records to September
30, 1978, Yukon Basin, Alaska
Still, P. J.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver,
CO 80225, Price: $5.50 in paper copy, $3.50 in
p, 1 Fig, 1 Tab., Journal Announcement: SWRA1405
This report, which is one of a series of reports for
Alaska, lists stations in Yukon Basin, Alaska, at which
streamflow and water quality data have been collected by
the U.S. Geological Survey. Included are a hydrologic
subregion map of Yukon Basin, Alaska, and a table listing the types
of data collected and periods of record. (USGS)

Index of Streamflow and Water-Quality Records to September
30, 1978, South-Central Alaska
Still, P. J.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver,
CO 80225, Price: $7.50 in paper copy, $3.50 in
p, 1 Fig, 1 Tab., Journal Announcement: SWRA1405
This report, which is one of a series of reports for
Alaska, lists stations in south-central Alaska at which
streamflow and water quality data have been collected by
the U.S. Geological Survey. Included are a hydrologic subregion
map of south-central Alaska and a table listing the types
of data collected and periods of record. (USGS)

Index of Surface Water Quality Records to September 30,
1973, Northwest and Arctic Slope, Alaska
Still, P. J.
Open-File Report (basic data), 1976. 9 p, 1 Fig, 2 Tab.,
Journal Announcement: SWRA1015
This report includes a map showing the locations of all
water quality sites in Northwest and Arctic Slope,
Alaska, a table listing the types of data collected, and the
periods of record to September 30, 1973. (Woodard-USGS)

Index of Surface Water Quality Records to September 30,
1973, South-Central Alaska
Still, P. J.
Open-File Report (basic data), 1976. 12 p, 1 Fig, 1 Tab.,
Journal Announcement: SWRA1015
This report includes a map showing the locations of all
surface water quality sites in South-Central Alaska, a table
listing the types of data collected, and the periods of record
September 30, 1973. (Woodard-USGS)

A REVIEW OF WATER RESOURCES OF THE UMIAI AREA, NORTHERN ALASKA
WILLIAMS, JOHN R.
GEOLOGICAL SURVEY, WASHINGTON, D.C.
GEOLOGICAL SURVEY CIRCULAR 630, 1970, 8 P, 2 FIG, 2 TAB, 11
REF.
Journal Announcement: SWRA0409
IN THE UMIAT AREA OF NORTHERN ALASKA, SURFACE-WATER
SUPPLIED FROM THE COLVILLE RIVER, SMALL TRIBUTARY CREEKS, AND
LAKES ARE ABUNDANT IN SUMMER BUT LIMITED IN WINTER BY LOW OR
ZERO FLOW IN STREAMS AND THICK ICE COVER ON LAKES. A FRESH
GROUNDWATER OCCURS IN UNFROZEN ZONES IN ALLUVIUM AND IN THE UPPER
PART OF BEDROCK BENEATH THE COLVILLE RIVER AND BENEATH LAKES THAT DO NOT
FREEZE TO THE BOTTOM IN WINTER. BRACKISH OR SALINE
GROUNDWATER OCCURS IN BEDROCK BENEATH AS MUCH AS 1,055 FEET OF
PERMAFROST IN THE ARCTIC FOOTHILLS AND BENEATH 750 TO 800
FEET OF PERMAFROST BENEATH LOW TERRACES OF THE COLVILLE RIVER
VALLEY. THE FOOTHILL AREA IS UNFAVORABLE FOR DEVELOPING SUPPLIES
OF POTABLE GROUNDWATER BECAUSE OF THE GREAT DEPTH TO WATER,
PREDOMINANCE OF BRACKISH OR SALINE WATER, AND LOW POTENTIAL
YIELD OF THE BEDROCK. IN THE COLVILLE RIVER VALLEY, SHALLOW
UNFROZEN GROUNDWATER BENEATH THE RIVER AND DEEP LAKES WILL YIELD
ABUNDANT YEAR-ROUND SUPPLIES OF GROUNDWATER, BUT THE BEDROCK
BENEATH PERMAFROST YIELDS LESS THAN 10 GALLONS PER MINUTE OF SALINE
OR BRACKISH WATER. (WOODARD-USGS)

GROUNDWATER IN THE PERMAFROST REGIONS OF ALASKA
WILLIAMS, JOHN R.
GEOLOGICAL SURVEY, WASHINGTON, D.C.
FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS, U.S.
GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C. 20402 - PRICE $1.00.
GEOLOGICAL SURVEY PROFESSIONAL PAPER 696, 1970. 83 P. 23 FIG. 4
TAB. 270 REF.

Journal Announcement: SWRA0401

ALTHOUGH GROUNDWATER IN PERMAFROST REGIONS IN ALASKA OCCURS
ACCORDING TO THE SAME GEOLOGIC AND HYDROLOGIC PRINCIPLES
PREVAILING IN TEMPERATE REGIONS, SUBFREEZING TEMPERATURES
RESULT IN PROFOUND MODIFICATION OF GROUNDWATER FLOW SYSTEMS.
FROZEN GROUND IS AN IMPENETRABLE LAYER WHICH: (1) RESTRICTS
RECHARGE, DISCHARGE, AND MOVEMENT OF GROUNDWATER, (2) ACTS AS A
CONFining LAYER, AND (3) LIMITS THE VOLUME OF UNCONSOLIDATED
DEPOSITS AND BEDROCK IN WHICH LIQUID WATER MAY BE STORED. FROZEN
GROUND IN MANY AREAS ELIMINATES SHALLOW AQUIFERS AND REQUIRES
THAT WELLS BE DRILLED DEEPER THAN IN SIMILAR GEOLOGIC
ENVIRONMENTS HAVING NO PERMAFROST. LOCAL VARIATIONS IN THE
THICKNESS, AREAL EXTENT, AND TEMPERATURE OF PERMAFROST
DEPEND ON VARIABLE THERMAL PROPERTIES OF EARTH MATERIALS AND ON
LOCAL DIFFERENCES IN THE RATE OF HEAT FLOW FROM WITHIN
THE EARTH, CLIMATE, TOPOGRAPHY, VEGETATION, GEOLOGY, AND
HYDROLOGY. GROUNDWATER OCCURS ABOVE, BELOW, AND LOCALLY
WITHIN PERMAFROST. IN THE CONTINUOUS-PERMAFROST ZONE, THE
MOST ECONOMICALLY DEVELOPED SOURCES OF WATER ARE IN UNFROZEN
ALLUVIUM BENEATH LARGE LAKES AND RIVERS. IN THE
DISCONTINUOUS-PERMAFROST ZONE, GROUNDWATER IS PRODUCED LOCALLY
FROM SHALLOW AQUIFERS ABOVE PERMAFROST OF OFFSHORE BARS AND SPITS
BECAUSE WATER WITHIN OR BELOW THE FROZEN BEACH DEPOSITS IS
SALINE. (KNAPP-USGS)

Summary Appraisals of the Nation's Ground-Water Resources--Alaska
Zenone, C.; Anderson, G. S.
Available from SuDoc. of Documents, GPO, Washington, DC
1978. 28 p. 13 fig. 4 tab. 77 ref.

Journal Announcement: SWRA1211

Ground water is a large but virtually unexplored and
undeveloped resource in Alaska. Perennially frozen ground
(permafrost) influences the occurrence, movement and
availability of ground water except in the southern and
southeastern coastal areas of the State. The most extensive
aquifers occur in alluvium of major river valleys such as the
Yukon, Tanana, Kuskokwim and Susitna. Large amounts of
ground water are also stored in glacial outwash aquifers in
coastal basin and valley deposits at Anchorage, Kenai and
Juneau. Individual wells yielding more than 1,000 gallons per
minute have been developed in the Tanana River Valley,
Cook Inlet lowlands, and the coastal valleys at Seward and Juneau.
Comparable yields should be possible in other areas that have
similar geohydraulic environments. Both recharge and
discharge of the large alluvial aquifers are concentrated along
stream channels. It is estimated that 25 percent of the total
volume of streamflow in Alaska (exclusive of coastal areas) is
contributed by ground-water discharge. (Woodard-USGS)
Water-Resources Reconnaissance of the Ouachita Mountains, Arkansas

Albin, Donald R.


Water for domestic and nonirrigation farm use can be obtained from wells nearly everywhere in the Ouachita Mountains, and ground-water supplies as large as 50,000 gpd (gallons per day) often can be developed. In general, the best procedure for developing ground-water supplies in the mountains is to drill wells on the flanks of anticlines (in synclinal valleys) and off the noses of plunging anticlines. Ground water for industrial or municipal use in the area may require treatment for removal of iron and calcium magnesium hardness.

Streams are the best potential sources of water for municipal growth and economic development in the Ouachita Mountains. Although most streams in the mountains occasionally have very little or no flow, with adequate storage facilities they generally are the best sources of supply when water demands approach 50,000 gpd. The streams contain water of excellent quality that chemically is suitable for nearly all uses.

Geology and Ground-water Resources of Bradley, Calhoun, and Ouachita Counties, Arkansas

Albin, Donald R.

U.S. Geological Survey Water-Supply Paper 1779-G

Bradley, Calhoun, and Ouachita Counties comprise an area of approximately 2,000 square miles in south-central Arkansas. The area is in the Coastal Plain physiographic province and is characterized by heavily timbered flatlands and low hills.

The geologic units at the surface in the counties are of Eocene, Pleistocene, and Recent age. Water for domestic and small-farm use can be obtained in and at short distances downdip from the outcrop areas of each of the formations. However, only the Sparta Sand, the Cockfield Formation, the terrace deposits, and the alluvium are major fresh-water aquifers.

The total ground-water use in the counties is approximately 6.1 mgd (million gallons per day). Of this total, about 5.0 mgd is withdrawn from the Sparta Sand, about 0.1 mgd is withdrawn from the Cockfield Formation, and about 1.0 mgd is withdrawn from the terrace deposits and alluvium. Most of the pumpage is concentrated in the vicinity of the major towns and cities. Each of the aquifers is capable of yielding larger quantities of water than presently are being withdrawn from them. However, in a small area near Camden the total pumpage from the Sparta Sand is almost the maximum sustained yield.

The ground water in Bradley, Calhoun, and Ouachita Counties primarily is of the sodium bicarbonate type. Water from the Sparta Sand and the Cockfield Formation is suitable for most municipal, industrial, agricultural, and domestic uses.

Well records, depth-to-water measurements and logs of selected
wells and test holes, and chemical analyses of ground water in Bradley, Clark, and Ouachita Counties, Arkansas
Albin, D. R., 1963

Forest Species as Indicators of Flooding in the Lower White River Valley, Arkansas
Bedinger, M. S., 1971

The dominant environmental factor of forest habitats within the lower valley of the white Arkansas, is flooding. The flood plain consists of a series of terraces. Distribution of forest species on the terrace levels is related to flooding. The relationship is sufficiently distinct to permit determination of flood characteristics at a given site by evaluation of forest-species composition. The vegetation of the lower white river valley can be divided into four groups. Each group occurs on sites flooded distinctly different flooding characteristics. On sites flooded 29-40 percent of the time, the dominant species are water-hickory and overcup oak. On sites flooded 10-21 percent of the time, a more varied flora exists including nuttall oak, willow oak, sweetgum, southern hackberry, and American elm. The third group of sites is subject to flooding at intervals of 2 to 8 years. This group is marked by presence of southern red oak, shagbark oak, and black gum. The presence of blackjack oak marks the fourth group (not flooded in historic times).

Ground-Water Potential of the Alluvium of the Arkansas River between Little Rock and Fort Smith, Arkansas
Bedinger, M. S., Emett, L. F., and Jeffery, H. G., 1965
U.S. Geological Survey Water-Supply Paper 1669-L

Alluvium along 200 miles of the Arkansas River from Fort Smith to Little Rock, Arkansas, on the western border of the State, to Little Rock in the approximate geographic center of the State, is potentially the most important aquifer in the Interior Highlands of Arkansas. The flood plain of the river generally is 1 to 3 miles wide, but in places its width is 5 miles. The flood plain is underlain by alluvial sands, gravel, silt, and clay which ranges in thickness from about 40 feet near Fort Smith to about 80 feet near Little Rock. Wells tapping the alluvium yield between 300 and 700 gpm (gallons per minute), wells tapping the sandstone and shale of the Mississippian and Pennsylvanian age, which border the alluvium, generally yield less than 50 gpm.

Generally, ground water in the alluvium is under-water-table conditions. Movement of ground water is from the valley wall to the river, and the river acts as a draining agent throughout most of the year.

The alluvium is recharged primarily by infiltration of rainfall. On the average, the aquifer is recharged at the rate of 10 inches per year of approximately 130 mgd (million gallons per day). Pumpage from the alluvium is about 3.2 mgd. The amount of recharge to the aquifer can be increased many times over the natural recharge rate by constructing wells that will induce recharge from the river.

Medians values of the principal constituents in water from the alluvium indicate that it is a calcium magnesium bicarbonate water. Local high concentrations of sulfate, chloride, or nitrate are probably the result of water moving from other formations into the alluvium. High concentrations of chloride in the water, however, can be the result of influent seepage of river water.

The quality of water in the alluvium generally is suitable for domestic and irrigation purposes. The hardness and high content of iron and nitrate, however, make the water undesirable for some industrial uses.

Alluvial Aquifer of the Cache and St. Francis River Basins, Northeastern Arkansas
Broom, M. E., and Lyford, F. P., 1976


Journal Announcement: SWHA 1423

The alluvial aquifer underlies about 9,000 square miles of the study area. Well yields from the aquifer commonly are from 1,000 to 2,000 gallons per minute. Flow toward the main area of pumping stress is eastward from the Cache River and westward from the St. Francis River. The Memphis aquifer acts as a conduit through Crowleys Ridge for induced flow from the alluvial aquifer since the early 1900's has been mostly for rice irrigation. Total pumpage for rice in 1978 was about 1,650,000 acre-feet of which about 90 percent was pumped from the aquifer west of Crowleys Ridge. Water levels in wells west of the ridge in parts of Poinsett, Cross, and Craighead Counties in 1978 were 75 feet below land surface and declining about 2 feet per year. Digital-model analysis indicated that at the end of 1978 water was being removed from aquifer storage at the rate of 540,000 acre-feet per year, and streamflow, mostly from Cache River and Bayou DeTivier, was being captured at the rate of 430,000 acre-feet per year. Projecting the 1978 pumping rate of 1,460,000 acre-feet per year, the pumping rate would have to be reduced by about 110,000 acre-feet per year by 1990 to support current aquifer saturation for water needs through the year 2000. In all parts of Poinsett, Craighead, and Cross Counties west of Crowleys Ridge, the aquifer would not be able to support the expected 1,460,000 acre-feet per year pumping rate. The water quality of alluvial aquifer water is generally suitable for domestic purposes; however, hardness and high chloride content make the water undesirable for some industrial uses.

Hydrology of the Bayou Bartholomew Alluvial Aquifer-Stream System, Arkansas
Broom, M. E., and Reedy, J. E., 1973

The study area comprises about 3,200 square miles of the Mississippi alluvial plain in southeastern Arkansas. About 90
percent of the area drains south to the Ouachita River in Louisiana.

The alluvial aquifer and the streams are hydraulically connected and are studied as an aquifer-stream system. Bayou Bartholomew is a principal stream of the system.

The aquifer is underlain by confining strata of the Jackson Group and Cockfield Formation. The mean annual surface-water yield of the area that drains to the Ouachita River basin is nearly 2 million acre-feet. Flood-control projects have significantly reduced flooding in the area. Basin boundaries and low-flow characteristics of streams have been altered as a result of the flood-control projects and streamflow diversion for irrigation.

The direction of ground-water flow generally is southward. Bayou Bartholomew functions mostly as a drain for ground-water flow from the west and as a recharge source to the aquifer east of the bayou. As a result of navigation pools, the Arkansas River is a steady-charge source to the aquifer.

Pumping from the aquifer and streams increased from about 20,000 acre-feet in 1941 to 237,000 acre-feet in 1970.

Estimates of flow derived from analog analysis but lacking field verification indicate that recharge to the aquifer in 1970 was about 161,000 acre-feet. About 70 percent of the recharge was by capture from streams as a result of ground-water pumpage. Discharge from the aquifer was about 235,000 acre-feet. About 80 percent of the discharge was through wells.

Stream diversion in 1970 from capture and open channel, excluding capture from the Arkansas and Mississippi Rivers, was about 110,000 acre-feet. Return flow to streams from rice irrigation and fishponds was about 60,000 acre-feet.

The chemical quality of streamflows is excellent for irrigation. Water from the aquifer generally ranges from permissible to excellent for irrigation. The use of water from the aquifer in the flood-plain areas, exclusive of irrigation, is severely limited unless it is treated to remove the iron and reduce the hardness.

Waste-load allocation studies for Arkansas streams, Arkansas River basin, Petit Jean and Poteau Rivers, Segment 3F.

Bryant, C. T., 1974


Waste-load allocation studies for Arkansas streams, Ouachita River basin, Segment 2F.

Bryant, C. T., 1975


Waste-load allocation studies for Arkansas streams, St. Francis River basin, L'Anguille River, Segment 5B.

Bryant, C. T., Jennings, M. E., and Reed, J. E., 1974


Waste-load allocation studies for Arkansas streams, St. Francis River basin, St. Francis River, Segment 5C.

Bryant, C. T., Jennings, M. E., and Hauer, D. P., 1974


Water-Quality Assessment of the L'Anguille River Basin, Arkansas.


Journal Announcement: SWRA1311

For several years, dissolved oxygen in the L'Anguille River has been reduced to concentrations of less than 5.0 milligrams per liter during the summer and fall. In addition, concentrations of pesticides have been reported consistently at one long-term station on the river and trace metals have been reported at two long-term monitoring sites. The U.S. Geological Survey conducted an intensive study of the L'Anguille River basin during the summer and fall of 1978 in cooperation with the Arkansas Department of Pollution Control and Ecology. An assessment of the general water quality was made; the causes of stream dissolved-oxygen reductions were determined; and the occurrence of pesticides and trace metals in the basin was documented. A steady-state, segmented, dissolved-oxygen model was calibrated and used to project simulated dissolved-oxygen profiles. (Kosco-USGS)

Drainage areas of streams in Arkansas, St. Francis River basin.

Christensen, R. C., Gilstrap, R. C., and Sullivan, J. N., 1967


Well records, depth-to-water measurements and logs of selected wells and test holes and chemical analyses of groundwater in the Arkansas Valley region, Arkansas.

Cordova, R. M., 1962


Reconnaissance of the Ground-water resources of the Arkansas Valley region, Arkansas.

Cordova, R. M., 1963


Ducret, G. L., Jr., 1979


Ground-water levels in Arkansas, Spring 1983.

Edds, Joe

The report contains about 650 ground-water level measurements made in observation wells in Arkansas in the spring of 1983. In addition, the report contains well hydrographs relating to the alluvial aquifer and the Sparta Sand, the most important aquifers with respect to ground-water availability and use in Arkansas.

Ground-water levels in Arkansas, Spring 1982

Eds, Joe

U.S. Geological Survey Open-File Report 82-852

The report contains about 640 ground-water level measurements made in observation wells in Arkansas in the spring of 1982. In addition, the report contains potentiometric-surface maps and well hydrographs relating to the alluvial aquifer and the Sparta Sand, the most important aquifers with respect to ground-water availability and use in Arkansas.

Floodflow characteristics of Archey Creek along U.S. Highway 65 at Clinton, Arkansas

Gilstrap, R. C., 1975

U.S. Geological Survey Open-File Report 75-603

Floodflow characteristics of Illinois River tributary near Siloam Springs, Arkansas

Gilstrap, R. C., 1976


Water-resources investigations in Arkansas, Fiscal Year 1981

Gurley, R. L., 1981


Water resources of Grant and Hot Spring Counties, Arkansas


U. S. Geol Surv Water-Supply Pap 1857, 64 p., 1968. 12 fig, 6 tab, 82 ref.

Journal Announcement: SWRA207

The availability and quality of groundwater and the lithology of the principal aquifers are described, and information is given on surface water availability, including magnitude and frequency of floods and low flows, duration of daily flows, and storage requirements for dependable yields of streams. Quality of water in Ouachita and saline rivers and many tributary streams is described, and existing or potential river and groundwater pollution is cited. The Ouachita, saline, and Caddo Rivers yield large quantities of soft, good-quality water. Small streams in southeastern Hot Spring County and in the Ouachita Mountains have relatively high base flow. In Grant County small streams yield little water during dry periods. At times, sewage and mine drainage pollute a part of the Ouachita River in the Lake Catherine area. At low flow, Hurricane Creek water is unfit for most uses, wells in the Sparta Sand, the principal aquifer, yield as much as 650 gpm of soft water in Grant County. The Carrizo sand and Cane Creek formation are potentially important aquifers in Grant County and southeastern Hot Spring County. Wells in the Wilcox Group yield as much as 100 gpm of fresh water in southeastern Hot Spring County and southwestern Grant County; in the rest of Grant County its water is brackish. Alluvium along the principal streams and in consolidated rocks of the Ouachita Mountains yield small quantities of water variable in quality from place to place. Some of the alluvial water has high nitrate content and may be a health hazard. (Long-USGS)

Coal Resources of Arkansas, 1954

Haley, R. L., 1960


Ground water in the Springfield-Salem Plateaus of Southern Missouri and Northern Arkansas. (Duplicated see Missouri).


Journal Announcement: SWRA1420

Water resources of Clay, Greene, Craighead, and Poinsett Counties, Arkansas


Journal Announcement: SWRA1516

Fourteen illustrations and tables in this 2-sheet hydrologic atlas. Describe the water resources of Clay, Greene, Craighead, and Poinsett Counties. Arkansas. The occurrence, quantity, availability, and quality of ground and surface water and the variability in these supplies are determined. In addition, water problems peculiar to the area are defined and corrective measures suggested. Average annual streamflow ranges from 1.2 cfs per 50 mi in the western part of the West of the Four Counties to 1.6 cfs per 50 mi in the eastern part. Average annual precipitation is about 48 inches. Use of water for agriculture greatly exceeds all other uses combined. In 1965, 111.4 MGD was used for rice irrigation, and 71.5 MGD was used for irrigation of other crops. An additional 16.9 MGD...
Arkansas

WAS USED BY INDUSTRY, MUNICIPALITIES, AND OTHERS. OF THESE AMOUNTS, 180.1 MGD WAS GROUNDWATER AND 19.7 MGD WAS SURFACE WATER, OR A TOTAL OF 199.8 MGD. (WOODARD-USGS)

GEOHYDROLOGY OF THE COASTAL PLAIN AQUIFERS OF ARKANSAS

HOSKINS, R. L.

GEOLOGICAL SURVEY, WASHINGTON, D. C.

GEOL SURV HYDROL INVEST ATLAS HA-309. 1 SHEET, 1969. 3 MAP, 3 TAB. TEXT.

Journal Announcement: SURO271

DATA ON WATER QUALITY, WATER WELLS, AND CHARACTER AND EXTENT OF THE GULF COASTAL PLAIN SYSTEM OF AQUIFERS IN ARKANSAS ARE SUMMARIZED IN A 1-SHEET HYDROLOGICAL ATLAS CONSISTING OF BLOCK DIAGRAMS SHOWING STRATIGRAPHY AND EXTENT OF AQUIFERS, WATER CHEMICAL QUALITY DIAGRAMS, AND TABLES. THE HYDROLOGICAL CHARACTERISTICS OF THE PRINCIPAL AQUIFERS ARE DESCRIBED AND A SUMMARY OF PUMPING TEST RESULTS IS GIVEN. THE ALTITUDE OF THE BASE OF FRESH WATER IS SHOWN BY A MAP.

(KNAPP-USGS)


Jennings, Marshall E., and Bryant, Charles T.


Waste load allocation studies in Arkansas form a central part of the development and implementation of basin water-quality management plans required by the Arkansas Department of Pollution Control and Ecology by the Environmental Protection Agency (EPA). This report describes the methodology to be used in Arkansas waste load allocation studies. Steady-state segmented dissolved oxygen (DO) analysis of riverine segments is the recommended basis for waste load allocation studies. A dilution model, based on the mass-balance principle, is used for analysis of stream conservative mineral loads. Data collection and laboratory procedures to support such a modeling effort are discussed.

Discharge Data at Water-Quality Monitoring Stations in Arkansas—published annually since 1975.

KNOTT, R. K.


Available from the OFS, USGS Box 254275, Fed. Ctr., Denver, CO 80223.

Discharge data were computed for a network of water-quality monitoring stations operated by the Arkansas Department of Pollution Control and Ecology. Some of the sites are located at U.S. Geological Survey of U.S. Army Corps of Engineers daily-discharge stations, but most sites are at points where discharges are not regularly measured. (USGS)

Arkansas

Time of Travel of Selected Arkansas Streams

Lamb, T. E. 1983

U.S. Geological Survey Open-File Report 82-4068

The travel time of water-soluble materials in a stream is important for stream modeling, pollution studies, and estimating arrival time of contaminants to points downstream from spills. Between 1971 and 1981, time-of-travel and dispersion measurements were made in 15 streams in Arkansas. Most of the streams studied were at or near base flow. Graphs are presented for predicting traveltime of solutes in segments of the streams. The relationship of time of passage and peak unit concentration to traveltime is presented for two of the streams. Examples of use and application of the data are given.

Water-Quality Investigation of the Vache Grasse Creek Watershed, Sebastian County, Arkansas

Lamb, T. E. 1979


The results of a 1-year study in the upper Vache Grasse Creek watershed are presented to document surface-water quality conditions before implementation of Soil Conservation Service programs. Analysis of samples collected at four sites showed that during periods of warm weather several of the parameters sampled produced unusually high or low values that indicated possible water-quality problems. Low dissolved-oxygen concentrations, high nitrogen and organic carbon concentrations, and high coliform bacteria counts were found at sampling sites upstream from the Greenwood water-supply lake. Sampling in and downstream from the lake indicated that the quality of the water passing through the lake was improved significantly. However, sampling in the lake indicated that there is a large layer of water with low oxygen concentration and a buildup of phosphorus, iron, manganese, and some other metals in the bottom ooze.

Water-Quality Investigation of the Tyrone River Watershed, Arkansas

Lamb, T. E.


Journal Announcement: SWA1115

The results of a 1-year study of surface-water quality in the Tyrone River Watershed, Arkansas, are presented to document conditions before implementation of Soil Conservation Service Programs. The report includes a general description of the watersheds' topography, geology, and aquifers, and the results of monthly measurements of discharge at five sites, and several physical and chemical parameters, plus quarterly analyses for several ions and semiannual analyses for bottom material for various pesticides. The results indicate that the quality of the water in the streams and ditches samples is normal for an intensely farmed area such as this.
Logs and water-level measurements of selected test holes and wells in the alluvium of the Arkansas River valley between Little Rock and Fort Smith, Arkansas
May J. R. and Emnett L. F., June 1964

Logs and water-level measurements of selected test holes and wells in the alluvium of the Arkansas River valley between Little Rock and Fort Smith, Arkansas
May J. R. and Emnett L. F., June 1964

Chemical analyzes of the water from selected wells in the Arkansas River Valley from the mouth to Fort Smith, Arkansas
May J. R., Yanchosek J. J., and Jeffery H. G., June 1964

Logs of Test Holes and Wells in the Red River Valley in Lafayette, Little River, and Miller Counties, Arkansas

Geohydrologic Significance of Lithofacies of the Cerrito Sand of Arkansas, Louisiana, and Texas and the Meridian Sand of Mississippi

Journal Announcement: SWA011978

The Thickness of the Cerrito and Meridian Sands is the Fourth Part of an Investigation of the Geohydrology of the Claiborne Group, the Regional Dip of the Cerrito and Meridian Sands is Into the Desha Basin, Mississippi Embayment, and Gulf Coast Coast. Some Movements of Major Structural Features Took Place During Cerrito and Meridian Time. Normal Faulting Is Rather Extensive in Southern Arkansas and in Texas. The Thickness of the Cerrito and Meridian Sands Varies from 0 in Areas of Nondeposition to a Maximum of 700-750 Feet in De Witt and Karnes Counties, Tex. Aquifer Tests Indicate that the Coefficient of Permeability Increases with Increase in Sand-Unit Thickness. But the Range in Values in the Cerrito and Meridian Sands Is Not as Great as the Range in Values Found in the Other Claiborne Aquifer Formations. The Areas of Highest Transmission of the Formations Are in the West-Central Mississippi and in Southern Texas. In Mississippi and Texas the Dominant Anion is Bicarbonate in Water from the Cerrito and Meridian Sands from Depths of 1,700 to More than 2,500 Feet, in Arkansas and Louisiana, Chloride Is the Dominant Anion. Mean Depths of 500-1,000 Feet.
HYDROLOGIC SIGNIFICANCE OF LITHOFACIES OF THE CANE RIVER FORMATION OR EQUIVALENTS OF ARKANSAS, LOUISIANA, MISSISSIPPI, AND TEXAS

P.AYNE, J. N.
GEOLOGICAL SURVEY, WASHINGTON, D.C.
AVAILABLE FROM GPO, WASHINGTON, D.C. 20402 - PRICE $10.90.
GEOLOGICAL SURVEY PROFESSIONAL PAPER 569-C, 1972. 17 P., 4 FIG., 16 PLATE (BOUND SEPARATELY), 1 TAB., 61 REF., JOURNAL ANNOUNCEMENT: SWRA0679


Reconnaissance of Stormwater-Runoff Water Quality of the Big Piney Creek Segment of the Cedar-Piney Creeks Watershed, Yell County, Arkansas

Petersen, James E.
U.S. Geological Survey Open-File Report 82-761
A reconnaissance of the Big Piney Creek watershed was conducted between June 1981 and January 1982 to assess the water-quality of selected streams in the watershed. Streamflow was measured at water samples were collected three times at each of three sites during the study. All samples were collected during periods of stormwater runoff. The water was soft (7 to 20 milligrams per liter of calcium carbonate) and dissolved-solids concentrations ranged from 36 to 74 milligrams per liter. Suspended-sediment concentrations ranged from 7 to 144 milligrams per liter. The 5-day biochemical oxygen demands, total-nitrogen concentrations and total-phosphorus concentrations ranged from 1.5 to 6.8 milligrams per liter, 0.54 to 5.08 milligrams per liter, and 0.03 to 0.56 milligrams per liter, respectively. Fecal-coliform bacteria were present in large enough numbers to indicate that the U.S. Environmental Protection Agency criterion for bathing waters and the Arkansas water-quality standard may be exceeded at times. Total-iron concentrations greater than 1,000 milligrams per liter (the U.S. Environmental Protection Agency criterion for protection of freshwater aquatic life) were detected at least once at all sites.

WATER RESOURCES OF CLARK, CLEVELAND, AND DALLAS COUNTIES, ARKANSAS

PELBUCH, RAYMOND O.; HINES, MARION S.
GEOLOGICAL SURVEY, WASHINGTON, D.C.

CLARK, CLEVELAND AND DALLAS COUNTIES CONSTITUTE AN AREA OF 2,151 SQUARE MILES IN SOUTH-CENTRAL ARKANSAS. THE AREA IS DRAINED BY THE OUACHITA SALINE, AND LITTLE MISSOURI RIVERS AND THEIR TRIBUTARIES. THE AMOUNT OF WATER AVAILABLE FOR USE CAN BE INCREASED BY THE CONSTRUCTION OF RESERVOIRS. SECOND PER SQUARE MILE, OR A TOTAL OF ABOUT 3,000 CFS. GENERALLY, THE WATER QUALITY IS GOOD; BUT WATER FROM SOME OF THE STREAMS, PARTICULARLY FROM THE SMALLER TRIBUTARIES, MAY REQUIRE TREATMENT FOR EXCESSIVE IRON CONTENT AND HIGH COLOR. THE CONSOLIDATED ROCKS IN THE INTERIOR HIGHLANDS GENERALLY YIELD LESS THAN 10 GPM TO Wells, PRECLUDING THE DEVELOPMENT OF LARGE MUNICIPAL OR INDUSTRIAL GROUNDWATER SUPPLIES IN THAT AREA. THE FORMATIONS OF TERYOUTH, QUEEN CITY, AND CARRizo SAND ARE THE BEST POSSIBILITIES FOR GROUNDWATER, PARTICULARLY IN DALLAS AND CLEVELAND COUNTIES. THE SPART ASAND IS THE BEST AQUIFER IN THE PROJECT AREA, PARTICULARLY EAST OF CENTRAL DALLAS COUNTY. WELL YIELDS OF 700 GALLONS PER MINUTE OR MORE ARE POSSIBLE. THE DEPOSITS OF QUERNARY AGE ARE THIN AND GENERALLY SUITABLE ONLY FOR DOMESTIC SUPPLIES. TOTAL WATER USE IN THE PROJECT AREA IN 1965 WAS ABOUT 0.6 MILLION GALLONS PER DAY SINCE SURFACE-WATER SOURCES. TOTAL WATER USE IN THE AREA IN 1967 WAS INSIGNIFICANT COMPARED WITH THE TOTAL WATER AVAILABLE.

WATER RESOURCES OF PULASKI AND SALINE COUNTIES, ARKANSAS

PELBUCH, RAYMOND O.; HINES, MARION S.
GEOLOGICAL SURVEY, WASHINGTON, D.C.

PULASKI AND SALINE COUNTIES CONSTITUTE AN AREA OF 1,506 SQUARE MILES IN THE GEOGRAPHIC CENTER OF ARKANSAS. THE AREA IS DIVIDED INTO A HILLY WESTERN PART, KNOWN AS THE INTERIOR HIGHLANDS, AND A RELATIVELY FLAT EASTERN PART, KNOWN AS THE COASTAL PLAIN. IN THE INTERIOR HIGHLANDS, SURFACE WATER OFFERS GREATER POSSIBILITIES THAN GROUNDWATER FOR WATER SUPPLIES.
ALUM FORK, MIDDLE FORK, AND NORTH FORK OF THE SALINE RIVER OFFER EXCELLENT IMPoundMENT STORAGE. MANY OF THE SMALLER STREAMS ARE SUITABLE FOR DEVELOPMENT OF SMALL SUPPLIES. IN CONTRAST, IN THE COASTAL PLAIN IT IS EASIER TO DEVELOP GROUNDWATER THAN SURFACE WATER IN RELATIVELY LARGE QUANTITIES. TWO AQUIFERS, UNITS 3 AND 5, YIELD AS MUCH AS 350 AND 2,000 GPM OF WATER, RESPECTIVELY. A THIRD AQUIFER, UNIT 7, IS AS YET RELATIVELY UNDEVELOPED IN THE PROJECT AREA, BUT YIELDS 860 GPM TO A WELL SOUTH OF THE PROJECT AREA. THESE AQUIFERS YIELD WATER THAT, WITH TREATMENT, IS SUITABLE FOR MOST USES. (KNAIP-USGS)

Digital model of the Bayou Bartholomew Alluvial Aquifer-Stream System, Arkansas
Reed, J. E., and Broom, M. E., 1979
A digital model of the aquifer-stream system was calibrated for the purpose of predicting hydrologic responses to stresses of water development. The simulated-time span for model calibration was from 1953 to 1972, during which time the system was stressed largely by ground- and surface-water diversions for rice irrigation.

The model was calibrated by comparing ground-water-level and streamflow data with model-derived ground-water levels and streamflow. In the calibrtated model, the ratio of model-derived to observed streamflows for 17 subbasins averaged 1.1; the ratios among the subbasins ranged from 0.8 to 1.6. The average deviation of the differences between model-derived and observed ground-water levels at 47 nodes was 0.25 the average among the nodes ranged from 2.1 to 10.4. The average standard deviation of the differences between the model-derived and observed ground-water levels was 3.5; the average among the nodes ranged from 2.0 to 5.0. The model will provide projections of changes in the potentiometric surface resulting from (1) changes in the rate or duration of ground-water pumpeeage or (2) changes in the stage of streams and reservoirs. The model will provide only approximate projections of the streamflow.

Waste-load allocation studies for Arkansas streams, Ouachita River basin, Saline River, Segment 2C

Waste-load allocation studies for Arkansas streams, Ouachita River basin, Bayou Bartholomew, Segment 2B
Reed, J. E., Terry, J. E., Lambert, B. F., and Morris, E. E., 1975

Waste-load allocation studies for Arkansas streams, Ouachita
Floodflow characteristics of Mulberry River at Interstate 40, near Mulberry, Arkansas
Sullivan, J. N., 1976

Water-Resources Appraisal of the South-Arkansas Lignite Area

The feasibility of developing lignite resources in south-central Arkansas is an important question at the present time (1978). Part of the concern is related to the possible impacts that mining and processing of lignite will have on water resources. Not only will the disturbance caused by excavating affect the quantity and quality of surface and ground water, but the mining, processing, and conversion processes will require the use and consumption of significant quantities of water. To assess the magnitude of the effects of strip mining upon both surface and ground water, baseline conditions (hydrologic conditions in the area prior to mining) must be well defined. A thorough data file and literature search was made so that baseline conditions in the area could be defined. In addition, data-collection networks have been established for the collection of quantitative and qualitative information on streamflow and water levels in the aquifers. Data collected to date at these sites are included in the report. Collection of data at these sites will continue through at least September 1979. Information presented in this report can be used to estimate the quantities of water available for use and the possible effects of mining and associated dewatering on water resources. (USGS)

Waste-load allocation studies for Arkansas streams, White River basin, Segment 4A

Waste-load allocation studies for Arkansas streams, Ouachita River basin, Ouachita River and Bayou Macon, Segment 2A
Terry, J. E., Morris, E. E., Lambert, B. F., and Sniegocki, R. T., 1975

Quality of surface waters of the United States, 1969: Part 7, Lower Mississippi River basin
Geological Survey, Reston, VA.

During the water year ending September 30, 1969, the geological survey maintained 259 stations on 156 streams in the Lower Mississippi River basin for the study of chemical and physical characteristics of surface water. Samples were collected daily and monthly at 235 of these locations for chemical-quality studies. Samples also were collected less frequently at many other points. Water temperatures were measured continuously at 28 and daily at 79 stations. Daily water temperatures were measured at most of the stations at the time samples were collected for chemical quality or sediment content. So far as practicable, the water temperatures were taken at about the same time each day. Quantities of suspended sediment are reported for 19 stations. Sediment samples were collected once or more times daily at most stations, depending on the rate of flow and changes in stage of the stream. Particle-size distributions of sediments were determined at 19 stations. The stream discharge reported for each composite sample is usually the average of daily mean discharges for the composite period. The discharges reported in the tables of single analyses are either daily mean discharges or discharges obtained at the time samples were collected and computed from a stage-discharge relation or from a discharge measurement. (Woodard-USGS)
QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1970: PART 7. LOWER MISSISSIPPI RIVER BASIN


Available from the National Technical Information Service, Springfield, VA 22161.

Water resources data for Arkansas consist of records of stage, discharge, and water quality of streams; and stage, contents, and water quality of lakes and reservoirs. Additional water data were collected and placed in the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Arkansas.

(USGS)
Journal Announcement: SWRA1212

Surface-water and ground-water data were compiled for the parts of the Colorado River and the White River basins in and adjacent to the Grand hogback coal field. The data were evaluated to assess the quantity and quality of water resources available in the area for use in hydraulic coal mining, based on discharge records, surface-water supplies of most streams should be adequate to meet the demands for hydraulic mining of 1 million tons of coal per year with a recycled water system. However, on some of the smaller streams in the area, some storage of water may be required for use during low-flow periods to meet downstream reaches. Other potential sources of water include Rifle Gap Reservoir, Harvey Gap Reservoir, and ground water from valley fill deposits along major streams and rivers. Surface water and ground water should be of adequate quality for use in hydraulic mining, with the possible exceptions of suspended-sediment concentrations that periodically may be as much as 18,800 milligrams per liter in streams near River Creek drainage, and dissolved-solids concentrations greater than 20,000 milligrams per liter in some aquifers. Data are insufficient to assess the potential impact of hydraulic coal mining on downstream water quality. (Woodard-USGS)


Journal Announcement: SWRA1214

Average annual suspended- and total-sediment loads in streamflow were determined by the flow-duration sediment-transport-curve method at 18 sites in the Yampa River basin, Colorado and Wyoming. These computations indicate that about 750,000 tons of sediments are carried by the Yampa River at Deerlodge Park during an average year. Significant areal differences in the sediment yield from various parts of the basin were determined. The lower Yampa River subbasin contributes about 60 percent of the total basin sediment yield, although it represents less than 35 percent of the area and supplies less than 3 percent of the streamflow. In contrast, the upland (eastern) one-third of the basin contributes only about 14 percent of the sediment yield but 76 percent of the streamflow. Projected economic development of the basin, especially surface mining of coal, will impact the physical environment. Depending upon the amount and location of land disturbed, an estimated 10,000 to 30,000 tons per year of additional annual suspended-sediment load will be contributed to the main-stem Yampa River. (Woodard-USGS)

MAP SHOWING AVAILABILITY OF HYDROLOGIC DATA PUBLISHED AS OF 1973 BY THE ISUS AND ENVIRONMENTAL DATA SERVICE AND BY THE U.S. GEOLOGICAL SURVEY AND COOPERATING AGENCIES, COLORADO SPRINGS-Castle Rock Area, Front Range Urban Corridor, Colorado. Available from the GSA, rests on, VA 22092, price $0.75. MISCELLANEOUS INVESTIGATIONS SERIES MAP 1-857-D, 1974. 1 SHEET, 1 MAP. 26 REF.

Journal Announcement: SWRA0902

This map shows by symbols and color the hydrologic data published as of January 1974 for the Colorado Springs-Castle Rock area, Colorado, area by the U.S. environmental data service and by the U.S. geological survey and cooperating agencies. All sources of the data are given in the references and are referred to in the discussion. Of the 44 climatological stations shown the longest precipitation records are for Fountain, Colorado, beginning in 1866. Colorado Springs precipitation records begin in 1871. Surface-water data include continuous records of stage and discharge of streams. Location of 16 surface-water data sites are shown. Included are 7.
CONTINUOUS-RECORD STREAM-STAGE AND DISCHARGE STATIONS, AND A STATE-WIDE STREAM DISCHARGE SITES, STREAMFLOW RECORDS WERE COLLECTED AS EARLY AS 1908. GROUNDWATER DATA SITES PLOTTED ON THE MAP REPRESENT 40 WELLS WHERE WATER LEVELS HAVE BEEN MEASURED PERIODICALLY FOR 4 OR MORE YEARS OR MONTHLY FOR AT LEAST 1 YEAR, AND 49 WELLS FROM WHICH WATER SAMPLES HAVE BEEN ANALYZED FOR DISSOLVED-CHEMICAL CONSTITUENTS. (WOODARD-USGS)

LAND-USE CLASSIFICATION MAP OF THE COLORADO SPRINGS--CASTLE ROCK AREA, FRONT RANGE URBAN CORRIDOR, COLORADO

BY L. J. DRISCOLL

GEOLOGICAL SURVEY, DENVER, COLO.

FOR SALE USGS, RESTON, VA., 22092, PRICE $1.75.

MISCELLANEOUS INVESTIGATIONS SERIES MAP I-857-B, 1975. 1 SHEET, 1 MAP, 2 REF., JOURNAL ANNOUNCEMENT: SWRA0924

THE FRONT RANGE URBAN CORRIDOR OF COLORADO, FROM FORT COLLINS ON THE NORTH THROUGH FOUNTAIN ON THE SOUTH, IS AN AREA OF RAPID POPULATION GROWTH AND EXPANDING LAND DEVELOPMENT. THIS MAP PROVIDES FOR THE COLORADO SPRINGS--CASTLE ROCK AREA THE FIRST STEP TOWARD COMPATIBLE LAND USES IN THE FUTURE--A COMPREHENSIVE PICTURE OF THE DISTRIBUTION OF DIFFERENT LAND CLASSES AND AN ILLUSION ABOUT THE PROPORTIONS OF VARIOUS USES. IF USED WITH MAPS SHOWNING RESOURCES, SOIL TYPES, GEOLOGY, WATER AVAILABILITY, TOPOGRAPHY, DEMOGRAPHY, AND OTHER ATTRIBUTES, THIS LAND-CLASSIFICATION MAP HELPS TO SET LIMITATIONS ON USE OF THE LAND. ONCE THE LIMITATIONS ARE KNOWN, ZONING CAN HELP ASSURE LAND USES THAT ARE COMPATIBLE WITH THE NATURAL ENVIRONMENT. EXAMPLE, THE ZONING OF FLOOD PLAINS FOR GREENBELL OR RECREATIONAL USE. (WOODARD-USGS)

Ground-water geology of parts of Laramie and Albany Counties Wyoming and Weld County, Colorado


Economic geology of Gilpin County and adjacent parts of Clear Creek and Boulder Counties, Colorado


Analysis of waste-load assimilative capacity of the Yampa River, Steamboat Springs to Hayden, Routt County, Colorado


Traveltime, unit-concentration, longitudinal-dispersion, and reaeration characteristics of upstream reaches of the Yampa and Little Snake Rivers, Colorado and Wyoming


Geology and coal resources of North Park, Colorado


WATER-LEVEL DECLINES AND GROUNDWATER QUALITY, UPPER BLACK SQUIRREL CREEK BASIN, COLORADO

Bingham, D. L., Klehn, J. M., GEOLOGICAL SURVEY, DENVER, COLO.

COLORADO WATER RESOURCES CIRCULAR 23, 1973. 21 P., 7 FIG., 2 PLATE, 3 TAB, 12 REF., JOURNAL ANNOUNCEMENT: SWRA0708


GROUNDWATER OCCURRENCE IN NORTHERN AND CENTRAL PARTS OF WESTERN COLORADO

Boettcher, A. J., GEOLOGICAL SURVEY, DENVER, COLO.

COLORADO WATER CONSERVATION BOARD WATER RESOURCES CIRCULAR NO 15, 1972. 15 P., 3 FIG., 6 PLATE, 7 TAB, 35 REF., JOURNAL ANNOUNCEMENT: SWRA0610

GROUNDWATER RESOURCES ARE DESCRIBED FOR A 29,000-SQUARE-MILE AREA IN WESTERN COLORADO. THE AREA INCLUDES ALL OR PARTS OF 15 COUNTIES AND IS DRAINED BY THE COLORADO, GUNNISON, WHITE, YAMPA, AND GREEN RIVERS. DATA SUMMARIES INCLUDE THE AVAILABILITY OF GROUNDWATER, THE CHEMICAL QUALITY OF GROUNDWATER, EXTENT OF CURRENT GROUNDWATER USE, AND PROBLEMS THAT ARE ASSOCIATED WITH MANAGING AND USING GROUNDWATER.
OTHER BASIC INFORMATION INCLUDES GEOLOGIC, LAND USE, SOILS, AND LAND STATUS (OWNERSHIP). MAPS. THE 35 REPORTS USED IN THE STUDY ARE SHOWN IN THE REFERENCES. GROUNDWATER SUPPLIES 18 OF THE 51 TOWNS IN THE AREA. FOUR TOWNS ARE SUPPLIED BY GROUND AND SURFACE WATER, AND 29 USE SURFACE WATER. ABOUT 28% OR 6.9 MGD OF THE 25 MGD WATER USED BY TOWNS IN 1970 WAS FROM WELLS AND SPRINGS, WHEREAS 72% OR 18.1 MGD WAS FROM STREAMS. GROUNDWATER IS WELL SUITTED FOR DOMESTIC SUPPLIES BECAUSE WELL SYSTEMS ARE CHEAPER AND MORE SANITARY THAN MOST SMALL SURFACE-WATER SYSTEMS. DESPITE NATCHI WIDESPREAD USE OF GROUNDWATER, ONLY 161 OF THE MORE THAN 4,000 WATER WELLS ARE REPORTED TO YIELD MORE THAN 100 GPM. (WOODARD-USGS)

SALT-LOAD COMPUTATIONS--COLORADO RIVER; CAMCO, COLORADO, TO CISCO, UTAH. CONSISTS OF REGRESSION CURVES OF DISCHARGE VERSUS SPECIFIC CONDUCTANCE AND SPECIFIC CONDUCTANCE VERSUS CALCIUM, MAGNESIUM, HARDNESS, SODIUM, BICARBONATE, CHLORIDE, DISSOLVED SOLIDS, AND SULFATE; DURATION TABLES OF DAILY SPECIFIC CONDUCTANCE AT SIX STREAM-GAGING STATIONS; AND DAILY SPECIFIC-CONDUCTANCE DATA FOR THE PERIOD OF RECORD FOR ALL STATIONS IN THE STUDY AREA, LOCATION OF STREAMFLOW AND WATER-QUALITY STATIONS ARE SHOWN ON A MAP. (SEE ALSO W76-10142) (WOODARD-USGS)

SALT-LOAD COMPUTATIONS--COLORADO RIVER; CAMCO, COLORADO, TO CISCO, UTAH. CONSISTS OF REGRESSION CURVES OF DISCHARGE VERSUS SPECIFIC CONDUCTANCE AND SPECIFIC CONDUCTANCE VERSUS CALCIUM, MAGNESIUM, HARDNESS, SODIUM, BICARBONATE, CHLORIDE, DISSOLVED SOLIDS, AND SULFATE; DURATION TABLES OF DAILY SPECIFIC CONDUCTANCE AT SIX STREAM-GAGING STATIONS; AND DAILY SPECIFIC-CONDUCTANCE DATA FOR THE PERIOD OF RECORD FOR ALL STATIONS IN THE STUDY AREA, LOCATION OF STREAMFLOW AND WATER-QUALITY STATIONS ARE SHOWN ON A MAP. (SEE ALSO W76-10142) (WOODARD-USGS)

Availability and Chemical Characteristics of Ground Water in Central La Plata County, Colorado


The central part of La Plata County, Colo., has undergone rapid population growth in recent years. This growth has resulted in an increased demand for information on additional domestic, industrial, and municipal water supplies. A knowledge of the occurrence of ground water will permit a more efficient allocation of the resource. Aquifers in central La Plata County include alluvium, Anima Formation of Oligocene and Tertiary age, Fruitland Formation, Pictured Cliffs Sandstone, three formations of the Mesa Verde Group, the Mancos Shale, and Piceance Sandstone. Members of the Jurassic age, and undifferentiated formations. Well yields generally are low usually less than 25 gallons per minute. However, higher yields, 25 to 50 gallons per minute may be found locally in aquifers in the alluvium and the Anima Formation.


Journal Announcement: SWRA1107
The quality of water from the aquifers is dependent on rock type. Most of the water is a calcium bicarbonate type. However, aquifers that are predominantly fine-grained or contain interbeds of shale may contain sodium bicarbonate type water. The dissolution of minerals in the coal beds, which are present in the Mesaverde Group and the Dakota Sandstone, can contribute high concentrations of iron, sulfate, and chloride to ground water. (Woodard-USGS)

Reconnaissance of Ground-Water Resources in a Part of the Yampa River Basin between Craig and Steamboat Springs, Moffat and Routt Counties, Colorado

Brogden, R. E.; Giles, T. F.


Water-Resources Investigations 77-4 (open-file report), May 1977, 1 sheet 2 tabs 7 ref., Journal Announcement: SWAK-1103

Parts of the Yampa River basin near the towns of Steamboat Springs and Craig, Colorado, have undergone rapid, population growth in recent years. Fort Union, Lance, Williams Fork, and Iles Formations, and the Lewis and Mancos Shales. Well yields are generally less than 25 gpm (gallons per minute). In the alluvium of the Yampa River, well yields may be as much as 900 gpm. Where the sandstones of the Williams Fork and Iles Formations are fractured, well yields have been reported to be as much as 100 gpm. Well yields from the Lewis and Mancos Shales are less than 5 gpm. The quality of the ground water is variable and dependent on rock type. Most of the waters are calcium and sodium bicarbonate types. Calcium sulfate type waters are found where water has been in contact with gypsum, organic materials, or coals. Dissolved-solids concentrations of ground water range from as little as 82 to as much as 4,230 milligrams per liter. (Woodard-USGS)

Availability and Quality of Groundwater, Southern Ute Indian Reservation, Southwestern Colorado


Poor aquifers and the potential development of subsurface mineral resources have increased the need for good quality groundwater on the Southern Ute Indian Reservation in southwestern Colorado. A study was conducted during 1974-76 to assess the groundwater resources of the Shale, Mesaverde Group, Lewis Shale, Pictued Cliffs Sandstone, Fruitland formation, Kirtland Shale, Animas and San Jose formations, and terrace and flood-plain deposits. Well yields from the sandstone and shale aquifers are water quality in aquifers depends in part on rock type. Water from sandstone, terrace, and flood-plain aquifers is predominantly a calcium bicarbonate type, whereas water from shale aquifers is predominantly a sodium bicarbonate type. Water from rocks containing interbeds of coal or carbonaceous shales may be either a calcium or sodium sulfate type. Dissolved-solids concentrations of groundwater range from 115 to 7,130 water from terrace and flood-plain aquifers is the least mineralized. In many water samples collected from bedrock, terrace, and flood-plain aquifers, the concentrations of arsenic, chloride, dissolved solids, fluoride, iron, manganese, nitrate, sodium, sulfate, and fluoride exceeded U.S. Public Health Service (1962) recommended limits for drinking water. Selenium in the ground water in excess of the recommended limit of 10 micrograms per liter for drinking water occurs throughout the reservation but principally in the central part. (USGS)

GEOLOGY OF THE PIECANCE CREEK STRUCTURAL BASALN BETWEEN THE WHITE AND COLORADO RIVERS, NORTHWESTERN COLORADO

COFFIN, D. L.; WELDER, F. A.; GLANZMAN, R. K.

GEOLOGICAL SURVEY, WASHINGTON, D.C.


This Atlas describes the availability, occurrence and chemical properties of the water resources for part of the Piceance Creek structural basin in Northwestern Colorado. The area is between the White and Colorado Rivers and contains about 1,600 square miles in parts of Rio Blanco, Garfield, and Mesa counties. The Piceance Creek basin contains some of the richest oil shale deposits in North America. These deposits represent a huge potential source of petroleum and efforts are currently being made to develop the resource. Some of the problems associated with the mining and retorting of oil shale are: removal of water from mines, supplying water for mining and retorting operations, supplying additional domestic water for an increase in population, effect of mining operations on present users of groundwater and surface water, and water-quality problems created by mining operations. Surface-water supplies in the basin are small and are completely developed. Pumping large quantities of groundwater from either the alluvium or from the leached zone of the Green River formation would have adverse effects on present surface supplies. (Woodard-USGS)

MAP SHOWING POTENTIAL SOURCES OF GRAVEL AND CRUSHED-ROCK AGGREGATE IN THE BOULDER-FORT COLLINS-GREELEY AREA, FRONT RANGE
HYDRAULIC TESTING AND SAMPLING OF USBM-AEC COLORADO CORE HOLE 3 IN RIO BLANCO COUNTY, COLORADO. THIS HOLE WAS DRILLED TO EXPLORE THE SITE FOR PROJECT BRONCO. A FLOWSHARE EXPERIMENT TO STUDY THE STABILITY OF IN SITU FRACTURING OF OIL SHALE AFTER BREAKING THE ROCK WITH A NUCLEAR EXPLOSION. THE HYDRAULIC TESTS INDICATE THE EXISTENCE OF A HIGHLY PERMEABLE WATER-BEARING ZONE IN THE UPPER AND MIDDLE PARTS OF THE PROJECT AREA. UNDER THE GREAT RIVER FORMATION. THE ZONES YIELDED WATER IN EXCESS OF 2,700 CUBIC METERS PER DAY. NATURAL GROUNDWATER CIRCULATION DISSOLVED THE SALT DEPOSITS FROM A PART OF THE OIL SHALE, LEAVING A HIGHLY PERMEABLE ZONE. UNDERLYING ROCKS ARE COMPARATIVELY IMPERMEABLE AND YIELDED LESS THAN 16 CUBIC METERS PER DAY OF HIGHLY SALINE FLUID, POTENTIAL FLOODING OF A RUBE 900N WALL. AN IMPORTANT CONSIDERATION FOR DREDGE TO THE SITE. THE MINIMUM FIGURE OF 20 PERCENT IS ESTIMATED TO BE THE LOWER LIMIT AT WHICH GRAVEL CAN BE ECONOMICALLY EXTRACTED FROM A DEPOSIT. LOWER QUALITY DEPOSITS HAVE BEEN WORKED IN AREAS WHERE MOUNTAIN DISTANCES ARE SHORT AND A MARKET FOR SAND EXISTS. (WOODARD-USGS)

Journal Announcement: SWRA1511

Quality of Ground Water in Routt County, Northwestern Colorado
Covay, K. J.; Tobin, R. L.

Journal Announcement: SWRA1511

Chemical and bacteriological data were collected to describe the quality of water from selected geologic units in Routt County, Colo. Calcium carbonate was the dominant water-chemistry type; magnesium, sodium, and sulfate limited occurrence as codominant ions. Specific conductance was frequently greatest in waters from the older sedimentary rocks of the airplane formation, the saucer shale, the mesaverde group, and the mancos shale. Least in the ground waters from the alluvial deposits, the brown park formation, and the basement complex. Correlations of specific conductance with dissolved solids and specific conductance with hardness were found, with specific conductation ranges. On the basis of the data for water-quality analysis, water from the alluvial deposits, the brown park formation, and the basement complex generally is not suitable for domestic uses. Chemical constituents in water from wells or springs exceeded State and Federal standards for public-water supplies or State criteria for agricultural uses were pH, arsenic, boron, fluoride, manganese, nitrate plus nitrite, selenium, and dissolved solids. Total-coliiform bacteria were detected in water from 29 sites and fecal-coliiform bacteria were detected in water from 6 of the 29 sites. (USGS)

Utilization of MULL (FOREST HUMUS LAYER) IN GEOCHEMICAL EXPLORATION IN THE EMPIRE DISTRICT, CLEAR CREEK COUNTY, COLORADO

HYDRAULIC TESTING AND SAMPLING OF USBM-AEC COLORADO CORE HOLE 3 IN RIO BLANCO COUNTY, COLORADO. THIS HOLE WAS DRILLED TO EXPLORE THE SITE FOR PROJECT BRONCO. A FLOWSHARE EXPERIMENT TO STUDY THE STABILITY OF IN SITU FRACTURING OF OIL SHALE AFTER BREAKING THE ROCK WITH A NUCLEAR EXPLOSION. THE HYDRAULIC TESTS INDICATE THE EXISTENCE OF A HIGHLY PERMEABLE WATER-BEARING ZONE IN THE UPPER AND MIDDLE PARTS OF THE PROJECT AREA. UNDER THE GREAT RIVER FORMATION. THE ZONES YIELDED WATER IN EXCESS OF 2,700 CUBIC METERS PER DAY. NATURAL GROUNDWATER CIRCULATION DISSOLVED THE SALT DEPOSITS FROM A PART OF THE OIL SHALE, LEAVING A HIGHLY PERMEABLE ZONE. UNDERLYING ROCKS ARE COMPARATIVELY IMPERMEABLE AND YIELDED LESS THAN 16 CUBIC METERS PER DAY OF HIGHLY SALINE FLUID, POTENTIAL FLOODING OF A RUBE 900N WALL. AN IMPORTANT CONSIDERATION FOR DREDGE TO THE SITE. THE MINIMUM FIGURE OF 20 PERCENT IS ESTIMATED TO BE THE LOWER LIMIT AT WHICH GRAVEL CAN BE ECONOMICALLY EXTRACTED FROM A DEPOSIT. LOWER QUALITY DEPOSITS HAVE BEEN WORKED IN AREAS WHERE MOUNTAIN DISTANCES ARE SHORT AND A MARKET FOR SAND EXISTS. (WOODARD-USGS)

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Utilization of MULL (FOREST HUMUS LAYER) IN GEOCHEMICAL EXPLORATION IN THE EMPIRE DISTRICT, CLEAR CREEK COUNTY, COLORADO
Preliminary results of 1978 coal exploratory drilling in the Trinidad-Raton coal region, Las Animas County, Colorado.

Danilchik, Walter, 1978


Geologic and coal outcrop map of the Madrid quadrangle, Las Animas County, Colorado.

Danilchik, Walter, 1979a


Geologic and coal outcrop map of the Weston quadrangle, Las Animas County, Colorado.

Danilchik, Walter, 1979b


Effects of Effluents from a Coal-Fired, Electric-Generating Powerplant on Local Ground Water Near Hayden, Colorado

Ellis, N. J. and Mann, P. G.


Preliminary report on the geology of the Coalmont district, Jackson County, Colorado.

Erdmann, C. E., 1961


Giles, T. M.


Available from the OFS's USGS Box 25425, Fed. Ctr., Denver,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 899. Price codes: A03 in paper copy, A01 in microfiche. Information was collected in the Gunnison-Crested Butte area, Colo. to determine the availability and chemical quality of groundwater. Parts of the area have undergone rapid population growth in recent years due to an increase of winter sports activities. This rapid growth has resulted in a demand for additional domestic, recreational, and municipal water supplies. Maximum yields of 100 gallons per minute are available from wells completed in the alluvial aquifers while as much as 60 gallons per minute may be obtained from wells completed in the Dakota and Entrada Sandstones. Yields from other aquifers generally are less than 25 gallons per minute. Calcium magnesium bicarbonate water is the predominant water type in the study area. Dissolved solids concentrations ranged from 30 to 829 milligrams per liter and hardness ranged from 18 to 400 milligrams per liter. (USGS)

Selected Hydrologic Data, Yampa River Basin and Parts of the White River Basin, Northwestern Colorado and South-Central Wyoming

Available from the OFS Branch of Distribution, USGS, Box 25425 Fed. Ctr., Denver, Colo. 80225, Open-file report 78-23, January 1978. 91 p. 1 fig, 2 plates, 5 tabs, 7 ref., Journal Announcement: SWRA120 Selected hydrologic data are presented from four energy-related projects conducted by the U.S. Geological Survey in the Yampa River basin and parts of the White River basin in northwestern Colorado and south-central Wyoming. Water-quality data during 1974 and 1975 and parts of 1976 for 129 ground-water sites and 119 surface-water sites are tabulated. For most samples, major cations, anions, and trace metals were analyzed. For the same time periods, field measurements of specific conductance, temperature, and pH were made on 252 springs and wells. These sampling sites, as well as the locations of 20 climatological stations, 18 snow-course sites, and 43 surface-water gaging stations, are shown on maps. Geologic units that contain coal deposits or supply much of the water used for stock and domestic purposes in the area also are shown on a map. (Woodard-USGS)

The Carboniferous formations and tuffs of Colorado

Available and Quality of Ground Water in the Lake George Area, Southeastern Park County, Colorado

Colorado Springs coal field, Colorado, J.B. Campbell; Marius R., geologist in charge, Contributions to economic geology, 1908. Part II- Mineral Fuels

Goldman, Marcus L. 1910


Geologic Survey, Denver, CO, Water Resources Div. Geological Survey Open-File Report 79-700, 1979. 17 p, 2 fig, 2 table, 5 ref., Journal Announcement: SWRA1415 Data showing results of 38 groundwater and 25 surface-water samples analyzed for hexavalent chromium are presented. Most samples were taken within the Telluride, Colo. city limits during October 1978. Twenty-four of the 38 groundwater samples (63%) contained more than 50 micrograms per liter of hexavalent chromium. Excluding the mill tailings pond, 6 of the 23 surface-water samples (26%) contained more than 50 micrograms per liter of hexavalent chromium. Hexavalent chromium concentrations in groundwaters ranged from 0 to 2700 micrograms per liter and in surface waters from 0 to 160 micrograms per liter. (USGS)
Hydrologic data collected during 1975-77 as part of a comprehensive water-resources investigation of Boulder County, Colorado, by the U.S. Geological Survey in cooperation with the Boulder County Health Department and the Colorado Geological Survey are presented in this report. The data, in tabular and graphic form, consist of water-quality analyses of selected constituents and geohydrologic-site, water-treatment, and sewage-treatment data for 609 wells and 48 springs; water-quality analyses for 1/2 of the wells and 9 of the springs; water-quality analyses of streamflow at five sites; specific conductance and water-temperature measurements of streamflow from 3 sites. State and local officials in Boulder County may find these data useful in planning for residential, commercial, and industrial development.

Hydrologic Data from Upper Grange Hall Creek Basin, Northglenn, Adams County, Colorado


Journal Announcement: SWRA1311

Hydrologic data collected during 1977-79 as part of a water-resources investigation of storm runoff in Upper Grange Hall Creek basin, Adams County, Colorado, are presented in this report. Data presented in tabular form consist of: (1) estimated daily precipitation at one site (April through October, 1976 and 1979); (2) mean daily streamflow at two sites (December 1977 through September 1979); (3) instantaneous streamflow at two sites along Grange Hall Creek and corresponding cumulative rainfall at one to three sites for 17 storms (April 7, 1976 to August 26, 1979); (4) concentrations of selected major ions, fecal-coliform bacteria, suspended sediment, nutrients, and trace elements at five sites during dry-weather flow, at three sites during runoff, and at five sites during snowmelt runoff; and (5) concentrations of pesticides and polychlorinated biphenyls at two sites during dry-weather flow and rainfall runoff. (USGS)

Water Resources of Boulder County, Colorado

Available from USGS, 1515 Sherman St., Denver, CO 80202. Price: $8.00 in paper copy. Colorado Department of Natural Resources Bulletin 42, 1980, 19 p. Fig. 1 Plate. 2 Tab. 36 Ref.

Journal Announcement: SWRA1407

Surface water is abundant in Boulder County, Colorado, because large amounts of precipitation fall in the higher mountains and this precipitation feeds the streams directly or indirectly throughout the year. Ground water is an important source of water mostly for domestic, stock, or limited- acreage irrigation needs. The most frequently used aquifers are flood plain, terrace, Laramie- Fox Hill, Pierre- Niobrara-Benton, and crystalline rock. Median well yields of 15 or more gallons per minute occur for the flood plain, terrace, and Laramie- Fox Hill aquifers. The quality of the surf ace water is best at higher altitudes and decreases as the streams flow easterly to the plains and leave the county. The chemical quality in the ground water is identified through geohydrology and the activities of man such as mining, farming, and sewage disposal. Many sources of water examined failed to meet Colorado Department of Health water-quality standards for raw drinking-water use, for agricultural use, and for aquatic life. Chemical quality of the ground water, particularly dissolved solids, is better in water from the unconsolidated and crystalline rock aquifers in the mountains and decreases in the aquifers on the plains. Factors involved in the decrease of quality are the geohydrology and the quality of associated surface water. Local contamination of ground water by subsurface wastewater disposal is a frequent problem. (USGS)

MAP SHOWING AVAILABILITY OF HYDROLOGIC DATA PUBLISHED BY THE U.S. ENVIRONMENTAL DATA SERVICE, AND BY THE U.S. GEOLOGICAL SURVEY AND COOPERATING AGENCIES, GREATER DENVER AREA FRONT RANGE URBAN CORRIDOR, COLORADO

HAMPSON, E. R. GEOLOGICAL SURVEY, DENVER, COLO. FOR SALE BY USGS, RESTON, VA. 22092. $125. MISCELLANEOUS INVESTIGATIONS SERIES MAP 1-856-C, 1975, 1 SHEET. 1 MAP, 41 REF.

Journal Announcement: SWRA926

THIS MAP SHOWS TYPES AND LOCATIONS OF THE HYDROLOGIC DATA PUBLISHED DURING JANUARY 1974 FOR THE GREATER DENVER AREA FRONT RANGE URBAN CORRIDOR, COLORADO. THE DATA ARE GIVEN IN BOTH THE DISCUSSION AND THE REFERENCE. CLIMATOLOGICAL DATA INCLUDE RECORDS OF PRECIPITATION, TEMPERATURE, AND EVAPORATION. SURFACE-WATER DATA INCLUDE CONTINUOUS RECORD OF STAGE AND DISCHARGE OF STREAMS; CREST-STAGE AND LOW-FLOW DISCHARGE OF STREAMS; CHEMICAL QUALITY OF STREAMS, LAKES, AND RESERVOIRS; SEDIMENT LOAD OF STREAMS; AND STAGE OF RESERVOIRS. LOCATIONS OF 46 SURFACE-WATER
Coal resources of Trinidad-Aquifer area, Las Animas and Huerfano Counties, Colorado.
Harbour, R. L., and Dixon, G. H., 1959

General geology and petrology of the Pre-Cambrian crystalline rocks, Park and Jefferson Counties, Colorado.
Hawley, C., and Wobus, R. A., 1977

Mining in Colorado - A history of discovery, development, and production, by C. W. Henderson
Henderson, C. W., 1926

Water-Resources Investigations of the U.S. Geological Survey in Colorado-Fiscal Year 1979
Hillier, D. E.
Geological Survey open-file report 79-402, March 1979, 101 p. (fig. 1 plater 1 tab.)
Journal Announcement: SWRA1217

Water-resources data-collection activities for October 1, 1978, through September 30, 1979, are summarized for Colorado and bordering States. Forty-nine interpretive hydrologic investigations include 6 statewide investigations, 5 regional investigations, 10 investigations in the Missouri River basin, 8 investigations in the Arkansas River basin, 3 investigations in the Rio Grande basin, 15 investigations in the Colorado River basin, and 2 multistate investigations. The summaries of the investigations consist of maps showing the location of the areas of investigations and a brief description of the investigation's purpose, objective, approach, progress, and plans. (Woodard-USGS)

Well Yields and Chemical Quality of Water From Water-Table Aquifers in the Colorado Springs--Castle Rock Area, Front Range Urban Corridor, Colorado
Hillier, D. E., and Hutchinson, E. C.

Journal Announcement: SWRA1321

Industrial, irrigation, and public-supply wells are completed in unconsolidated alluvial deposits and the Dawson aquifer, the principal water-table aquifers in the area, have measured and reported yields ranging from less than 100 to 1,000 gallons per minute. Most wells yielding more than 500 gallons per minute are located in the Colorado Springs area and are completed in unconsolidated alluvial deposits. The maximum reported yields from the Dawson aquifer are 500 gallons per minute. Most of the principal water-table aquifers yield water containing dissolved solids concentrations less than 500 milligrams per liter. Water containing more than 500 milligrams per liter of dissolved solids occurs principally in the Colorado Springs area, and water containing more than 500 milligrams per liter of dissolved solids generally is suitable for all uses associated with urban development. The potential uses for urban development decrease as dissolved solids concentrations in the water increase. (USGS)

Well Yields and Chemical Quality of Water From Water-Table Aquifers in the Colorado Springs--Castle Rock Area, Front Range Urban Corridor, Colorado
Hillier, D. E., and Hutchinson, E. C.

Journal Announcement: SWRA1321

Industrial, irrigation, and public-supply wells are completed in unconsolidated alluvial deposits and the Dawson aquifer, the principal water-table aquifers in the area, have measured and reported yields ranging from less than 100 to 1,000 gallons per minute. Most wells yielding more than 500 gallons per minute are located in the Colorado Springs area and are completed in unconsolidated alluvial deposits. The maximum reported yields from the Dawson aquifer are 500 gallons per minute. Most of the principal water-table aquifers yield water containing dissolved solids concentrations less than 500 milligrams per liter. Water containing more than 500 milligrams per liter of dissolved solids occurs principally in the Colorado Springs area, and water containing more than 500 milligrams per liter of dissolved solids generally is suitable for all uses associated with urban development. The potential uses for urban development decrease as dissolved solids concentrations in the water increase. (USGS)
the environment and on the use of water. It is a useful technique of river-quality assessment for basins wherein substantial economic growth is either occurring or expected. Residuals management techniques were utilized to assess the effects of coal development and utilization in the Colorado River basin. These models were used to describe the material and energy balances and the operating costs of surface mining of coal, the Synthane process of coal gasification, coal-fired thermal-electric generation of power transportation of coal by slurry pipeline, and transportation by unit train. As part of the model of electric power generation, four alternative methods of cooling-heat considered: once-through cooling, cooling ponds, wet cooling towers, and dry cooling towers. Each of these models provides estimates of water withdrawal, water consumption, and residuals generated directly by the process. The process the total growth of the regional economy under four coal-development scenarios. The amount of coal assumed to be mined is constant across all of these, but each of them assumes a different use of the new coal: gasification, electric power generation, coal-slurry pipeline export, or model to provide estimates of total (direct and indirect) water use and residuals generation in the regional economy under the four scenarios. (See also WRD-03600, Humphreys-ISSW)

Residuals Management: A Tool in River-Quality Assessment Applied to Coal Development in the Yampa River Basin, Colorado

Hirsch, R. M.; James, J. C.; Schoemer, J. E.

Geological Survey, Reston, VA


Journal Announcement: SWA1311

Residuals management provides a basis for projecting the effects of economic development on the discharge of residuals to streams affecting rivers and lakes, and developing effective management plans. The results of this work can help determine the maximum loading of pollutants consistent with environmental standards and the economic and energy requirements of the process. (Woodard-USGS)

Water Resources Investigations of the U.S. Geological Survey in Colorado--Fiscal Year 1977

Hillel, D. E. J.; Weeks, J. U.


Open-file report 77-532, June 1977, 88 p., 30 fig., 1 plate, 1 tab.

Journal Announcement: SWA1105

Current water-resources data-collection activities in Colorado are summarized for the 1977 fiscal year. The locations of long-term data-collection stations are shown on a map of the State. Forty-three interpretive hydrologic investigations are summarized: 6 statewide investigations, 6 regional investigations, 11 investigations in the Missouri River basin, 5 investigations in the Arkansas River basin, 2 investigations in the Rio Grande basin, and 13 investigations in the Colorado River basin. The summaries of the investigations consist of a map showing the location of the area of the investigation and a brief description of the investigation's purpose, objective, scope, progress, and plans. (Woodard-USGS)
Selected Hydrologic Data, Uinta Basin Area, Utah and Colorado.

The Uinta basin area in northeastern Utah and northwestern Colorado covers an area slightly more than 10,000 sq mi. More than 95 percent of the basin is in Utah, thus most of the data in this report apply to that state. This area is watered from available records of water wells, springs, petroleum test wells, and streams. Included are well logs, laboratory analysis of data, and maps showing the locations of sampling sites. Many of the samples contained arsenic, chloride, dissolved solids, fluorspar, magnesium, and sulfate. The samples were analyzed for nitrogen, selenium, and sulfate in drinking water established by the Colorado Department of Health and U.S. Public Health Service.

Journal Announcement: SWA1017

Water-Resources Investigations 77-7 (open-file report), January 1977. 31 p. 9 fig, 6 plates, 7 tabs, 13 ref.

Ground water is a source of municipal, domestic, stock, and irrigation supply for most of northeastern Larimer County. A study of the alluvial aquifers in the northeastern part of the county was conducted to determine volume of water in storage, rate and location of ground-water withdrawals, and chemical quality of the water with particular attention to dissolved solids, hardness, sulfate, and selenium.

Journal Announcement: SWA1102


There are 251 large-capacity wells in the study area. Well yields range from about 80 gpm (gallons per minute) to a little over 1,800 gpm. Total volume of water in storage is about 133,000 acre-feet = 32,000 acre-feet in the alluvium of Buckeye terrace and 101,000 acre-feet in the valley fill aquifer associated with Boxelder Creek. Ground-water withdrawals for irrigation and municipal supplies amount to 54,000 acre-feet annually. The municipal wells pumped 210 acre-feet in 1974. The factors affecting ground-water quality are the quality of applied irrigation water, the amount of water lost to evapotranspiration during irrigation, and to a lesser degree, the solution of soluble material in the alluvium and in the bedrock at the base of the alluvium. Ground water at dissolved solids, pH, and some anions and cations of water, as well as radionuclides, are presented in two tables. Data in the tables are key by numbers to maps showing the locations of sampling sites. Many of the samples contained arsenic, chloride, dissolved solids, fluoride, magnesium, iron, manganese, and sulfate.
compiled during 1976-77. These data, consisting of records for 157 wells and 47 springs and chemical analyses of water for 135 of the wells and all 47 springs, are presented in tabular form. The tables contain data that were collected during the investigations, data compiled from reports published by the Colorado Water Conservation Board and unpublished data from the files of the U.S. Geological Survey, State and local officials in the Colorado Springs-Castle Rock area may find these data useful in planning for residential, commercial, and industrial development. (Woodward-USGS)


RECONNAISSANCE INVESTIGATION OF GROUND WATER IN THE RIO GRANDE DRAINAGE BASIN—WITH SPECIAL EMPHASIS ON SALINE GROUND-WATER RESOURCES. Kelly, T. E. GEOLOGICAL SURVEY, ELSTON, VA. FOR SALE BY USGS. 1200 S. RAD ST, ARLINGTON, VA. $2.20 PER SET. HYDROLOGIC INVESTIGATIONS ATLAS HA-510, 1974. 4 SHEETS, 16 MAPS, 48 REF.

Journal Announcement: SWAUS-01.

The SURFACE-WATER RESOURCES OF THE RIO GRANDE DRAINAGE BASIN, COLORADO, NEW MEXICO, AND TEXAS, ARE INSUFFICIENT TO MEET PRESENT NEEDS IN MOST OF THE BASIN. GROUNDWATER SUPPLIES HAVE BEEN EXTENSIVELY DEVELOPED FOR IRRIGATION AND FOR MUNICIPAL PURPOSES. IN AREAS OF heavy GROUNDWATER USE, WITHDRAWALS OFTEN SUBSTANTIALLY EXCEED ANNUAL RECHARGE; THEREFORE THE GROUNDWATER IN STORAGE IS BEING DEPLETED STEADILy WITH ACCOMPANYING DETEORATION IN QUALITY. GROUNDWATER IN THE RIO GRANDE BASIN CAN BE DIVIDED INTO TWO MAJOR QUALITY TYPES: FRESHWATER WHICH GENERALLY IS NEAR THE SURFACE, AND THE MORE DEEPLY GZURED SALINE WATER. FRESHWATER IS PRESENT IN SIGNIFICANT QUANTITIES IN MOST OF THE RIO GRANDE BASIN IN COLORADO AND NEW MEXICO, AND IN PARTS OF WEST TEXAS. THE GREATEST THICKNESS OF THE FRESHWATER AQIFER IS PRESENT IN THE SAN LUIS STRUCTURAL BASIN OF COLORADO. THROUGHOUT THIS ENTIRE AREA, FRESHWATER OVERALL IS LESS THAN 12 FEET BELOW THE LAND SURFACE, THE MIDDLE BASIN AREA IS CHARACTERIZED BY WELL LITHIFIED PALEOZOIC ROCKS. LIMESTONE IS THE MAJOR LITHOLOGY THROUGHOUT OF THIS AREA. FRESHWATER IS PRESENT IN THE THIN ALLUVIAL DEPOSITS OF THE RIVER VALLEYS; IN OTHER AQIFERS THE WATER DEGREES IN QUALITY FROM SLIGHTLY SALINE TO BRINE. THE LOWER BASIN REGION IS SIMILAR TO THE MIDDLE BASINS, BUT THE ROCKS GENERALLY ARE MESOZOIC IN AGE AND THE GROUNDWATER IS LESS HIGHLY MINERALIZED. THE MAJOR AQIFERS IN THE REGION ARE LIMESTONE AND MARL OF CRETACEOUS AGE WHICH GENERALLY YIELD FRESHWATER TO WELLS AT SHALLOW (KNAPP-USGS).


Journal Announcement: SWA6102.

Statistical summaries of water-quality data are compiled for eight streams in two separate coal areas of Jackson County, Colo. The quality-of-water data were collected from October 1976 to September 1980. For inorganic constituents, the
maximum, minimum, and mean concentrations, as well as other statistics are presented; for minor elements, only the maximum, minimum, and mean values are included. Least-squares equations (regressions) are also given relating specific conductance of the streams to the concentration of the major ions. The observed range of specific conductance was 85 to 1,150 microhmhos per centimeter for the eight sites. (USGS)

Coal resources of Colorado; tabulated by bed; Landsis, E. R., and Cone, G. C., 1971

Coal resources of Colorado Landsis, E. R., 1959

CHEMICAL AND RADIOCHEMICAL ANALYSES OF WATER FROM STREAMS, RESERVOIRS, WELLS, AND SPRINGS IN THE RULISON PROJECT AREA, GARFIELD AND MESA COUNTIES, COLORADO
Larson, J., D.J. Belcher, W. A.
GEOLICAL SURVEY, DENVER, COLO.
GEOLICAL SURVEY OPEN-FILE REPORT, JAN 1970, 16 P, 2 FIG, 6 TAB, 6 REF, CONTRACT NO AT(29-2)-474 USACE.

JOURNAL ARTICLES
WELLS WERE INVENTORIED AND SAMPLED, AND A NETWORK OF 21 SURFACE-WATER SAMPLING STATIONS WAS ESTABLISHED IN THE RULISON AREA, COLORADO, TO DETERMINE CHANGES IN TRITIUM CONTENT AND WATER CHEMISTRY ATTRIBUTABLE TO THE RULISON PROJECT. AN EXPERIMENT IN STIMULATING NATURAL GAS PRODUCTION BY A NUCLEAR EXPLOSION, LOCATIONS OF THE SAMPLING SITES, PRE-EXPLOSION CHEMICAL ANALYSES OF SURFACE WATERS AND GROUNDWATERS, WELL RECORDS, CISTERN RECORDS, AND SPRING RECORDS ARE TABULATED. (KNAPP-USGS)

APPRaisal OF THE WATER RESOURCES OF NORTHWESTERN EL PASO COUNTY, COLORADO
Livingston, R. K.; Bingham, D. L.; Klein, J. M.
Colorado Water Conservation Board, Denver, Colorado Water Resources Circular No 32, 1976, 85 p, 53 fig, 4 tab, 7 append, 4 JOURNAL ANNOUNCEMENTS SWRA-005B
The rate of population growth in El Paso County, Colo., has been one of the fastest in the United States. Continued rapid population growth has been accompanied by a similar growth in demand for industrial and municipal water. The largest municipality in the county, Colorado Springs, imports more than one-half of its water from sources outside the county. Estimated water budgets for four drainage areas indicate that precipitation and evapotranspiration account for 82 to 100 percent of the water entering and leaving each basin. The county is drained by tributaries of both the South Platte and Arkansas...
Rivers—the Arkansas River basin draining about 95 percent of the county, the dissolved-solids concentration of water in the streams of the county is inversely related to streamflow. The addition of sewage effluent deteriorates the water quality of Fountain Creek. The principal alluvial aquifers are in Fountain Creek and Jimmy Camp Creek valleys, which contain an estimated 350,000 acre-feet of water in storage. The principal bedrock aquifers, the Dawson Formation contains an estimated 38 million acre-feet of water in the upper 500 feet of saturated thickness. In most areas the dissolved-solids concentration of ground water from the Paso Group can be augmented primarily by future increased water imports from outside of the county and reuse of that water and by increased use of ground water. (Woodard-USGS)

Ground Water in the San Juan Basin, New Mexico and Colorado, by Lyford, F. P.


Principal aquifers in the San Juan basin of New Mexico and Colorado are the Entrada Sandstone, Westwater Canyon Member of the Morrison Formation, Gallup Sandstone of the Mesaverde Group, several sandstones in the Mesaverde Group, Gallup (Dalton Sandstone Member of the Cretaceous-Canyon Formation, Point Lookout Sandstone, Menefee Formation, Cliff House Sandstone), and sandstones of Tertiary age. Most of the water flows from topographically high outcrop areas toward the San Juan River and Rio Grande valley. Much of the water may move through confining layers to other aquifers or to the land surface rather than discharging directly to the streams. Transmissivities of the sandstones range from 50 to 500 square feet per day. Lowest dissolved-solids concentrations occur in or near outcrop areas of the sandstones and increase in the direction of groundwater flow. Concentrations range from less than 50 milligrams per liter to more than 30,000 milligrams per liter. (Kosco-USGS)

MAP SHOWING APPROXIMATE GROUNDWATER CONDITIONS IN THE PARKER QUADRANGLE, ARAPAHOE AND DOUGLAS COUNTIES, COLORADO

GEOLOGICAL SURVEY, WASHINGTON, D.C.

FOR SALE BY USGS, WASHINGTON, D.C. 20242, PRICE $0.75.

GEOLOGICAL SURVEY, MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP, M-1-770-K, 1972. 1 MAP, 5 REF.

JOURNAL ANNOUNCEMENT: SWRA-12413

A MAP (SCALE 1:24,000) OF THE PARKER QUADRANGLE, ARAPAHOE AND DOUGLAS COUNTIES, COLORADO, SHOWS APPROXIMATE GROUNDWATER CONDITIONS IN GROUNDWATER SYSTEMS IN THREE AQUIFER SYSTEMS: STREAM ALLUVIUM AND ALLUVIAL TERRACES, RELATIVELY SHALLOW BEDROCK, AND RELATIVELY DEEP BEDROCK UNITS. THE GREATEST AMOUNTS OF WATER AVAILABLE GROUNDWATER OCCUR IN THE SANDY GRAVEL ALLUVIAL FILL OF YORK CREEK AND UPLAND ALLUVIAL AND TERRACE DEPOSITS OF ITS MAJOR DISTRIBUTARIES. THE ALLUVIUM IS AS MUCH AS 150 FEET THICK AT YORK CREEK VALLEY. LARGE-CAPACITY WELLS PRODUCING FROM ALLUVIUM ALONG CHERRY CREEK YIELD FROM 900 TO 1,800 GPM AND AVERAGE ABOUT 1,200 GPM. MOST OF THESE WELLS ARE USED FOR MUNICIPAL WATER SUPPLIES. DISSOLVED SOLIDS IN WATER FROM THE ALLUVIUM RANGE FROM 200 TO 350 PPM. (WOODARD-USGS)

MAP SHOWING FLOOD-PRONE AREAS, COLORADO SPRINGS-CASTLE ROCK AREA, FRONT RANGE URBAN CORRIDOR, COLORADO

MCCAIN, J. F.; HITCHKISS, W. R.

GEOLOGICAL SURVEY, DENVER, COLO.

FOR SALE BY USGS, RESTON, VA 22090, PRICE $0.75.

MISCELLANEOUS INVESTIGATIONS SERIES MAP 1-857-C, 1975. 1 SHEET. 1 MAP, 9 REF.

JOURNAL ANNOUNCEMENT: SWRA-9902


MAP SHOWING FLOOD-PRONE AREAS, GREATER DENVER AREA, FRONT RANGE URBAN CORRIDOR, COLORADO

MCCAIN, J. F.; HITCHKISS, W. R.

GEOLOGICAL SURVEY, DENVER, COLO.

FOR SALE BY USGS, RESTON, VA 22092, PRICE $0.75.

MISCELLANEOUS INVESTIGATIONS SERIES MAP 1-850-D, 1975. 1 SHEET. 1 MAP, 21 REF.

JOURNAL ANNOUNCEMENT: SWA-9913

THE RAPID GROWTH OF POPULATION IN THE FRONT RANGE URBAN CORRIDOR OF COLORADO IS CAUSING INTENSE COMPETITION FOR AVAILABLE LAND RESOURCES. ONE FORM OF COMPETITION POSING SERIOUS PROBLEMS IS THE DEVELOPMENT ALONG FLOOD FLAINS ALONG CREEKS AND RIVERS. THIS MAP DEPICTS A HOBB-LATER VIEW OF FLOOD-PRONE AREAS ALONG PRINCIPAL STREAMS IN THE GREATER DENVER

Exploratory drilling in the Coalmont Coalfield, Jackson County, Colorado
Madden, D. H., 1977a

Exploratory drilling in the McCallie Coalfield
Madden, D. H., 1977b

THE EAGLE VALLEY EVAPORITE, NORTHWEST COLORADO--A REGIONAL SYNTHESIS
MALLORY, W. W., GEOLOGICAL SURVEY, WASHINGTON, D.C. BULLETIN 1311-E, 1971, 37 p., 8 FIG. 3 PLATE, 1 TAB., 31 REF.,
Journal Announcement: SWRAU423

The Eagle Valley Evaporite of Northwest Colorado consists principally of gypsum and anhydrite, but contains an appreciable quantity of halite and traces of potash salts. The enclosing rocks are conglomerate, sandstone, siltstone, shale, and limestone. The age of the formation is middle Pennsylvanian, late Atoka, and Des Moines. The thickness of the evaporite interval ranges from 9,000 feet in the vicinity of Eagle, Colorado, to zero at the northeastern edge of the Eagle basin, 25 miles away. In some areas flowage has increased original depositional thickness. Because of its pliability, the evaporite is deformed more than other rocks in its vicinity. It shows the effects of load metamorphism, laminar tilting, diapiric upwellings, and contortion due to flowage and hydration of anhydrite. The evaporite was deposited in a landlocked trough between the uncomparable and front range uplifts. Marine circulation and interchange of water were impeded on the open northwest end by a broad, shallow shelf, while exceptionally thick evaporite rocks were deposited at occasional torrential rain. Mineral commodities of possible future commercial value, contained in or associated with this formation, are gypsum, halite, salts of potassium, oil and gas. (WOODARD-USGS)

Coal of the Denver Basin, Colorado
Martin, G. C., 1973


THERMODYNAMIC CONSTRAINTS ON METAL SOLUBILITIES IN A STREAM AFFECTED BY MINE DRAINAGE, GOMANZA, COLORADO
MORAN, R. E.; WENTZ, D. A., GEOLOGICAL SURVEY, DENVER, COLO.
IN: WATER RESOURCES PROBLEMS RELATED TO MINING; AMERICAN WATER RESOURCES ASSOCIATION PROCEEDINGS SERIES NO. 18, P 54-64, JUNE 1974, 8 FIG., 1 TAB., 15 REF.,
Journal Announcement: SWRAU906

DRAINAGE FROM ABANDONED MINE MINES AND TAILING PILES HAS RESULTED IN ACID METAL-LIFEROUS SURFACE WATER IN THE VICINITY OF GOMANZA, COLO. MUCH OF THE STREAMBED IS COVERED WITH AMORPHOUS FEOH3 THAT CONTAINS SIGNIFICANT CONCENTRATIONS OF OTHER METALS. USING THERMODYNAMIC TECHNIQUES, IT WAS FOUND THAT SEVERAL COMPOUNDS OTHER THAN FEOH3 COULD BE PRECIPITATING. THESE COMPOUNDS INCLUDE Cu2(OH)2CO3, Cu3(OH)2(CO3)2, Cu5(OH)4Cl2, Cu4(OH)4SO4, Cu2(OH)3SO4, MnCO3, AND ZnSiO4. SOLUBILITY PRODUCTS WERE NOT EXCEEDED FOR ANY OF THE CADMIUM, LEAD, OR NICKEL COMPOUNDS CONSIDERED. (WOODARD-USGS)

Selecting Biological Characteristics of Streams in the Southeastern Uinta Basin, Utah and Colorado (Duplicated see Utah).
HATFIELD, R. W.; FULLER, P. H., GEOLOGICAL SURVEY, SALT LAKE CITY, UT, WATER RESOURCES DIV.
Geological Survey Open-File Report 81-664 (WRD), 1981, 38 p., 26 FIG., 4 TAB., 12 REF.,
Journal Announcement: SWRAU1512

HYDROLOGIC RECONNAISSANCE OF THE SOUTHERN UINTA BASIN, UTAH AND COLORADO. (Duplicated see Utah).
PRINGLE, D. J.; MILLER, L. L., GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH, DEPARTMENT OF NATURAL RESOURCES, SALT LAKE CITY, TECHNICAL PUBLICATION NO. 49, 1975, 66 p., 11 FIG., 3 PLATE, 15 TAB., 38 REF.,
Journal Announcement: SWRAU821

The Trinidad coal field, Colorado
RICHARDSON, G. B., 1970

Hydrogeochimistry and Simulated Solute Transport, Piceance Basin, Northwestern Colorado
ROBSON, S. G.; Saulnier Jr., G. J., 1970
Oil-shale mining activities in Piceance basin in northwestern Colorado could adversely affect the ground- and surface-water quality in the basin. This study of the hydrology and geochemistry of the area used groundwater solute-transport-modeling techniques to investigate the possible impact of the mines on water quality. Maps of the extent and structure of the aquifer were prepared and show that a saturated thickness of 2,000 feet occurs in the northeast part of the basin. Ground-water recharge in the upland areas in the east, south, and west parts of the basin moves down into deeper zones in the aquifer and laterally to the discharge areas along Piceance and Yellow Creeks. The saline zone and the unsaturated zone provide the majority of the dissolved solids found in the ground water. Precipitation, ion-exchange, and oxidation-reduction reactions are also occurring in the aquifer. Model simulations of groundwater pumpage in tracts C-a and C-b indicate that the altered direction of groundwater movement near the pumped mines will cause an improvement in groundwater quality near the mines and a degradation of water quality downgradient from the tracts. Model simulations of mine leaching in tract C-a and C-b indicate that equal rates of mine leaching in the tracts will produce much different effects on water quality in the basin. Tract C-a, by virtue of its remote location from perennial streams, will primarily degrade the groundwater quality over a large area to the northeast of the tract. Tract C-b, by contrast, will primarily degrade the surface-water quality in Piceance Creek, with only localized effects on the ground-water quality. (USGS)

Geological Structure, Hydrology, and Water Quality of the Laramie-Fox Hills Aquifer in the Denver Basin, Colorado


Journal Announcement: SWA1522

Oil-field mining activities in Piceance basin in northwestern Colorado could adversely affect the ground- and surface-water quality in the basin. This study of the hydrology and geochemistry of the area used groundwater solute-transport-modeling techniques to investigate the possible impact of the mines on water quality. Maps of the extent and structure of the aquifer were prepared and show that a saturated thickness of 2,000 feet occurs in the northeast part of the basin. Ground-water recharge in the upland areas in the east, south, and west parts of the basin moves down into deeper zones in the aquifer and laterally to the discharge areas along Piceance and Yellow Creeks. The saline zone and the unsaturated zone provide the majority of the dissolved solids found in the ground water. Precipitation, ion-exchange, and oxidation-reduction reactions are also occurring in the aquifer. Model simulations of groundwater pumpage in tracts C-a and C-b indicate that the altered direction of groundwater movement near the pumped mines will cause an improvement in groundwater quality near the mines and a degradation of water quality downgradient from the tracts. Model simulations of mine leaching in tract C-a and C-b indicate that equal rates of mine leaching in the tracts will produce much different effects on water quality in the basin. Tract C-a, by virtue of its remote location from perennial streams, will primarily degrade groundwater quality over a large area to the northeast of the tract. Tract C-b, by contrast, will primarily degrade the surface-water quality in Piceance Creek, with only localized effects on the ground-water quality. (USGS)

Chemical analysis, physical property tests, and lithologic descriptions of cores and cuttings of lignite and overburden rocks from an area near Watkins, Colorado.

Journal Announcement: SWA1411

Groundwater in the Laramie-Fox Hills aquifer is a potential source of supplemental municipal water supplies for the communities of Erie, Lafayette, Louisville, and Superior in Colorado. The present water supplies for these communities are not always adequate to meet current or future demands. The U.S. Geological Survey made a water-supply assessment of the Laramie-Fox Hills aquifer for the U.S. Bureau of Reclamation, which is investigating and evaluating alternative sources of water for the communities. Recharge to the aquifer is mostly in the western and southwestern parts of the study area. Groundwater movement is generally from the southwest to the northeast, discharge is in the western part of the area. Groundwater levels in other parts of the area are generally higher. The aggregate sand thickness determined from well logs ranges from 42 to 360 feet and the mean thickness is 229 feet. The volume of groundwater in storage in the study area is about 5 million acre-feet. Reported yields from 93 wells ranged yields tended to be larger in the areas where aggregate sand thickness is the greatest. The water sample analyses from a sodium calcium bicarbonate type to a sodium calcium sulfate type as it moves through the aquifer away from the recharge areas. The maximum limit established by the U.S. Environmental Protection Agency for nitrate plus nitrite in public water supplies was exceeded in water from three wells, the maximum limit for fluoride was exceeded in water from two wells, and the maximum limit for selenium was exceeded in water from three wells. (USGS)
Journal Announcement: SWRA1308

With increasing development of coal production, there is concern over increased water demand and anticipated environmental impacts associated with coal mining, particularly in the Rocky Mountain States which have small populations and limited water resources. These assessment studies focus on the Yampa River basin in northwestern Colorado and south-central Wyoming, and involve that part of the basin east of Dinosaur National Monument. Objectives include: (1) to evaluate the environmental and economic impacts of regional energy- and water-resource development for existing and feasible alternative policies, and (2) to describe the assessment methodologies used so that they may be applied to other energy-rich regions of the western U.S. where water resources are limited. The major energy resource in the basin consists of near-surface coal deposits; other resources—oil and gas, oil shale, uranium and geothermal springs—also occur in the basin. The regional-appraisal and modeling studies used in this assessment are: ambient stream quality, stream traveltime and re-aeration characteristics, waste-load assimilative capacity, sediment loadings in streams, reservoir-modeling analysis, groundwater solute transport, remote-sensing applications and air quality modeling. In this assessment concern was given to projected increased water uses and how they are to be met within existing use patterns and other institutional constraints. Continuing studies such as these will enable resource managers to anticipate potential problems concerning the impending coal-resource development in the Yampa River basin.

An Overview of River-basin Assessment Techniques in an Energy-Impacted Region--Yampa River Basin, Colorado and Wyoming

Steele, T. D., Geological Survey, Denver, CO.

Water Supply and Management, Vol 3, No 3, p 151-171, 1979, 10 Fig, 2 Tab, 29 Ref.

Journal Announcement: SWRA1305

Reported here are the results of completed basin assessment studies of the Yampa River Basin in northwestern Colorado and south-central Wyoming that had as their objectives (1) to evaluate the environmental and economic impact of regional energy and water resource development for existing and feasible alternative policies, and (2) to describe the assessment methodologies used so that they may be applied to other energy-rich regions of the western U.S. where water resources are limited. A set of 7 coal-resource development alternatives are specified in order to evaluate the effects of possible water demands and generated residuals on the region's water resources. The resultant analyses consider both the direct effects of coal mining, processing, conversion and transportation and the indirect effects of increased population.
and related commercial and service needs, based upon extensive field collection of hydrologic data and the analysis of regional economic projections, a range of impacts of the projected development on the basin's water resources are evaluated using several data-analysis and physical modelling techniques. (Tickes-Arizona)

Coal-Resource Development Alternatives, Residuals Management, and Impacts on the Water Resources of the Yampa River Basin, Colorado and Wyoming
Steeley, T. D.
Journal Announcement: SWRA0100

Development of coal resources in the Yampa River basin in the southern Rocky Mountains of the United States will have a variety of effects on available water resources. These involve both direct effects caused by coal extraction, processing, transport, and conversion techniques utilized or proposed for the region and also indirect effects associated with regional economic growth. Impacts from both types of effects involve water resources of the basin in terms of water withdrawals, consumptive use, and assimilative capacities of discharged residuals (that is, non-economic byproducts). A regional residual-management analysis involves assessing mass and energy balances of the primary economic activities, as well as an economic and technical evaluation of alternative strategies of minimization and modification of residuals discharged to the environment from various sources. Approaches and results to date of residuals-management and environmental-modeling techniques are described for evaluating water-resources impacts of coal-related development in the Yampa River basin, Colorado and Wyoming. (Woodard-USGS)

Assessment Techniques for Modeling Water Quality in a River Basin Affected by Coal-Resource Development
Steeley, T. D.

A regional water-resources assessment in the Yampa River basin, Colorado and Wyoming, used modeling techniques applied in five component studies to evaluate direct and indirect impacts of coal-resource development. Modeling of the waste-load assimilative capacity of the Yampa River indicated exceedence of a proposed standard for nonionized ammonia concentration using anticipated population and treatment-plant effluents. Travel times for a 50-kilometer reach of the Yampa River ranged from 15.7 hours for seasonal high flow of 28 cubic meters per second to 120 hours for a low flow of 0.6 cubic meter per second; measured reaeration coefficients for selected subreaches ranged from 6.04 to 33.4 per day. Modeling of alternative configurations of proposed reservoirs indicated a reduction of annual time-weighted dissolved-solids concentrations downstream by an estimated 54 percent. By 1990, an increase of between 9 and 27 thousand metric tons of dissolved solids derived from surface-mined areas is estimated to be transported annually in basin streams. Model simulations of a hypothetical 5,000 milligrams per liter conservative contaminant indicate a site-specific dispersion in one of the major coal-bearing aquifers during a 200-year period. The benefits of integrating physically based modeling components for assessing regional water-resources management alternatives are demonstrated. (Woodard-USGS)

AN ENVIRONMENTAL ASSESSMENT OF IMPACTS OF COAL DEVELOPMENT ON THE WATER SOURCES OF THE YAMPA RIVER BASIN, COLORADO AND WYOMING-PHASE-1 WORK PLAN
STEELEY, T. D.; BAUER, D. P.; WENTZ, D. A.; WARNER, J. W.
GEOLeGICAL Survey, Denver, COLO.
OPEN-FILE REPORT 76-567, MAY 1976, 17 P., 2 FIG., 3 TAB., 11 REF.
Journal Announcement: SWRA0919

COAL RESOURCES OF THE WESTERN UNITED STATES ARE BEING DEVELOPED AT INCREASING RATES, CAUSING CONCERNS OF THE EFFECTS OF MINING AND ASSOCIATED ACTIVITIES ON THE ENVIRONMENT. THE YAMPA RIVER BASIN IN NORTHWESTERN COLORADO AND SOUTH-CENTRAL WYOMING IS UNDERGOING ECONOMIC DEVELOPMENT OF ITS COAL, OIL AND GAS, AND URANIUM RESOURCES. THE YAMPA RIVER BASIN ASSESSMENT IS A 2.5-YEAR PROGRAM OF THE U.S. GEOLOGICAL SURVEY. IT IS DESIGNED PRIMARILY TO ASSESS THE AVAILABILITY AND QUALITY OF THE BASIN'S WATER RESOURCES. THE BASIN ASSESSMENT ALSO WILL EVALUATE POTENTIAL ENVIRONMENTAL AND SELECTED SOCIOECONOMIC IMPACTS OF ENERGY-RESOURCE DEVELOPMENT PLANS PROPOSED BY MINING AND POWER COMPANIES. THIS REPORT SERVES AS A PROJECT WORK PLAN FOR THE BASIN ASSESSMENT'S FIRST-PHASE WORK ACTIVITIES. (WOODARD-USGS)

The Yampa River Basin, Colorado and Wyoming—a Preview to Expanded Coal-Resource Development and its Impacts on Regional Water Resources
STEELEY, T. D.; BAUER, D. P.; WENTZ, D. A.; WARNER, J. W.
Investigations 78-125. September 1979. 123 p, 35 Fig, 16 Tab, 124 Ref.
Journal Announcement: SWA1307

An environmental assessment of the impacts of coal development on the water resources of the Yampa River Basin, Colorado and Wyoming. The assessment is designed primarily to assess the availability and quality of the basin's water resources. The basin assessment also will evaluate potential environmental and selected socioeconomic impacts of energy-resource development plans proposed by mining and power companies. This report serves as a project work plan for the basin assessment. It describes the program objectives and the various approaches of analysis and evaluation. Environmental studies are outlined for analyzing both the direct effects of various proposals regarding coal mining, wastewater disposal, and conversion, and the secondary effects resulting from increased population and urban growth. The basin assessment is designed to provide federal, state, and local decision-makers with the basic environmental information needed when formulating and evaluating policies for the development of energy resources. The techniques applied and conclusions reached in the Yampa River basin assessment should aid similar studies in other energy-rich basins in the western United States. (Woodard-USGS)


Journal Announcement: SWA1122

A hydrologic reconnaissance of a 74-kilometer reach of the Yampa River in Dinosaur National Monument in Colorado was made during the low flow in mid-August 1976. Stream discharge, which was measured every 16 to 24 kilometers, ranged from 9.4 to 10.6 cubic meters per second. Variations in streamflow were explained, in part, by underflow loss to ground water and evaporation. Specific conductance was measured about every 2 kilometers and indicated a downstream increase on the order of 11 to 12 percent for the reach. Except for mercury, bottom-sediment trace-element concentrations in the study reach were less than maximum concentrations determined during August-September 1976 for bottom sediments at unperturbed sites upstream in the Yampa River basin. At one of five sampling sites, the mercury concentration in bottom sediments exceeded the maximum measured upstream level. (Woodard-USGS)

MAP SHOWING POTENTIAL SOURCES OF GRAVEL AND CRUSHED-ROCK AGGREGATE IN THE GREATER DENVER AREA, FRONT RANGE URBAN CORRIDOR, COLORADO
TRIMBLE, D. E.; FITCH, H. N., GEOLOGICAL SURVEY, DENVER, COLO., FOR SALE BY USGS, RESTON, VA., 22092, PRICE $1.75.

Miscellaneous Investigations Series Map I-850-A, 1974. 1 SHEET, 1 MAP, 1 TAB, 33 REF.
Journal Announcement: SWA924

High-quality gravel in the front range urban corridor, Colo., is restricted largely to areas beneath flood plains of Colorado River streams and to low terraces and floodplains of the Yampa River. Grain size of gravel selected for processing into crushed-rock aggregate is plentiful in the older rocks of the mountains and in certain volcanic rocks of the foothills and plains. Potential sources of gravel suitable for aggregate lie near more than 30 map units—three of gravel and four of crushed-rock aggregate. A potential source of gravel, as herein defined and mapped, contains 20 percent or more of granite-and pebble-size, boulders smaller than 2.5 inches or 64 cm, but retained on a No. 10 U. S. STANDARD SIEVE. The minimum gravel content was placed at 25 percent of the deposit because this is the most likely economic limit under the most adverse foreseeable conditions. The map units are based on differences in physical characteristics, which, in turn, determine relative quality for different uses. (Woodard-USGS)

Water-quality characteristics of six small Semiarid watersheds in the Green River Coal Region of Colorado
The primary problems which might result from reuse of the mine drainage would be damage or destruction of crops if the drainage water were used for irrigation. Also, the chloride and sulfate concentrations in some samples were in excess of recommended standards for public water supplies. (Carroll et al. 1982)

Appraisal of Ground Water in the Vicinity of the Leadville Drainage Tunnel, Lake County, Colorado

Turk, J. T.; Taylor, O. J.


Available from the OFS Box 25425, Fed. Ctr., Denver, CO

80225 $3.50 in paper copy, $3.50 in microfiche, (Carroll et al. 1982)

Journal Announcement: SWRA1324

Ground water in the Leadville mining district occurs in granite, quartzite, limestone, sandstone, and unconsolidated material. These rocks form a single aquifer system because the formations are hydraulically connected through contact, mine workings, faulting, and fracturing. The aquifer is recharged by precipitation and water moves toward California Gulch and probably toward Evans Gulch, in the drainage basin of the Arkansas River. The Leadville drainage tunnel was constructed from 1943 to 1945 and later extended during 1950 to 1952, in order to drain the mine workings.

Discharge from the tunnel lowered water levels 30 to 96 feet in mine shafts from 1944 to 1951. Installation of an inner plug in the tunnel has been proposed in order to reduce the discharge of water containing objectionable concentrations of trace metals into the East Fork Arkansas River. The proposed plug will reduce the discharge of water from the tunnel, and cause water levels east of the town of Leadville to rise, flood some mine workings, and increase ground-water discharge to California Gulch.

However, the proposed plug is not expected to cause water levels in Leadville to rise substantially, but more current and detailed data are needed to verify this. Discharge from the Leadville drainage tunnel is probably a mixture of water in equilibrium with carbonate aquifer material from the mineralized zone, water acidified by the localized oxidation of pyrite from the mineralized zone, and water perennially saturated with calcite from the glacial mantle. Based on limited data, water from the carbonate mineral deposits has a pH of about 7.0 and concentrations of about 1,800 micrograms per liter and zinc concentrations of about 13,000 micrograms per liter. (U.S.G.S.)


Journal Announcement: SWRA1512

Coal production in Colorado has increased significantly in the period since 1965, raising questions concerning the effects of mine drainage on water quality. Major dissolved ions that contribute to the overall salinity of the water, restricting its suitability for various uses, are frequently found in water from underground coal mines. Thermodynamics provides an effective tool for the assessment of the origin of seepage from underground coal mines and for prediction of compliance with water quality criteria of seepage from other mines within the same geologic formations. Analysis of samples from 13 of the 14 studies indicated that calcite saturated water had probably reacted with sodium rich marine shales to produce the seepage, which was saturated or supersaturated with respect to calcite. Samples showing evidence of being most completely reacted were comparatively rich in sodium and bicarbonate ions and had a calcium to sodium activity ratio similar to that of seawater. The one sample not saturated with calcite was saturated with respect to gypsum, probably as a result of simple dissolution of gypsum from the strata through which the groundwater percolated. (U.S.G.S.)
The South Park Coal field, Colorado, J. P. Campbell, Marius R., geologist in charge, Contributions to economic geology 1908, Part II: Mineral Fuels, Washington, Chester W., 1910


Weeks, J. W.


The digital model used to simulate ground-water flow in the aquifer system in the basin drained by Piceance and Yellow Creeks in northwestern Colorado is described in detail. The model is quasi-three-dimensional in that it simulates ground-water flow in a multi-aquifer system by assuming horizontal flow in the aquifers and vertical flow through the confining layers separating the aquifers. The model uses the iterative alternating-direction implicit procedure to solve the finite-difference flow equations. The digital model is documented by a program listing and flow charts. Data used in the model and sample output are presented to document the simulation of steady-state flow in the aquifer system. The variables used in the computer program and program options are discussed in detail. (Woodard-USGS)

Hydrologic and Geophysical Data from the Piceance Basin, Colorado.

Weeks, J. W., Welder, F. A.

Geological Survey, Denver, CO, Colorado Dept. of Natural Resources, Denver, Colorado Water Resources Basic-Data Release No. 35, 1974, 121 p. 21 fig. 5 plate, 70 tab.

Journal Announcement: SWRA0806

Potential Oil-shale Development and the Need for Information on the Water Resources of the Piceance Basin, Colorado, a Cooperative Project between the Colorado Department of Natural Resources and the U.S. Geological Survey to Provide the Data Needed to Evaluate the Effects of Future Development on the Hydrology of the Piceance Basin. Data are from 97 Wells, 2 Springs, and 57 Continuing Surface-Water Stations. Miscellaneous Measurements of Discharge and Specific Conductance in Streams Are Also Given. Included in This Report Are


Weir, J. E.


Journal Announcement: SWRA0718

The Discharge of Water Was Monitored during Drilling of Two Holes (Rb-e-01 and Rb-d-01) at the Rio Blanco Site in Western Colorado, Recovery of Water Level Was Measured Following Periods of Water Withdrawal from Hole Rb-d-01. Two Intervals of Hole Rb-d-01 Were Tested. Zone 1, from 245 to 845 Feet below Land Surface, Has a Transmissivity of About 4,600 Gallons per Day per Foot and a Static Water Level of 59.90 Feet below Land Surface. Zone 2, from 882 to 1,651 Feet Below Land Surface, Has a Transmissivity of About 200 Gallons per Day per Foot and a Static Water Level of 39.63 Feet Below Land Surface. There Is Potential at Hole Rb-d-01 for Flow of Water Upward from Zone 2 to Zone 1; However, Differences in Quality of Water in the Two Zones Indicate That Water Probably Does Not Circulate Freely between the Zones. (Knapp-USGS)

Hydraulic Testing Accompanying Drilling of Five Exploratory Holes, Piceance Creek Basin, Colorado.

Weir, J. E., Jinwiddie, G. A.


Journal Announcement: SWRA0701

Five Exploratory Core Holes Which Penetrated Alluvium and the Green River Formation Were Drilled in the Piceance Creek Basin, Colorado, and Hydrologic Information Was Obtained During Drilling. Transmissivity of the Rocks Tested Was Low (Less than 7,500 Gallons per Day per Foot). Field Conductance Indicated That Discharged During Drilling Ranged from About 500 to About 29,000 Micromhos per Centimeter. General Conclusions, Based on Comparison and Evaluation of Available Data, Are That (1) The Rocks Having Greatest Permeability Penetrated by the Five Test Holes Are Above the Mahogany
LEGEND ZONE IN THE UPPER PART OF THE PARACHUTE CREEK MEMBER OF THE GREEN RIVER FORMATION; (2) GROUNDWATER IN THE PENETRATED ROCKS BECOMES MORE MINERALIZED WITH DEPTH, NOTICEABLY AT AND BELOW THE MANOSAY LEGEND ZONE; AND (3) THE TEST HOLES PROBABLY ARE IN AN AREA OF POTENTIAL GROUNDWATER DISCHARGE. (WOODARD-USGS)

APPRAISAL OF SHALLOW GROUND-WATER RESOURCES, PUEBLO ARMY DEPOT, COLORADO

WELDER, F. A.; HURR, R. T.
EGOLOGICAL SURVEY, DENVER, COLO. WATER RESOURCES DIV.

EGOLOGICAL SURVEY OPEN-FILE REPORT 71006, DECEMBER 1971, 44 P, 10 FIG, 5 PLATE, 5 TABLE, 7 REF.

Journal Announcement: SWRA7517

THE WATER SUPPLY FOR THE PUEBLO ARMY DEPOT, 15 MILES EAST OF WELD COUNTY, IS OBTAINED FROM WELLS THAT TAP AN AQUIFER IN TERRACE ALLUVIUM. ADVERSELY AFFECTS THE DISCHARGE RATE OF INDIVIDUAL WELLS. FURTHERMORE, EXCESSIVE PUMPAGE HAS RESULTED IN PROGRESSIVE DETERIORATION OF WATER THE DEPOT AND WERE TESTED TO DETERMINE AQUIFER PROPERTIES AND PROBABLE YIELDS. THE HYDRAULIC CONDUCTIVITY DETERMINED FROM THESE TESTS RANGE FROM ABOUT 350 TO NEARLY 600 GALLONS PER DAY PER SQUARE FOOT. THE TRANSMISSIVITY FOR THE FULL THICKNESS OF THE AQUIFER IS IN THE RANGE OF 7,500 TO 12,000 GALLONS PER DAY PER FOOT. THE TWO NEW SUPPLY WELLS CAN BE PUMPED AT A COMBINED RATE OF ABOUT 140 GALLONS PER MINUTE. IF PUMPAGE IN THE EXISTING WELLS IS REDUCED BY THE SAME AMOUNT, SOME RECOVERY OF WATER LEVELS IN THE FIELD WILL OCCUR AND THE TENDENCY IN WATER QUALITY DETERIORATION MAY SLOW OR EVEN REVERSE. (WOODARD-USGS)

Geohydrologic Data from Twenty-Four Test Holes Drilled in the Piceance Basin, Rio Blanco County, Colorado 1975-76

WELDER, F. A.; JAOULLEIN, G. J.
EGOLOGICAL SURVEY, LAKESIDE, CO. WATER RESOURCES DIV.


Journal Announcement: SWRA1211

Twenty-four holes were drilled in the Piceance basin, northwestern Colorado, to obtain geohydrologic data from the Uinta and Green River Formations of Eocene age. Depths of test holes ranged from 640 to 2,800 feet. The maximum quantity of water discharged during the drilling of individual test holes ranged from 14 to 880 gallons per minute. The specific conductance of water discharged during the test ranged from 100 to 50,000 microhms per centimeter at 25 degrees Celsius. Aquifer tests made during the drilling indicate transmissivity at four sites ranged from 100 to 1,600 feet squared per day and the storage coefficient at two sites ranged from 0.004 to 0.006. Depths to the static water level ranged from 30 to 695 feet. Water levels were measured in each test well, and potentiometric maps constructed from these measurements are comparable in configuration and altitude to those previously drawn from composite data. Water samples taken during drilling indicate that, except for water from the Uinta Formation, the water in Piceance basin is generally not suited for domestic water supply due to the presence of excessive amounts of certain trace constituents, notably fluoride. The average concentration of dissolved solids based on data from the test holes was 909 milligrams per liter. The water from part of the Parachute Creek member. (WOODARD-USGS)

Metamorphism and structural history of the Coal Creek area, front ranges, Colorado. J. short papers in the geologic and hydrologic sciences. Article 196


EFFECT OF MINE DRAINAGE ON THE QUALITY OF STREAMS IN COLORADO, 1971-72

WENTZ, D. A.
EGOLOGICAL SURVEY, LAKEWOOD, COLO. COLORADO WATER RESOURCES CIRCULAR NO 21, 1974, 117 P, 9 FIG, 3 PLATE, 12 TABLE, 93 REF. APPEND.

Journal Announcement: SWRA7517

MINE DRAINAGE IN COLORADO IS COMMONLY ACID WATER CONTAINING HIGH CONCENTRATIONS OF IRON AND SULFATE. THE OXIDATION OF METAL SULFIDES UNDER ACID CONDITIONS RELEASES HIGH CONCENTRATIONS OF TRACE ELEMENTS TO THE WATER. FIELD OBSERVATIONS OF TEMPERATURE AND SPECIFIC CONDUCTANCE, pH, STREAM-BOTTOM CONDITIONS, AND AQUATIC BIOTA AT 905 STREAM SITES IN COLORADO DURING 1971-72 WERE USED AS A GUIDE IN COLLECTING 192 SAMPLES, FOR ANALYSIS OF SULFATE AND DISSOLVED TRACE ELEMENTS. APPROXIMATELY 450 MILES OF STREAMS IN 25 DIFFERENT AREAS ARE ADVERSELY AFFECTED BY METAL-MINE DRAINAGE, OF THE TRACE ELEMENTS FOR WHICH THE U.S. PUBLIC HEALTH SERVICE HAS ESTABLISHED DRINKING WATER STANDARDS, CADMIUM EXCEEDS ITS LIMIT IN MORE THAN 12% OF THE SAMPLES, WHILE ARSENIC AND LEAD EXCEED THEIR LIMITS IN 1-3% OF THE SAMPLES. MERCURY AND SILVER STANDARDS ARE NOT SURPASSED AND CHROMIUM WAS NOT DETECTED. COPPER AND ZINC APPEAR TO PRESENT THE GREATEST DANGER INSOFAR AS TOXICITY TO RESIDENT AQUATIC LIFE IS CONCERED. ACID PRODUCTION IS LESS OF A PROBLEM IN COLORADO STREAMS DRAINING METAL-MINING AREAS THAN IN STREAMS DRAINING THE COAL-MINING AREAS OF APPALACHIA. (KNAPP-USGS)

STREAM QUALITY IN RELATION TO MINE DRAINAGE IN COLORADO

WENTZ, D. A.
EGOLOGICAL SURVEY, DENVER, COLO.

IN: WATER RESOURCES PROBLEMS RELATED TO MINING: AMERICAN WATER RESOURCES ASSOCIATION PROCEEDINGS SERIES NO 18, P 158-175, JUNE 1975, 5 FIG, 5 TABLE, 31 REF.

Journal Announcement: SWRA0908

MOST OF COLORADO'S METAL DEPOSITS ARE COMPOSED OF SULFIDE ORES.
OXIDATION OF ASSOCIATED PYRITE YIELDS ACIDIC WATER, WHICH IN TURN DISOLVES OTHER METAL SULFIDES AND RELEASES TRACE ELEMENTS TO THE SURFACE DRAINAGE. THE PROCESS IS RELATIVELY UNIMPORTANT IN COAL DEPOSITS WITHIN THE STATE. TRACE ELEMENTS IN COLORADO STREAMS DO NOT OFTEN FOLLOW A NORMAL OR SIMPLE LOGNORMAL FREQUENCY DISTRIBUTION. CONCENTRATIONS OF CADMIUM, COBALTCOPPER, IRON, LEAD, MANGANESE, MOLYBDENUM, NICKEL, VANADIUM AND ZINC OCCUR IN GREATER CONCENTRATIONS IN STREAMS DRAINING METAL-MINING AREAS THAN IN STREAMS DRAINING COAL-MINING OR CONTROL AREAS. OF THESE, CADMIUM, COBALTCOPPER, MANGANESE, NICKEL, AND ZINC TEND TO OCCUR TOGETHER. ARSENIC, CHROMIUM, MERCURY, SELENIUM, AND SILVER DO NOT SEEN TO OCCUR TOGETHER IN THE SAME AREAS. IN THE SELECTION OF STREAMS AFFECTED BY METAL MINING, VISUAL OBSERVATIONS OF STREAM CONDITIONS CAN ALSO HELP. IN SITUATIONS WHERE VISUAL OBSERVATIONS ARE DIFFICULT (FOR EXAMPLE, GROUNDWATER STUDIES), MEASUREMENT OF ONE OR MORE INDICATOR CHEMICAL CONSTITUENTS MAY BE FEASIBLE. IN COLORADO, ZINC AND POSSIBLY SULFATE MIGHT BE USED IN THIS REGARD. (WOODARD-UGS)

Analysis of Stream Quality in the Yampa River Basin, Colorado and Wyoming

Wentz, D. A.; Steeley, T. D.


Historic data show no significant water-temperature changes since 1951 for the Little Snake or Yampa Rivers, the two main tributaries to the Yampa River basin in Colorado and Wyoming. Regional analyses indicate that harmonic-mean temperature is negatively correlated with altitude. No change in specific conductance since 1951 was noted for the Little Snake River; however, specific conductance in the Yampa River has increased 14% since that time and is attributed to increased agricultural and municipal use of water. From specific conductance and specific conductance for the Little Snake and Yampa Rivers were similar to regional relationships developed from both historic and recent (1975) data. These relationships provide a means for estimating concentrations of major inorganic constituents from specific conductance, which is easily measured. Trace-element and nutrient data collected from August 1975 through December 1976 at 92 sites in the Yampa River basin indicate that water-quality degradation occurred upstream from 3 sites. The degradation resulted from underground discharges from mining and inorganic materials that probably are associated with coal at one site.

The Rio Grande is an inter-state and international stream which regime in high mountains of Colorado, flows across New Mexico, and forms the boundary between Texas and Mexico. Annual precipitation on the region is about 86 million acre-feet; however, all but 4 million acre-feet is returned to the atmosphere by evaporation and transpiration. The groundwater reservoirs contain an aggregate of 5,800 million acre-feet of fresh and slightly saline water in storage, which could be withdrawn through wells. In contrast, the surface reservoirs have a combined storage capacity of only 18 million acre-feet.

Withdrawal of groundwater in 1970 was 2.7 million acre-feet, of which 88% was used for irrigation. The region appears to offer several opportunities for utilizing underground water for purposes other than the withdrawal of water, such as waste disposal, artificial recharge, water-quality control, and development of geothermal energy. (Woodard-USGS)

Geology and coal resources of the Gulnare, Cucharas Pass, and Stonewall areas, Huerfano and Las Animas Counties, Colorado
Wood, G. H., Jr., Johnson, R. B., and Dixon, G. H., 1956

Geology and coal resources of the Starkville-Weston area, Las Animas County, Colorado
Wood, G. H., Jr., Johnson, R. B., and Dixon, G. H., 1957

Geology and coal resources of the Stonewall-Tercio area, Las Animas County, Colorado

Hydrologic data from the Piceance Basin, Colorado
Geological Survey, Denver, Colo.

Wells Data Collected and Compiled for the Piceance Basin, Colorado Are Presented. Included Are Groundwater and Surface-Water Data Collected by the Geological Survey and

PRIVATE COMPANIES, GROUNDWATER DATA WERE COLLECTED FROM 52 WELLS IN THE PICEANCE BASIN, OF THE 52 WELLS, 25 WELLS HAVE TRANSMISSIVITY DATA, 16 WELLS HAVE DISCHARGE DATA, 39 WELLS HAVE TEMPERATURE DATA, 8 WELLS HAVE VERTICAL FLOW DATA, 57 WELLS HAVE SPECIFIC CONDUCTANCE DATA, 47 WELLS HAVE COMMON ION DATA, AND 18 WELLS HAVE TRACE ELEMENT DATA. A POTENTIALISTIC MAP OF THE REPORT AREA IS GIVEN. THE MAP IS BASED ON THE ALTITUDE OF WATER LEVELS IN 51 OBSERVATION WELLS WHICH PENETRATE THE GREEN RIVER FORMATION. THE WATER-LEVEL MEASUREMENTS WERE MADE DURING THE SUMMER OF 1972. (Woodard-USGS)


This report summarizes the hydrologic studies related to coal development being conducted by the U.S. Geological Survey in the State of Colorado. The objective of the hydrologic data-acquisition program is to collect surface-water quality and quantity data and groundwater level records. These data are needed to define predevelopment conditions and to monitor the effects of construction and operation of coal mines and waste-disposal areas. Data-acquisition activities related to coal development in Colorado are based on the Yampa River basin. A description of the hydrologic data-acquisition activities, including parameters collected and frequency of collection, precedes the summaries of the three interpretive studies currently in progress. Each study summary consists of the project title, definition of the problem being studied, objective of the study, approach of the study, and when known, the schedule for completion of the proposed report products resulting from the study. (Woodard-USGS)

PUBLICATIONS OF WATER RESOURCES INVESTIGATIONS IN COLORADO AND SELECTED PUBLICATIONS PERTAINING TO COLORADO GEOLOGICAL SURVEY, DENVER, COLO. WATER RESOURCES DIV. GEOLOGICAL SURVEY, COLORADO DISTRICT REPORT, 1973, 33 P., Journal Announcement: SWRA620

The water-resources program of the U.S. Geological Survey consists of the collection of basic information through its hydrologic-data acquisition, areal hydrologic and interpretive studies, and research projects. The basic data collected, the results of the areal studies, and the research findings are presented mainly in publications of the U.S. Geological Survey and Colorado agencies, but some appear also in technical journals and other publications. This list contains publications of water-resources investigations in Colorado that have either been published or in preparation. This report lists the publications pertaining to Colorado. (Woodard-USGS)
Colorado

Foidel Creek Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in Routt County, northwestern Colorado
BLM, Denver, Colorado
EMRIA Report No. 6-76

The 4.36-square-mile Foidel Creek study site includes much of the ephemeral and intermittent headwater drainage to Foidel Creek. Relief in less than 2 miles is 1080 feet. Annual precipitation is about 16 inches. Runoff occurs only in spring from snowmelt and spring rains. The Wadge coal in the Williams Fork Formation of the Mesaverde Group dips northward, as does much of the surface, and contains 31 million tons of coal no deeper than 201.3 feet. Small quantities of water, less than 10 gallons per minute to wells, occur in this discontinuous sandstone layers above, within, and below the coal. The water is not highly mineralized, containing only hundreds of milligrams per liter total dissolved solids. Surface mining spoil will increase dissolved solids content of ground water. Proper operational and restoration practices should minimize or eliminate erosion and addition of sediment downstream.

Lay Creek Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in Moffat County, northwestern Colorado
BLM, Denver, Colorado
EMRIA Report No. 20-78

The 5.7-square-mile Lay Creek site consists mostly of "badlands" between gently sloping valley bottoms and steep slopes leading to 40-foot vertical escarpments of narrow dissected mesas. The site is drained by through-flowing Lay and Bond Creeks, both ephemeral. Annual runoff is probably less than 200 acre-feet. The coal is in the Fort Union Formation, which slopes gently northward from the Mud Springs anticline. Strippable coal resources in the Emerald and Blevens beds from 4.5 to more than 15 feet thick amount to 142 million tons. Small amounts of water occur in alluvium, good quality, and in the coals (dissolved solids, 900 to 1,400 milligrams per liter). Mining would remove 6 small stock reservoirs which could be replaced readily. No significant hydrologic impacts are foreseen.

Northwest Colorado Coal
BLM, Craig, Colorado
FES, undated (1976)

This document addresses impacts of approval of mine plans in existing Federal leases, grants of associated rights-of-way, and possible future leasing, in

Colorado

Moffat and Routt Counties, in Colorado. Federal action would result in annual coal production of 15.7 billion tons by 1980, and 24.8 billion tons by 1990. The coal would be mined both by underground and surface methods. Precipitation ranges from less than 8 inches to more than 24 inches annually. The area is drained almost entirely by the Yampa and White Rivers—major tributaries to the Green River flowing into the Colorado River in southeastern Utah. The northwest corner of the area is drained by intermittent Vermillion Creek into the Green River. Water yields range from less than one inch of runoff in desert areas to more than 20 inches from areas at higher elevations. Total dissolved solids range from 50 to 500 milligrams per liter in streams of the area. Major water use in the area is for irrigation, which together with saline ground water inflow are the major causes of salinity (263 tons per day). Mining would add 5,000 tons per year of dissolved load and less than 30,000 tons of sediment annually to the Colorado River System by the year 1990, resulting in an insignificant, less than 1 milligram per liter increase in dissolved solids below Hoover Dam. Ground water occurs throughout the area in limited quantity, ranging from less than a gallon per minute from shale areas, to several tens of gallons per minute in coarser sedimentary rock units, to 1,500 gallons per minute from the Mississippian-age Madison Limestone and alluvium of larger streams. Quality ranges from less than 20 to more than 5,000 milligrams per liter of dissolved solids. Impacts of mining on ground water would be localized to the loss of a few wells and springs.

Taylor Creek Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in the Axial Basin Coal Field, northwestern Colorado
BLM, Denver, Colorado
EMRIA Report No. 3-75

The 2,000-plus acre Taylor Creek study site in Moffat County, northwestern Colorado is on the southern flank of the Axial Basin. Its rolling hills and sloping ridges are drained by minor ephemeral tributaries to the Yampa River, 8 to 10 miles north. The coals beneath the site are in the lower part of the Williams Fork Formation of the Upper Cretaceous Mesaverde Group. Coal seams within 200 feet of land surface range up to 12 feet thick and are separated by thin to thick layers of shale, siltstone and fine-grained sandstone layers. Thicker coal seams occur at greater depths. Water, perched on impermeable layers, is commonly found within 30 feet of the surface. Sustainable well yields probably would not exceed 5 gallons per minute. Small, manageable quantities of water may be encountered while surface mining. Proper operation and reclamation practices would reduce or eliminate increases in sediment to streams.
West-central Colorado Coal
BLM, Montrose, Colorado
FES, Undated (19787)

This statement evaluates impacts of six underground mine and reclamation plans in a seven-county area of west-central Colorado. Elevations and annual precipitation range from 4,100 feet and 10 inches on the west at the Utah border, to 14,000 feet and 35 inches in the east near the Continental Divide. The mines are in the Little Book Cliffs, Grand Mesa, Somersert, and Carbondale coal fields. Most of the coal is in the Cretaceous Mesa Verde Group/Formation but in the Little Book Cliffs Field, some of the coal is in the Anchor Mine Tongue of the underlying Mancos Shale. The area is in the Colorado Plateau and Eastern Rocky Mountain Provinces, and includes the southern Piceance and eastern Uinta Basins. The proposed mines would produce 10.54 million tons of coal by the year 1990. All mine entry would be from outcrops on valley sides. The major rivers draining the area are the Colorado, Gunnison and Uncompahgre. Slopes are sparsely vegetated and erode easily. Major river alluvium generally yields less than 25 gallons per minute but rarely as much as 500 gallons per minute to wells. Some terrace deposits yield up to 1,000 gallons per minute to wells but the deposits are soon drained. Water quality is generally poor because of irrigation. Wells in coals and related sandstone layers generally yield less than 10 gallons per minute. Coals and sandstones are generally drained near outcrops. Groundwater provides 0.4 percent of the area's water yield and 1.3 percent of its total dissolved solids. Mining would affect coal and sandstone aquifers in less than 0.08 percent of the study area, and would affect no existing wells. Mining could disturb stream channels in 0.03 percent of the study area. Water consumption could reduce water yield to Upper Colorado mainstems by 3,920 acre-feet per year, or 0.09 percent, and increase salt load by 0.26 milligrams per liter, 0.05 percent, at the state line, and 0.16 milligrams per liter, 0.02 percent, below Hoover Dam. Sediment yield would decrease during mining but after return to normal. Statement includes site-specific assessments of the six proposed mines.

Westmoreland Short-term Coal Lease
BLM, Montrose, Colorado
EAR, 1977

This record assesses the impacts of leasing 2,130 acres of Federal coal, three miles northwest of Paonia, Delta County, Colorado. The coal would be mined underground as an extension of existing Orchard Valley mine. The coal is the 26-foot thick "D" seam of the Mesa Verde Paonia Shale Member dipping 3 to 6 degrees northwestward on the southern flank of the Piceance Basin. Overburden ranges from zero at the outcrop to 2,000 feet three miles north.

Initial drilling disclosed no groundwater system and no major aquifers are anticipated. Water requirements of 45 acre-feet per year (28 gallons per minute) may be obtained from nearby Stevens Gulch alluvium. Testing 2 indicated transmissivities ranging from 1,057 to 1,750 gallons per day per foot, and storage coefficients ranging from 0.0003 to 0.006. Water from two wells in the alluvium contained 405 milligrams per liter of dissolved solids, mostly bicarbonate. Diversions and sediment retention dams would maintain the local environmental condition of the water resources.

Coal Amendment to the Williams Fork Management Framework Plan
BLM, Craig, Colorado
MFF-CA, 1982

This document amends the Williams Fork Management Framework Plan. The study area, 5,707 acres in Moffat and Routt Counties, 20 miles southwest of Steamboat Springs in northwestern Colorado, includes 5,063 acres of Federal coal potentially suitable for surface or underground mining. Parts of Fish and Middle Creek flood plains are considered unsuitable for coal mining or associated surface disturbance where 100-year flood depths would exceed 3 feet. Sixty acres along Fish Creek are alluvial valley floors considered unsuitable if mining would interrupt, discontinue or preclude farming. The remaining land would be evaluated for suitability in detail in site-specific environmental impact statements if leased, and mine plans would be environmentally assessed.
GROUNDWATER GEOLOGY OF THE ROCK ISLAND, MONMOUTH, GALESBURG, AND KEMANEE AREA, ILLINOIS

BRUECKMANN, JOHN E., GIERGSTRUM, ROBERT E.

ILLINOIS STATE GEOLOGICAL SURVEY, URBANA.

ILLINOIS GEOLOGICAL SURVEY REPORT OF INVESTIGATIONS 221, 1968.

56 P, 14 FIG, 3 TAB, 44 REF, APPEND.

Journal Announcements: SWRA0324

GROUNDWATER IN THE ROCK ISLAND, MONMOUTH, GALESBURG, AND KEMANEE AREA, ILLINOIS, IS OBTAINED FROM (1) SAND AND GRAVEL AQUIFERS WITHIN THE GLACIAL DRIFT; (2) SHALLOW BEDROCK AQUIFERS THAT ARE PRIMARILY DOLOMITE OF THE NIAGARA SERIES (SILURIAN) AND THE KEOUK-BURLINGTON LIMESTONE (MISSISSIPPIAN); (3) DEEP BEDROCK AQUIFERS, PRIMARILY THE ORODOVICIAN ANCILL GROUP (GLENWOOD-ST. PETER SANDSTONE) AND THE BRADYAN IRONTON-GALESVILLE SANDSTONE. MOST PRIVATE WATER SUPPLIES GENERALLY ARE OBTAINED FROM THE DEEP BEDROCK AQUIFERS. SAND AND GRAVEL AQUIFERS ARE SPARSELY DISTRIBUTED IN THE AREA. THE ESTIMATED TOTAL PUMPAGE OF GROUNDWATER ALONE IS 16,531,000 GALLONS PER DAY FOR THE AREA. THIS CONSTITUTES ABOUT 50% OF THE ESTIMATED TOTAL PUMPAGE OF BOTH SURFACE AND GROUNDWATER AND Serves ABOUT 63% OF THE POPULATION. MUNICIPALITIES NOW USING GROUNDWATER CAN PROBABLY DEVELOP ADDITIONAL GROUNDWATER SOURCES TO MEET INCREASED DEMANDS IN THE FUTURE. (KNAPP-USGS)

Magnitude and Frequency of Floods in Illinois

Carns, J. M.


This report presents flood-peak data and methods of estimating the magnitude and frequency of floods for most streams in Illinois.

Flood-frequency curves are given for gaged sites where 10 or more years of flood records have been collected. Flood characteristics from these curves were related, by multiple-regression analysis, to drainage basin characteristics. Regional equations are presented which relate flood-peak discharges to recurrence intervals of 1.25, 2, 5, 10, 25, 50, and 100 years using drainage area, main-channel slope, rainfall intensity, and a regional factor as independent variables. These equations can be used to estimate the magnitude and frequency of floods at ungaged sites where flood discharges are not significantly affected by regulation or urbanization. Graphs are presented for estimating flood magnitudes on some streams where the regional equations are not applicable.

The report contains a compilation of peak stages and discharges at gaging stations having 3 or more years of record. Where available, all floods above a selected base are included in the tabulations. Only the annual maximum floods are shown for other stations.

Frequency Analysis of Illinois Floods Using Observed and Synthetic Streamflow Records

Curtis, George W.


Equations, applicable Statewide, for estimating flood magnitudes having recurrence intervals ranging from 2 to 500 years for unregulated rural streams, with drainage areas ranging from 0.02 to 10,000 square miles (0.05 to 25,900 square kilometers), were derived by multiple regression analyses. A rainfall-runoff model was used in the synthesis of long-term annual peak data for each of 54 small watersheds (drainage areas less than 10.2 square-miles, 26.4 square-kilometers). Synthetic frequency curves generated from five long-term precipitation stations were combined into one synthetic curve and then this synthetic curve was combined with the observed station frequency curve to define the station frequency curve. Synthetic data from the 54 small streams, observed data at 33 small streams, and observed data at 154 large streams were used in the analyses. The most significant independent variables in the regression analysis for estimating flood peaks on Illinois streams were drainage area, slope, rainfall intensity, and an areal factor.

Technique for estimating magnitude and frequency of floods in Illinois

Curtis, G. W.


Time of Concentration and Storage Coefficient Values for Illinois Streams

Graf, Julia B., Garklavs, Georgey, and Oberg, Kevin A.


Values of time of concentration and storage coefficient, two unit hydrograph parameters, are presented for 194 and 120 basins in Illinois, respectively. Tabulated values consist of those computed by previous investigators as well as those computed for 96 basins as part of this investigation. These additional values were computed by calibration of the U.S. Army Corps of Engineers Flood Hydrograph Package (HEC-1). The significance of differences in method used by each investigator to compute these unit hydrograph parameters was evaluated by statistical comparison of four sets of time of concentration values and three sets of storage coefficient values. Because no difference due to method was identified, it is concluded that all of the values in table 1 in this report can be used in any application for which time of concentration and storage coefficient are required.

A Technique for Estimating Time of Concentration and Storage Coefficient Values for Illinois Streams

909
Samples of surface water were collected and analyzed by the Illinois Environmental Protection Agency. The results from water years 1975 to 1977 are presented in three volumes. The history of sampling and analytical methods used during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. Volume II includes the Illinois River basin and Mississippi River tributaries north of Illinois River basin. (Woodard-USGS)

Grason, D. J.; Healy, R. W.
Journal Announcement: SWRA1304

Samples of surface water were collected and analyzed by the Illinois Environmental Protection Agency. The results from water years 1975 to 1977 are presented in three volumes. The history of sampling and analytical methods used during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. Volume I includes the Des Plaines River basin and Lake Michigan. (Woodard-USGS)
River mileages are presented for points of interest on Illinois streams draining 10 square miles or more. Points of interest include bridges, dams, gaging stations, county lines, hydrologic unit boundaries, and major tributaries. Drainage areas are presented for selected sites, including total drainage area for any streams draining at least 100 square miles.

River Mileages and Drainage Areas for Illinois Streams - Volume 2, Illinois River basin

Healy, R. W.

River mileages are presented for points of interest on Illinois streams draining 10 square miles or more. Points of interest include bridges, dams, gaging stations, county lines, hydrologic unit boundaries, and major tributaries. Drainage areas are presented for selected sites, including total drainage area for any streams draining at least 100 square miles.

Chemical Analyses of Surface Water in Illinois, 1958-74 Volume I

Healy and L.G. Toler

Samples of surface water were collected and analyzed by the Illinois Environmental Protection Agency and its predecessors, the Stream Pollution Control Board of the Illinois Department of Public Health. The results for the period 1958 to 1974 are presented in tabular form and the history of sampling and analytical methods are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made.

Chemical Analyses of Surface Water in Illinois, 1958-74 Volume II

Healy, R. W., and Toler, L. G.

Samples of surface water were collected and analyzed by the Illinois Environmental Protection Agency and its predecessors, the Stream Pollution Control Board of the Illinois Department of Public Health. The results for the period 1958 to 1974 are presented in tabular form and the history of sampling and analytical methods are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made.

HYDROGEOLOGIC DATA FROM FOUR LANDFILLS IN NORTHEASTERN ILLINOIS

HUGHES, G. M.; LANDON, R. A.; FARVOLDEN, R. N.

Hydrogeologic and Water Quality Studies of Five Landfills in Northeastern Illinois were Carried Out over a Four-Year Period. The Distribution and Concentration of Dissolved Solids in the Vicinity of Four of These Landfills was Controlled by the Configuration of the Ground-Water System. The Major Factors Influencing the Attenuation of the Dissolved Solids where They Left the Landfill Appear to be the Particle Size of the Earth Materials Through Which These Dissolved Solids Move and the Distance That They Move. Precipitation in Northeastern Illinois is Adequate Natural Environment is not Capable of Containing or Assimilating This Leachate The Landfilling Operation Can Probably be Made Safe by Lining the Disposal Site, by Collecting and Treating the Leachate or by Other Relatively Simple Engineering Procedures.

Low-Flow Frequencies of Illinois Streams

Lapu, G. G.

This report contains low-flow data and regionalized low-flow frequency estimates for all areas in Illinois where at least five years of record (through 1956) have been collected.

In the first section minimum average flows for periods of 1, 7, 15, 30, 60, 120, and 183 days are tabulated for the benefit of those who are interested in the amount of flow available in the stream with minor or no storage. Data for 12, 24, and 60 months are also included in the tables for those concerned with the minimum expected inflow into large impounding reservoirs. Six
separate regionalized frequency curves for each station have been fitted on the plotted data. These curves evaluate the minimum average flows for periods of 7, 15, 30, 60, 120, and 183 days, respectively.

In the second section a technique is derived to serve as a guide for fitting frequency curves to observed data on regionalized basins and for the purpose of extrapolating short-term records. This technique is based on relations empirically developed between low-flow and flow-duration parameters. The advantage of using this approach of regionalization and synthesis of frequency curves is that methods for the synthesis and regionalization of duration curves are henceforth available (Mitchell, 1957). "Flow Duration of Illinois Streams."

Drainage areas for Illinois Streams

Ogata, K. M.

Drainage areas were tabulated for all streams in Illinois which drain over 100 square miles at sites where streamflow data have been collected and at other selected locations. Areas were planimetered on U.S. Geological Survey topographic quadrangle maps and balanced to known areas taken from Smithsonian Geographical Tables of areas of quadrilaterals of the water table (procedures and standards recommended by Subcommittee on Hydrology, Federal Inter-Agency River Basin Committee). Streams are tabulated in sequence; first, the Ohio River basin, followed by the St. Lawrence River basin, and finally, the Mississippi River basin. Streams are listed in downstream order, starting at the headwaters; the rank of the stream system within each basin is indicated by indentation. At sites where data are not available, previously assigned U.S. Geological Survey eight-digit numbers are used. These numbers, which describe unique sites, increase in downstream order. All locations are identified by reference to a town, land-line location, topographic quadrangle, and county at the point where the drainage area was determined. An alphabetical index is provided.

Hydrologic effects of storing liquified sludge in strip-mined land

Patterson, G. L.

The water table near four sewage sludge storage basins in a strip-mined area of western Illinois has risen about 10 feet since the basins were constructed in 1971. Two-dimensional models of the water flow in the mine spoil indicate that the rise is caused by leakage from storage basin 1. The hydrologic parameter values producing the best fit between computed and observed head values are $T = 10$ exp(-9) feet per second, for the hydraulic conductivity of the mine spoil, $4 \times 10^{-6}$ feet per second for the areal recharge rate, and $5.6 \times 10^{-3}$ exp(-8) feet per second 21.1 inches per year for recharge from basin 1. The model indicates that the volume of water leakage from basin 1 is $91,600$ cubic yards per year.

The principal component of the sewage sludge after the solids have been removed are alkalinity, nitrogen, phosphorus, and chloride. In ground water away from the storage basins, the principal cation was magnesium, whereas in that near the basins, the principal cation was sodium. Components in higher concentrations near the basins were sodium, calcium, and chloride. Sulfate was the principal anion in both areas. Because the sodium and chloride concentrations in the sludge were too low to cause the higher concentrations in the ground water, the strip-mine spoil used in constructing the basins was considered to be the major source of these constituents. This spoil had been moved from its original location and unweathered surfaces exposed, which allowed dissolution of carbonate and chloride and release of sodium through cation exchange.

Hydrologic Characteristics of Surface-Mined Land Reclaimed by Sludge Irrigation

Fulton County, Illinois

Patterson, G. L., Fuentes, R. F., and Toler, L. G.

Analyses of water samples collected at four stream-monitoring stations in an area surface mined for coal and being reclaimed by sludge irrigation show the principal metals to be sodium, calcium, and magnesium and the principal non-metals to be chloride, sulfate, and bicarbonate. Comparisons of yearly mean chemical concentrations show no changing trends since the reclamation began with differentiation. At sites where lower differences than upstream and downstream from the site, yearly suspended-sediment loads and discharge relationships between station and downstream from the site also are not notably different. Discharge hydrographs of two tributary streams draining the site show a delayed response to precipitation compared with other streams at that site, indicating that the damping effect of several upstream strip-mine lakes. The shape of the water-table surface generally follows the irregular topography. Monthly water-level fluctuations in wells were dependent on the surface material penetrated (mined or unmined) and their proximity to surface discharge. The largest fluctuations were in unmined land away from discharge, whereas the smallest were in mined land near discharge. The water table is closer to the surface in unmined land than in mined land. The chemical characteristics of ground water are typical of those in mined and unmined areas; low concentrations of sulfate, calcium, magnesium, chloride, iron, zinc, and manganese. However, no changes in ground-water quality attributable to reclamation were identified.
Conductivity (dissolved solids).

Water-quality data from five primary and eight secondary locations showed three basic types of responses to climatic and hydrologic stresses. Stream temperatures and concentrations of dissolved oxygen, ammonia nitrogen, total phosphorus, biochemical oxygen demand, and fecal bacteria showed seasonal variations. Conductivity (dissolved solids), pH, chloride, and suspended solids concentrations varied more closely with stream discharges. Total organic carbon, total nitrogen, total phosphorus, biochemical oxygen demand, and fecal coliform and fecal streptococcal bacteria concentrations exhibited variations indicative of initial flushing action during storm runoff. Selected analyses for herbicides, insecticides, and other complex organic compounds in solution and in bed material showed that these constituents were coming from sources other than the municipal sanitary treatment plant effluent. Analyses for 10 common metals: arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, and zinc showed changes in concentrations below the municipal sanitary plant outfall.

Report.

A proposed streamflow data program for Illinois Sieber, C. R., 1970


Some chemical characteristics of mine drainage in Illinois Tolra, L. G., 1980


Some chemical characteristics of mine drainage in Illinois Tolra, L. G., 1982

U.S. Geological Survey Water-Supply Paper 2078

Surface mining for coal in Illinois has affected runoff from the mined areas and altered water quality in the streams. Average annual sulfate loads in streams are 3,000-4,000 tons per square mile of mined land in the collected Muddy and Saline River basins in southern Illinois. Relatively high concentrations of dissolved aluminum, arsenic, chromium, copper, iron, manganese, and zinc are commonly associated with concentrations of sulfate greater than about 2,000 milligrams per liter.


Water-Resources Investigations 76-87 (open-file report), 1976, 81 pp., 4 tab.,

Journal Announcement: SWA1006

This index to water resources data for Illinois includes 1,275 sites where surface-water and ground-water data were collected through December 31, 1975. The index is the first comprehensive tabulation of data collected in Illinois by the U.S. Geological Survey; data collection began in 1903. Information included are the county code, drainage area, date and age of data available, and a code of record where data are filed, and the name of the current cooperating agency. The surface-water index is listed sequentially by station number and also alphabetically by station name. Station numbers for
Mississippi River from St. Louis, Missouri. One-fifth of the total land surface of 673 square miles is on flood plains of the Mississippi and Kaskaskia Rivers and Silver Creek. The flood plains are underlain by as much as 120 feet of gravel, sand, silt, and clay. The remaining four-fifths of the land surface is on uplands that contain flat or dissected plains, low ridges, and mound-shaped hills, about 20 square miles of terrace and karst topography, and an area of karst topography, mineral and water resources are abundant in the county. Water resources include groundwater from near-surface unconsolidated deposits and from bedrock and surface water from the Mississippi River. In some areas geologic conditions impose limitations on the use of land for particular problems. Three areas of particular problems are known for Illinois. Rarely are there limitations severe enough that they cannot be overcome by available engineering and construction techniques. This geologic information was prepared for land-use and resource planning on a county-wide scale. (Woodard-USGS)

Water Resources Data for Illinois, published annually since 1975 River Basin, Geological Survey, Urbana, IL, Water Resources Div. Available from the U.S. Geological Survey, Washington, D.C. Water resources data for Illinois consist of records of water levels and water quality. Additional water data were collected at various sites not involved in the systematic data collection program and are published as miscellaneous maps and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating States, local, and Federal agencies in Illinois. (USGS)

SHOW AVERAGE ANNUAL PRECIPITATION, DISCHARGE OF PRINCIPAL RIVERS, AND AREAS OF FLOOD INUNDATION. A MAP, SCALE 50 MI TO THE IN., SHOWS BY SYMBOLS, NUMBERS, AND COLORED OUTLINE THE HYDROLOGIC DATA NETWORK AND INVESTIGATIONS IN ILLINOIS IN JUNE 1968. (WOODARD-USGS)


A water-quality assessment of the Prairie Creek watershed was made April 1 to 5, 1974. Stream waters were a calcium bicarbonate type with moderately low dissolved solids content except where affected by drainage from coal mines in the headwaters. Dissolved manganese values were above the desired level of 0.05 milligram per litre at all but two sites sampled. Stream waters contained less than 0.05 milligram per litre dissolved phosphorus, and dissolved nitrate concentrations ranged from 0.8 to 2.9 milligrams per litre. Fecal coliform bacteria concentrations ranged from 150 to 3,500 colonies per 100 millilitres. Fecal streptococci concentrations ranged from 450 to 2,300 colonies per 100 millilitres. The concentration of dye in bed materials increased in a downstream direction in Prairie Creek from about 2 to 6 micrograms per kilogram. About 15 micrograms per kilogram PCB compounds were found in an upstream sampling site and 2.3 micrograms per kilogram DDT was found in a downstream sampling site. The Prairie Creek benthic communities at two sites were 80 percent midge and black fly larvae, with diversity indices of 2.7 and 2.8.

Gazetteer of Coal-Mine Lakes in Southwestern Indiana. Bobo, L. L., Geological Survey, Indianapolis, IN. Water Resources Div., report, June 1979, 107 p., 54 Fig. 2 Tab. 13 Ref. Journal Announcement: SWA1303. This gazetteer is a catalog of lakes formed by surface coal mining in southwestern Indiana that are 0.5 acre or larger and in nonactive mine areas. Approximately 1,000 of the lakes are listed by 7.5-minute quadrangle topographic map name, lake-identification number, latitude and longitude, and county. Other data given are shape of lake, maximum length, mean width, length and development of shoreline, surface area, orientation, presence of a stream inlet or outlet, and geologic data (geologic formation of area surrounding the lake and the mined coal-bed member). Field data (sampling date, pH, specific conductance, apparent color of lake, and general vegetation along the shoreline) were collected for 287 of the lakes. The apparent colors of the lakes observed were varying shades of aqua, blue, brown, lime green, red, and green. Eighty percent of the lakes sampled were green. (Woodard - USGS)

Ground and surface-water quality and hydrologic data from in and around an active surface coal-mining Clay and Vigo Counties, Indiana. Bobo, L. L., and Eikenberry, S. E., U.S. Geological Survey. Few data exist from reclaimed surface coal mines to evaluate water quality and hydrology, particularly in areas where high acid-production potential material is selectively buried. Because so few data exist from these regions, a study was done to determine the dissolved in split-drive reclaimed areas, 2.9, ground and surface water in and around an active reclaimed surface coal mine, Clay and Vigo Counties, Indiana. From September 1977 through February 1980, water quality and hydrologic data were collected from 41 wells and 24 stream sites, and use in the study area was agricultural and forested, affected and unaffected by mining operations, and reclaimed and unclaimed surface coal mine.

Field measurements included water temperature, specific conductance, pH, Eh, dissolved oxygen, ground-water elevations and streamflow. Water samples from wells and streams were analyzed for concentration of major cations and anions, alkalinity, hardness, aluminum, iron, manganese, trace elements, organic carbon, phosphorus and dissolved solids residue at 180 and 240 degrees C. Ferrous iron concentrations were determined in water samples from selected wells, and percent sulfur by weight and potential acid-production potential material was determined in split-drive reclaimed areas. Additional analyses of stream samples done to determine (1) concentrations of elements absorbed onto streamed materials, (2) concentrations and particle size of suspended sediment-waste water, and (3) populations and Shannon diversity indices of phytoplankton in water.

Water-Quality and other Hydrologic Data collected in and around a surface coal mine, Clay and Vigo Counties, Indiana, 1977-80. Bobo, Linda L., and Eikenberry, Stephen E. U.S. Geological Survey Open-File Report 82-639, 117 p. Few data are available for evaluating water-quality and other hydrologic properties in and around surface coal mines, particularly in areas where material having a high acid-production potential is selectively buried. This report contains hydrologic data collected in coal-mining areas in Clay and Vigo Counties, Indiana, from September 1977 through February 1980. Methods of sampling and analysis used in collecting data are also described. The data include field and laboratory measurements of water at 41 wells and 24 stream sites. Variables measured in the field include water temperature, specific conductance, pH, Eh,
dissolved oxygen, ground-water levels, and streamflow; and in the laboratory, concentrations of major ions, alkalinity, hardness, trace elements (in this report, elements having concentrations of 1 milligram per liter or less), organic carbon, phosphorus, and dissolved solids. Other variables measured in the laboratory include ferrous iron concentration of water samples from selected wells, percent sulfur by weight and the potential acidity of core samples of core cast overburden, concentrations of elements adsorbed on streambed materials, concentrations and particle size of suspended sediment in water, and populations and Shannon diversity indices of phytoplankton in water. Dissolved-solids concentrations and pH of ground water ranged from 173 to 5,130 milligrams per liter and from 6.1 to 8.9, respectively, and of surface waters, from 120 to 4,100 milligrams per liter and from 6.1 to 8.8, respectively.

Evaluation of ground-water quality, coal mining region, southwestern Indiana. (Soon to be published). Bobo L. L., and Martin J. D.

Water-Quality Assessment of the Cypress Creek Watershed, Warrick County, Indiana
Bobo L. L., Peters C. A.


The U.S. Soil Conservation Service needs chemical, biological, and hydrological information to prepare an environmental evaluation of the water quality in the Cypress Creek watershed, Warrick County, Ind., before plans can be made to improve water quality. (1) Minimize the effects of mining, (2) reduce sedimentation, and (4) provide adequate outlets for drainage in the watershed. The U.S. Geological Survey obtained these data for the Soil Conservation Service in a water-quality survey of the watershed from March to August 1979. Past and present surface coal mining is the factor having the greatest impact on water quality in the watershed. The upper reach of Cypress Creek receive acid mine drainage from a coal-mining waste slurry during periods of intense rainfall. All the remaining tributaries, except Summer Pecka drain, mined or reclaimed lands. The general water type of Cypress Creek and most of its tributaries is calcium and magnesium sulfate. In contrast, the water type at background site 21 on Summer Pecka drain is calcium sulfate. Specific conductance ranged from 470 to 4,730 microemhos per centimeter at 25 degrees Celsius, and pH ranged from 1.2 to 8.8. Specific conductance, hardness, and concentrations of major ions and dissolved solids were highest in tributaries affected by mining. The pH was lowest in the same tributaries. Concentrations of iron, manganese, and sulfate in water samples and chlordane, DDT, and PCB's in streambed samples exceeded water-quality set by the U.S. Environmental Protection Agency. (USEPS)

HYDROGEOLOGY OF THE PRINCIPAL AQUIFERS IN SULLIVAN AND GREENE COUNTIES, INDIANA
Cable L. W., Rouison T. M.

GEOLOGICAL SURVEY, INDIANAPOLIS, IND.

INDIANA DEPARTMENT OF NATURAL RESOURCES DIVISION OF WATER BULLETIN NO 35, 1973, 26 P, 8 FIG, 3 PLATE, 28 REF. * JOURNAL ANNOUNCEMENT: SWRAU708

The rocks that underlie Sullivan and Greene counties, Indiana, may be placed in two general categories—consolidated and unconsolidated. Based on their water-bearing properties the consolidated rocks are subdivided into three major hydrologic units. Aquifers in Unit 1 are relatively thickbedded limestone and sandstone bodies. The average yield from wells in this unit is 10 GPM with yields of as much as 100 GPM reported. The aquifers of Unit 2 are sandstone bodies which occur throughout the strata of this unit. The average yield of wells in this unit is 5 GPM, and maximum yields are about 20 GPM. Unit 3 is similar in most respects to Unit 2; however, in this unit there are fewer water-bearing sandstone bodies, and, as a consequence, numerous dry holes are drilled. Aquifers in the unconsolidated rocks of the area are coarse sand and gravel deposits located predominantly along the stream valleys. The valleys of the Wabash and White Rivers contain the thickest and, therefore, the best consolidated rock aquifers. Yields from wells in these aquifers average 350 GPM with yields of as much as 1,000 GPM reported. Analyses of over 500 water samples indicate that the consolidated rocks of the area yield calcium bicarbonate, sodium bicarbonate, and sodium chloride water, and the unconsolidated rocks yield calcium bicarbonate water. (WOODARD-SGUS)

Hydrogeology of the principal aquifers in Vigo and Clay Counties, Indiana
Cable L. W., Watkins F. A., Jr., and Robison T. M. 1971

Indiana Division of Water Bulletin 34, 91 p.

Ground-Water Resources of Vanderburgh County, Indiana
Cable L. W., Wolf M. J.

GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV. * GEOLOGICAL SURVEY, ST. PAUL, MN. WATER RESOURCES DIV.

INDIANA DEPARTMENT OF NATURAL RESOURCES, INDIANAPOLIS, BULLETIN NO 38 OF THE DIVISION OF WATER, 1977, 37 P, 19 FIG, 3 PLATES, 3 TAB, 17 REF. * JOURNAL ANNOUNCEMENT: SWRA1017

Sandstone units of Middle and Late Pennsylvanian age and sand
and gravel of Quaternary age are the source of fresh (1,000 parts per million of dissolved solids or less) ground water in Vanderburgh County, Indiana. Aquifers occur in older rock but are close to their depth, the water is too highly mineralized to be useful for most purposes. Sand and gravel deposits of the Ohio River Valley are the best aquifers in Vanderburgh County. These deposits form a single hydrologic unit referred to as the Ohio River valley aquifer. This is the only aquifer in the county capable of accommodating high-yield wells. Properly constructed wells in this aquifer could easily yield 1,000 gallons per minute and more. Transmissibilities in the Ohio River valley aquifer range from 120,000 gallons per day per foot and less near the valley walls to more than 200,000 gallons per day per foot in the thickest parts of the aquifer. The water in the aquifer is predominately a very hard calcium bicarbonate type having a high iron content. (Woodard-USGS)

Analysis of historical surface-water-quality data in the coal mining region of southwestern Indiana. (Soon to be published). Crawford, C. G.

A Water-Quality Assessment of the Feather Creek Watershed, Vermilion County, Indiana
Eikenberry, Stephen E.

Chemical quality of surface water within the Feather Creek watershed is generally good. However, fecal bacteria concentrations are high enough to represent a potential problem, especially because of the water-contact recreation proposed for the Feather Creek Valley. Chemical analyses of surface water-samples collected on October 9, 1974, and periodically from October 1, 1975, to September 28, 1976, show that the water was calcium bicarbonate type at all sites except one, where it was calcium sulfate. Range of dissolved-solids concentration was from 290 to 1,080 milligrams per liter.

Ranges of concentration (in milligrams per liter) of some of the dissolved constituents in water were: nitrate (as nitrogen), from 0.01 to 6.92; phosphate (as phosphorus), from 0.01 to 0.14; and total organic carbon, from 2.5 to 16. Concentrations of fecal coliform bacteria and fecal streptococci bacteria ranged from 60 to 6,700 and 70 to 18,000 colonies per 100 milliliters, respectively.

Concentration of dieldrin in bed materials from two sites was 0.4 microgram per kilogram, but aldrin, chlordane, DDE, DDT, endrin, heptachlor, heptachlor epoxide, lindane, toxaphene, polychlorinated dibenyl (PCB), and polychlorinated naphthalene (PCN) compounds were not detected. NAVICULA sp and SCENEDENHUS sp dominated the phytoplankton community at the site sampled and indicated an environment lacking in organic enrichment. CLADOPHORA sp dominated the periphyton community sampled. Benthic invertebrates sampled were mostly caddis flies (CHEUMATOPSYCHE sp) and midges (ORTHOCLADIUS sp) and had a diversity index of 2.3, which indicates some organic enrichment of the stream.

A Water-Quality Assessment of the Busseron Creek Watershed, Sullivan, Vigo, Greene, and Clay Counties, Indiana
Eikenberry, S. E.

Journal Announcement: SWRA113

The chemical constituent concentrations (in milligrams per liter) of dissolved solids and of some of the chemical constituents dissolved in streams from September 1975 to July 1976 were: dissolved solids, from 104 to 2,610; iron, from 0.00 to 150; sulfate, from 14 to 1,900; chloride, from 5.3 to 130; nitrate (as nitrogen), from 0.1 to 1.5; phosphate (as phosphorus), from 0.1 to 1.7; and total organic carbon, from 2.4 to 60. Range of pH was from 2.7 to 9.6. Ranges of concentration of chloroform hydrocarbons (by response of 2-micrograms per kilogram) detected in bed material of streams were: aldrin from 0.2 to 0.6; chlordane from 0.0 to 132; DDE, from 0.0 to 0.37; dieldrin, from 0.0 to 9.8; and heptachlor epoxide, from 0.0 to 1.0. Streams draining municipalities had high populations of fecal coliform bacteria (as many as 46,000 colonies per 100 milliliters) and phytoplankton (as many as 190,000 cells per milliliter). Dissolved oxygen concentration ranged from 2.8 to 15.0 milligrams per liter. (Woodard-USGS)

Effects of Surface Mining on Water Quality in a Small Watershed, Sullivan County, Indiana
Peters, J. G.
Journal Announcement: SWRA1501

The water quality in an unnamed tributary to Spencer Creek upstream and downstream from a surface mine and in South Lake
adjacent to the mine were monitored during a 5-year study (1975-79) in the 1,210-acre watershed of the tributary. Compared with the background values, pH and concentrations of all major dissolved ions and dissolved suspended and streambed metals generally increased in Spencer Creek tributary downstream from the mine. Median dissolved-sodium and sulfate concentrations increased as eighteenfold and fourteenfold respectively, and median dissolved-manganese and suspended aluminum concentrations increased as much as sevenfold and more than twofold. Concentrations of suspended metals decreased more than 50% after installation of sediment ponds by the mine operator. During high streamflow concentrations of major ions at background and at mined sites on Spencer Creek tributary decreased, but dissolved- and suspended-metal concentrations increased downstream from the mine. South Lake exhibited seasonal stratification and mixing changes similar to other lakes at a similar latitude. However, the bottom 3 feet of the water column demonstrated persistent chemical stratification. Phytoplankton populations of the lake varied seasonally, and the population density patterns resembled those in other lakes at latitudes similar to that of South Lake. (USGS)


Analysis of stormwater quality for different land uses in the coal-mining region of southwestern Indiana. (Soon to be published). Renn, B. E.


Journal Announcement: SWRA1411

On August 3, 1977, the Surface Mine Control and Reclamation Act, Public Law 95-57 (the Act), was enacted by the 95th Congress. Under Section 507(b)(11) of the Act, an appropriate Federal or State agency must provide applicants for coal-mining permits hydrologic and water-quality information for the general use of proposed mining. To help meet the goals of the Act, the U.S. Geological Survey is designing a data-collection network in the coal-mining region of southwestern Indiana. The purpose of the network is to provide hydrologic and water-quality data on the general area for coal-mining permits. Because of the large size of the study area and the lack of hydrologic and water-quality data, a preliminary assessment is being done to determine the factors that affect water quality in the coal-mining region. This information will be used in designing a data network that will (1) provide the hydrologic and water-quality data needed by applicants for coal-mining permits and (2) determine the factors that affect water quality. Reconnaissance data were collected at 293 sites in March, and hydrologic and water-quality data were collected at 84 synoptic sampling sites in May. (Synoptic sampling is the virtually simultaneous collection of data at specific sites.) In the reconnaissance, pH, specific conductance, dissolved-oxygen concentration, temperature, and Eh of streams were measured at each site for water-quality data. In the synoptic sampling, the preceding characteristics, as well as concentrations of various dissolved and suspended constituents of stream water and concentrations of heavy metals on streambed materials, were determined. (USGS)

Quality of surface water in the coal-mining region, southwestern Indiana, October 1979 to September 1980. (Soon to be published). Renn, B. E.; Wilber, W. G., and Crawford, C. G.

Ground Water Resources of Posey County, Indiana. Robison, T. M. Geological Survey, Mineola, N.Y. Water Resources Div., Indiana Department of Natural Resources (Indianapolis). Bulletin No 39, 1977. 27 p. 6 fig. 4 plates. 2 tabs. 18 ref.

Journal Announcement: SWRA111

Glacial sand and gravel deposits in and near the Wabash and Ohio River valleys of Posey County, Ind., are capable of yielding from 50 to more than 1,000 gallons per minute of water to individuals at 80 in the tributary valleys. As much as 35 gallons per minute has been obtained from small isolated sand and gravel deposits. In the remainder of the county, wells in sandstones of Pennsylvanian age yield from 5 to 25 gallons per minute. Natural discharge from sand and gravel into the Wabash and Ohio Rivers is estimated to be 40 million gallons per day, far exceeding the 6 million gallons per day estimated usage of ground water in the county. The shallow ground water is normally of the calcium bicarbonate type and has a dissolved-solids concentration of less than 500 parts per million. In deep bedrock wells, the water is of the sodium bicarbonate sodium chloride type and has a dissolved-solids concentration of more than 500 parts per million. (Woodard-USGS)
Low-Flow Characteristics of Indiana Streams

Stewart, James A.
U.S. Geological Survey Open-File Report 82-1007, 277 p., 8 illus., 1 table

Knowledge of low-flow characteristics of Indiana streams is essential to the planners and developers of water resources for municipal, industrial, and recreational uses in the State. Low-flow frequency characteristics and points on the duration curve are given for 208 continuous-record gaging stations having 10 or more years of record. In addition, a few low-flow-frequency characteristics were estimated for each of 258 partial-record stations. Methods used for estimating these characteristics are included in the report.

A preliminary biological assessment of streams in the coal-mining region of southwestern Indiana. (Soon to be published)

Wangsness, D. J.

Reconnaissance of stream Biota and Physical and Chemical Water Quality in areas of selected land use in the coal mining region, southwestern Indiana, 1979-80

Wangsness, David J.
1982


To help meet the goals of the Surface-Mining Control and Reclamation Act of 1977, the U.S. Geological Survey is assessing the physical, chemical, and biological characteristics of surface water within the coal-mining region of southwestern Indiana. This report discusses benthic-invertebrate and periphytocalgal communities in streams draining homogenous-agricultural, forested, active/reclaimed-mined, reclaimed-mined, and unreclaimed-mine watersheds—and relates the biological communities to the physical and chemical characteristics of the streams.

Alkalinity and pH were lower and the concentrations of dissolved solids, suspended solids, calcium, magnesium, sodium, potassium, sulfate, iron, manganese, aluminum, and zinc were higher in unreclaimed-mine watersheds than in the other land-use watersheds.

Numbers and community diversity of benthic invertebrates were less at sites affected by mining than at agricultural or forested sites, owing to (1) synergistic effects of low pH, metals, and unsuitable habitat and (2) lack of colonizing drift organisms because of the small drainage area upstream from the mined area. Only a few organisms such as the caddisflies CHEUMATOPSYCHE and HYDROPSYCHE and the chironomids CHIÆONOMUS and CREICOTOPUS were found in streams draining mine areas.

Preliminary water-quality Assessment of the Upper White River Near Indianapolis, Marion County, Indiana

Wangsness, D. J.; Elkenberry, S. E.; Wilber, W. G.; Crawford, C. G.

Hydrology of Area 30, Eastern Region. Interior Coal Province, Southwestern Indiana. (Soon to be published)

Wangsness, D. J.; McKenzie, A. L.; Miller, R. L.; Bailey, Z. A.; Chapman, L. G.; and Arjoodi, L. D.

Hydrology of Area 32, Eastern Region. Interior Coal Province, Indiana


Hydrologic and water-quality information from the coal region in parts of 11 counties in southwestern Indiana are summarized. Pennsylvanian and Mississippian bedrock are overlain by drift and till from the Kansan, Illinoian, and
Wisconsinan glaciers that covered two-thirds of the area. Most of the coal is mined from Pennsylvanian coal units. As of 1978, more than 1-billion short tons of coal had been mined from the 11 counties. More than 12-billion short tons remained in reserve. During 1978, 839-million short tons were mined. Coal mining disturbs less than 1% of the land in the study area. Sixty-two percent of the land is agricultural, and 29% is forested. More coal is mined in the southern and western parts of the study area than elsewhere. Surface water in these parts had lower pH and alkalinity than water in the north and east parts. Specific conductance and concentrations of sulfate, iron, and manganese in surface water were higher in the south and west than elsewhere. (USGS)

Hydrologic assessment of Area 33 eastern region, Interior Coal Province, southwestern Indiana and northern Kentucky. (Soon to be published).

Wangness, D. J., and others

Ground-water resources of west-central Indiana, preliminary report-Vigo County
Watkins, F. A., Jr., and Jordan, D. G., 1963
Indiana Division of Water Bulletin 17, 286 p.

Ground-water resources of west-central Indiana, preliminary report-Vermillion County
Watkins, F. A., Jr., and Jordan, D. G., 1965
Indiana Division of Water Bulletin 29, 50 p.

GROUNDFWATER APPRAISAL OF THE BIG WALNUT CREEK BASIN ABOVE LITTLE WALNUT CREEK AND BIG WALNUT CREEK RESERVOIR SITE, INDIANA
WATKINS, FRANK A. JR.
GEOLGICAL SURVEY, WASHINGTON, D.C.
11 P., 4 FIG., 1 TAB.
Jounal Announcement: SWA0225
LOSS OF WATER FROM A PROPOSED RESERVOIR IS POSSIBLE WHERE THE CHANNEL OF BIG WALNUT CREEK, INDIANA IS CUT INTO BEDROCK IN THE POOL AREA, DURING DRY-WEATHER PERIODS THE CREEK LOSES WATER IN THIS REACH. WATER SUPPLY IS NOT A PROBLEM IN THE BASIN AT THE PRESENT TIME BUT COULD BECOME A PROBLEM IN THE GREENCASTLE AREA IN A PERIOD OF SEVERE DROUGHT. (KNAP-USGS)

Reconnaissance for determining effects of land use and surficial geology on concentrations of selected elements on streamed materials from the coal-mining region, southwestern Indiana, October 1979 to March 1980
Wilber, William G., and Boje, Rita E.
U.S. Geological Survey Water-Resources Investigations 82-4013,

39 p.
Streamed materials were collected from 69 sampling sites in areas of predominantly forested, agricultural, and reclaimed and unclaimed mined land in the glaciated and unglaciated parts of southwestern Indiana to determine whether concentrations of sorbed metals and other trace elements were affected by land use and surficial geology.

Streamed materials smaller than 0.062 millimeter were collected in October 1979 and analyzed for sorbed and acid-soluble metals including aluminum, cadmium, chromium, copper, cobalt, iron, lead, manganese, mercury, nickel and zinc and several nonmetals, total arsenic, boron and selenium.

Analysis of variance indicated that differences in land use accounted for 10 percent or more of the variation in aluminum, arsenic, cobalt, iron, nickel, selenium, and zinc concentrations on streamed materials. Differences in glacial province (surficial geology) did not significantly affect the concentrations of metals and other trace elements on streamed materials. Concentrations of aluminum, cobalt, iron, nickel, selenium, and zinc on the less than 0.062-millimeter fraction of streamed materials from mined watersheds were significantly greater than the concentrations of these elements on streamed materials from agricultural and forested watersheds. The greater concentrations of these elements are due to (1) their concentrations in mine drainage and their subsequent adsorption and (or) coprecipitation with the oxides and hydroxides of aluminum and iron and (2) their concentrations in coal and pyritic material in streambed materials.

Concentrations of aluminum and iron on streamed materials from reclaimed, mined watersheds were significantly less than the concentration of these metals on streamed materials from unclaimed, mined watersheds.

Preliminary assessment of the factors affecting water quality in the coal-mining region, southwestern Indiana, March to October 1979. (Soon to be published).

Wilber, William G., Crawford, C. G., Renny, D. E., Ragone, S. E., and Wangness, D. J.

Hydrologic Evaluation of a Hypothetical Coal-Mining Site Near Chrisney, Spencer County, Indiana
Zogorsky, J. S., Kamey, D. J., Lambert, P. W., Martin, J. D., Warner, R. E.
Available from the OFS, USGS Box 25425, Fed Ctr, Denver, CO 80225.
Price: $19.50 in paper copy, $29.50 in microfiche.
Geological Survey. Water-Resources Investigations 80-1107, October 1981, 133 p., 34 Fig, 26 Tab, 32 Refs.
Journal Announcement: SWA1506

Protecting the nation's water resources is a major emphasis of the Surface Mining Control and Reclamation Act,
PL 95-87. Permanent regulations established for this Act by the Office of Surface Mining (OSM) require the issuance of a permit before mining begins. An application for a mining permit must include an assessment of the hydrologic characteristics of the mining site and adjacent areas, and a projection of the potential impacts of mining activities on surface water and ground water. OSM’s permanent regulations and guidelines provide little insight on the "how to" aspect of making the required hydrologic assessment. This investigation was completed to improve the understanding of the kinds of information needed to make such assessments by: (a) reviewing the regulations to determine what hydrologic information is required; (b) preparing an example hydrologic assessment using the regulations as a guideline; and (c) using the experience gained in (a) and (b) to identify areas lacking or needing additional data to make the required assessment. Hydrologic data for the study area were obtained from published and unpublished reports, maps, aerial photographs, personal interviews with residents in the area of the hypothetical mine site, and discussions with experts in the field. Where data were unavailable, "synthetic" data were generated by extrapolation from proximate or similar watersheds and (or) by assumptions based on experience or theory. A limited amount of field data was collected to corroborate and augment information originating from all these sources. (USGS)

Water Resources Data for Indiana. Published annually since 1975.


Water resources data for Indiana consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Indiana. (USGS)
Availability of groundwater in Wayne County, Iowa


Iowa Geological Survey Water Atlas No. 3, 1969. 33 p. 10 fig. 6 Tab. -
Journal Announcement: SWRA0310

Information is presented on the availability and quality of groundwater in Wayne County, one of several counties in Southern Iowa affected by a shortage of good-quality water. Only locally and in limited areas, or only after extensive water-quality treatment, are suitable supplies of groundwater available to satisfy the water needs. Bedrock aquifers yield variable small amounts of moderately to highly mineralized water. Surficial aquifers comprising glacial drift and alluvium are estimated to yield up to 45 gpm in some areas; an availability map indicates that there is a water supply in surficial deposits dissolved-solids concentrations range from about 470 mg/l in the alluvium to over 3,000 mg/l in the deep (more than 100 feet) glacial drift. Many shallow (100 feet or less) supplies are high in nitrate and chloride, and these concentrations are attributed to localized contamination. Wells in the alluvium and shallow drift that are properly constructed and located are expected to yield satisfactory quality water. (Knapp-USGS)

Definition and hydrology of the sandstone aquifers in the coal-bearing Pennsylvanian strata of southcentral Iowa


Water Resources of South-Central Iowa

Journal Announcement: SWRA1212

The availability, quality and use of ground and surf ace water in an eleven-county area in south-central Iowa. The best sources of water supply in the area are Red Rock and Rathbun Lakes and other impoundments. The Des Moines River is the only stream in the area that can supply adequate amounts of water without storage. Yields of wells from the deeply-buried Cambrian-Ordovician aquifer, yields of 150 to Des Moines and Skunk Rivers: yields from the alluvium in tributary valleys is suitable for most purposes; dissolved solids generally are less than 500 is available from parts of the aquifers except the Devonian but only the gallons per day in 1972-73, groundwater accounted for 66 percent of the total withdrawals and surface water sources made up

Mississippian Aquifer of Iowa

Horick, P. J. Geological Survey, Iowa City, Iowa.

Iowa Geological Survey Water Atlas Miscellaneous Map Series 3, 1973. 3 Sheets, 1.9 fig, 4 Tab, 3 Map, 10 Ref, -
Journal Announcement: SWRA709

The purpose of this 3-SHEET ATLAS IS TO PRESENT INFORMATION ON THE OCCURRENCE, MOVEMENT, AVAILABILITY, USE, AND CHEMICAL QUALITY OF WATER FROM THE MISSISSIPPIAN AQUIFER IN IOWA. INCLUDED IS A BRIEF DESCRIPTION OF THE PHYSICAL CHARACTERISTICS AND SPATIAL RELATIONS OF THE ROCKS THAT CONTAIN THE WATER. ALSO DISCUSSED AND EVALUATED ARE THE AREAS OF HIGH POLLUTION HAZARD TO THIS AND UNDERLYING AQUIFERS. THE MISSISSIPPIAN AQUIFER UNDERLIES ABOUT 60% OF THE STATE, BUT IN ONLY ABOUT 15% OF THIS AREA CAN THE AQUIFER BE CONSIDERED A MAJOR SOURCE OF POTABLE WATER. THIS AREA COMPILES ALL OR PARTS OF 10 COUNTIES IN THE NORTH-CENTRAL PART OF THE MISSISSIPPIAN OUTCROP, WHERE THE AQUIFER WILL YIELD MODERATE TO LARGE SUPPLIES OF GOOD TO EXCELLENT QUALITY WATER TO WELLS. ESTIMATES OF RECHARGE AND STORAGE IN THAT REGION INDICATE THAT MANY TIMES THE CURRENT WITHDRAWAL RATE OF ABOUT 12 MGD CAN BE DEVELOPED FROM THE AQUIFER. ELSEWHERE, THE AQUIFER YIELDS EITHER SMALL QUANTITIES OF MODERATELY TO HIGHLY MINERALIZED WATER (SUBCROP AREA), OR SMALL TO MODERATE QUANTITIES OF FAIR TO GOOD QUALITY WATER (SOUTHEAST OUTCROP AREA). ADDITIONAL SUPPLIES

34 percent. (Woodard-USGS)

Availability of groundwater in Decatur County, Iowa


Iowa Geological Survey Water Atlas No. 2, 1967. 27 p. 9 fig, 3 Tab, -
Journal Announcement: SWRA1212

Groundwater information is presented to help solve the supply problems of some water users in Decatur County, Iowa. The information includes the location, definition, and estimated potential yields of the water-bearing materials in the unconsolidated deposits and the uppermost bedrock; an evaluation of the general occurrence and availability of water from bedrock groundwater sources. Decatur County has an area of 330,500 acres, according to the 1960 census, has a population of 10,539, about 55% of the population live on farms or in small communities where the water supply is obtained from private wells, ponds and cisterns. The remainder of the residents live in towns that have municipal water systems. Small-to-moderate supplies of water are available for development from the unconsolidated deposits in the county. Yields of several hundred gpm per well can be obtained from the deeper bedrock strata at about 2,600 to 2,700 feet in depth. Bedrock strata (Woodard-USGS)

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Horick, P. J. Geological Survey, Iowa City, Iowa.

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34 percent. (Woodard-USGS)
Jordan Aquifer of Iowa
Horick, P. J.; Steinhilsber, W. L.

The purpose of this atlas was (1) to define and describe the spatial relations and physical characteristics of the Jordan aquifer, (2) to present information on the occurrence availability, use, and chemical quality of water in the aquifer, and (3) to define and delineate changes in the potentiometric surface of the aquifer. The geohydrologic information was divided into 3 subject headings that were presented on separate atlas sheets—geology, hydrology, and chemical quality. The Jordan aquifer is the most productive water-yielding unit of the Cambrian-Ordovician aquifer system, and is one of the most dependable sources of water supply for large capacity wells in Iowa. The total thickness of the aquifer ranges from about 400 to 450 feet in east-central and southeastern Iowa to about 150 feet or less in western Iowa. The transmissivity of the aquifer is

Baseline Water Quality of Iowa’s Coal Region
Slack, L. J.

Geological Survey open-file report 79-980, 1979, 74 p, 1 Fig, 7 Tab, 7 Ref.

Journal Announcement: SWRA1303

To assist the Iowa Department of Environmental Quality in determining the effects that coal mining and attendant activities will have on the water quality of Iowa streams, the U.S. Geological Survey collected three sets of water-quality samples (representative of high, average, and low streamflow) in the White Breast, English, and Cedar Creek basins in south-central Iowa. These samples were analyzed by the U.S. Geological Survey Central Laboratory at Denver, Colorado, and by the Iowa State Hygienic Laboratory (Iowa City and Des Moines). The report presents the data collected from May to November 1978 at 15 stations in the study area. (Woodard-USGS)
GEHYDROLOGY OF DONIPHAN COUNTY, NORTHEASTERN KANSAS

BAYNE, C. K.

GEOLOGICAL SURVEY, WASHINGTON, D.C.

FOR SALE BY USGS, WASHINGTON, D.C. 20242, PRICE $0.75.

HYDROLOGIC INVESTIGATIONS ATLAS HA-462, 1973, 1 SHEET, 1 FIG, 6 MAP, 1 TAB. 13 REF.

Journal Announcement: SWRA701

THIS ONE-SHEET ATLAS DESCRIBES THE GROUNDWATER RESOURCES OF DONIPHAN COUNTY, THE NORTHEASTERN MOST COUNTY IN KANSAS. REPORTS DESCRIBING THE WATER RESOURCES OF THE AREA CONTIGUOUS TO DONIPHAN COUNTY ARE LISTED IN THE SELECTED REFERENCES. THE LOCATIONS OF WELLS AND TEST HOLES ARE IDENTIFIED ACCORDING TO THE FEDERAL SYSTEM OF LAND SUBDIVISION SHOWN BY A WELL-NUMBERING SYSTEM DIAGRAM. ADEQUATE SUPPLIES OF WATER FOR DOMESTIC AND STOCK USE GENERALLY ARE AVAILABLE FROM WELLS IN THE GLACIAL DEPOSITS UNDERLYING THE UPLAND AREAS OF DONIPHAN COUNTY. ADJACENT TO THE MAJOR STREAMS, THE GLACIAL DEPOSITS ARE THIN OR HAVE BEEN REMOVED BY EROSION. IN THESE LOCALIZED AREAS, SMALL SUPPLIES OF WATER ARE AVAILABLE ONLY FROM WELLS DRILLED INTO BEDROCK AQUIFERS. LARGE SUPPLIES OF WATER ARE AVAILABLE ONLY FROM WELLS IN ALLUVIAL DEPOSITS IN THE MISSOURI RIVER VALLEY. GROUNDWATER IN DONIPHAN COUNTY IS OF THE CALCIUM BICARBONATE TYPE. THE CONCENTRATION OF DISSOLVED SOLIDS IN GROUNDWATER IN GLACIAL DEPOSITS ARE BELOW THE U.S. PUBLIC HEALTH SERVICE RECOMMENDED MAXIMUM, EXCEPT THOSE FOR NITRATE AND IRON, WHICH IN RESPECTIVELY. (WOODARD-USGS)

Statistical summaries of water-quality data for streams draining coal-mined areas, southeastern Kansas

BEVANS, H. E., AND BLAIR, A. M., 1980


A Procedure for Predicting Concentrations of Dissolved Solids and Sulfate Ion in Streams Draining Areas Strip-Mined for Coal

BEVANS, H. E.


Journal Announcement: SWRA1426

Current trends in increased coal production necessitate the development of techniques to gauge the environmental degradation resulting from strip mining. A procedure is introduced for the prediction of dissolved-solids and sulfate concentrations in streams draining strip-mined areas. Concentrations are a function of the percentage of the drainage area that has been strip mined. These relationships are expressed by regression equations computed from data collected in streams draining strip-mined areas of Elk, Brown, and Crawford Counties in southeast Kansas. High correlation coefficients indicate that the relationships may be useful in the evaluation of present or future strip-mining operations. (USGS)

Description of Data-Collection System and Synopsis of Selected Hydrologic Data for Soldier Creek Basin, Kansas

CARSWELL, W. J. Jr


Open-File report 78-676, July 1978, 80 p. 32 figs 5 tabs, 8 ref, 2 append.

Journal Announcement: SWRA1207

Soldier Creek basin is a long, narrow basin encompassing an area of about 290 square miles almost directly north of Topeka, Kansas. A wide range of hydrologic data has been collected in the basin since the spring of 1964. These data include rainfall, stream discharge, sediment concentrations, chemical quality of water, and ground-water altitudes. The data collection system consists of 7 recording streamflow stations.
Hydrologic Data for Soldier Creek Basin, Kansas

Carswell, W. J., Jr.


Selected hydrologic data collected in the Soldier Creek basin in northeastern Kansas are available on magnetic tape in card-image format. Data on the tape include water discharge in fifteen-minute and daily time intervals; rainfall in fifteensecond and daily time intervals; concentrations and particle sizes of suspended sediments; particle sizes of bed material; ground-water levels; and chemical quality of water in concentrations of selected constituents. The data-collection system includes: (1) 7 recording streamflow stations; (2) 5 recording rainfall stations; (3) 51 nonrecording rainfall stations located within and adjacent to the basin; (4) 31 ground-water observation wells (two recording); and (5) intermittent chemical quality of water and sediment sampling sites. Examples of the information on magnetic tape for each type of data collected are presented in computer-printout format. (Woodard-USGS)

Selected Hydrologic Relationships for Soldier Creek, Northeastern Kansas

Carswell, W. J., Jr.


Hydrologic data from Soldier Creek basin, northeastern Kansas, were compared with relations from statewide data. The quantity and quality of streamflow were affected mostly by soils, slopes, and land use. Average annual precipitation during the study (1964-76) was 35.12 inches, or 2.3 percent greater than the long-term (1929-76) average. The average streamflow in Soldier Creek at Topeka was 23 percent greater than the long-term average. In general, frequency curves of annual peak discharges compared poorly with curves from statewide relations due to the absence of extremely low peaks during the short period. A comparison of low-flow frequency for drainage areas of more than 100 square miles suggests that reasonable results may be obtained by extrapolating the statewide relations to small basins. Comparisons of flow-duration curves confirms the extrapolation for basins of less than 100 square miles, although the percentage duration of mean flow is variable. Water surveys showed that calcium, bicarbonate, and sulfate were the predominant ions and dissolved solids were derived mostly from limestones and shales. Suspended sediment in gaged sites ranged from 9.24 to 86.1 tons per day; yield per unit area increased significantly between two sites due to changes in slopes and land use. (USGS)

Multiyear Low Flow in Southeastern Kansas

Carswell, William J., Jr.


Many existing water supplies in southeastern Kansas are proving inadequate to meet current and expanded future needs. One of the methods in which the use of highly variable streamflow in the area can be evaluated is with the aid of multiyear low-flow frequency information. Data from 19 stream-gaging stations in the study area and a base period of 1940-77 were used to develop maps from which discharge values for the 2- and 50-year recurrence interval for durations of 12, 24, 36, and 60 months can be obtained for ungaged sites that have drainage areas of less than 100 square miles. Discharge values for intervals greater than 2 years can be obtained by interpolation. Extrapolation of regionalized values in this report to drainage areas smaller than 100 square miles and larger than 1,000 square miles has not been validated.

A General Classification of Source Areas of Fluvial Sediment in Kansas

Collins, Dannie L.

U.S. Geological Survey Bulletin Number 886

A map showing the mean annual sediment yields of large subdivisions of Kansas has been compiled by synthesizing the available data on areas geology, topography, soil characteristics, precipitation, runoff, sedimentation in reservoirs, and measured suspended-load discharges. The mean annual sediment yield, in tons per square mile, is less than 50 in parts of southwestern and south-central Kansas and is more than 5,000 in the extreme north-central part. The intermediate values characteristic of the state tend to increase from west to east.

Kansas and Oklahoma: Observations of low-flow characteristics of ungauged streams is needed for evaluation of stream flows for such uses as maintenance of aquatic life, water supplies, and pollution control. Low-flow information given in this report is for streamflow unaffected by major regulation, such as by large reservoirs. Low-flow magnitude and frequency data are given for 87 continuous-record streamflow-gaging stations throughout Kansas. Accuracy of the magnitude-frequency values is influenced greatly by the variability of the low flows shown as zero flow are very reliable. Percentage errors are largest for small rates of flow, which also are easily changed by manmade influences.

Seven-day low-flow values are provided for 76 partial-record stations and have been estimated from the relations to concurrent flows at nearby continuous-record stations. Estimation of low-flow magnitude and frequency at ungauged sites is unfeasible except near a gaging station on the same stream or after measurements have been made over a wide range of low flows.

Flow-duration curves for ungauged sites can be estimated by using a set of maps and graphs showing regionalized characteristics of such curves and their relations to size of drainage area. The low-flow part of an estimated flow-duration curve can be improved by the use of miscellaneous low-flow measurements.

Magnitude and Frequency of Floods in Kansas 1975

Kansans have a right to know. A flood envelope curve for western Kansas range from 2,440 cubic feet per second for 1,6 square miles to 178,000 cubic feet per second for 6,770 square miles. Maximum known floods on an envelope curve for eastern Kansas range from 7,080 cubic feet per second for 2,06 square miles to 436,000 cubic feet per second for 3,818 square miles.

Geology and Ground-Water Resources of Neosho County, Kansas


TOMAYO DISC,


THE ATLAS DESCRIBES THE AVAILABILITY OF GROUND AND SURFACE WATER IN A COUNTY IN SOUTHEASTERN KANSAS. CONSOLIDATED BEDROCK AQUIFERS GENERALLY CONTAIN FAIR TO POOR QUALITY WATER AT SHALLOW DEPTHS. MOST WELLS YIELD LESS THAN 5 GPM, BUT SOME YIELD AS MUCH AS 40 GPM WITH WET MULBERRY RIVERS AND DRILLING INTO CAMPBELL AND ORDOVICIAN ROCKS HAVE YIELDED HIGHLY MINERALIZED WATER. UNCONSOLIDATED ALLUVIAL DEPOSITS ALONG THE NEOSHO RIVER AND OTHER STREAMS ARE THE BEST AQUIFERS. GROUPS OF WELLS IN COLLECTION AREAS IN THESE DEPOSITS MAY PRODUCE 100 GPM. AN AQUIFER TEST IN A WELL IN ALLUVIAL RIVER AT PARSONS IS ABOUT 2,400 CFS AND IN LABETTE CREEK ABOUT 150 CFS. BOTH STREAMS HAVE EXPERIENCED PERIODS OF NO FLOW. THE QUALITY OF THE SURFACE WATER IS GOOD. A 1:63,360 SCALE MAP SHOWS GEOLOGIC UNITS, DEPTH TO WATER, YIELD, AND ALTITUDE OF WELLS. TABLES GIVE WATER-BEARING CHARACTERISTICS OF THE GEOLOGIC UNITS AND ANALYSES OF WATER FROM 76 REPRESENTATIVE WELLS. (23 REFERENCES)

Physical and Hydrologic Environments of the Mulberry Coal Reserves in Eastern Kansas


Strippable reserves of Mulberry coal underlie an area of approximately 300 square miles in Miami, Linn, and Bourbon Counties of eastern Kansas. Although subject to state reclamation, the land current and projected strip mining of this relatively thin coal seam could alter the hydrologic environment of the study area. Drained by the Marais des Cygnes and Little Osage Rivers and their tributaries, this area is characterized by low relief and moderately impermeable soils. Streamflows are poorly sustained by ground-water discharge and fluctuate widely due to changes in extent of surface-water use and supplies. Because ground-water supplies are generally unreliable in quantity and quality, surface water is used to meet most water requirements in the study area. Primary uses of surface waters are for domestic supplies, maintenance of wildlife and recreational areas, and cooling needs at the LaCygne Power Plant. The prevailing chemical type of the natural streamflow is calcium bicarbonate, with concentrations of dissolved solids generally less than 500 milligrams per liter and pH near neutral.
Additional streamflow and water-quality data are needed to evaluate pre-mining characteristics and any changes in the hydrologic environment as strip mining proceeds within the study area. A network of data collection stations and a sampling scheme have been established to acquire this additional information.

Geology and Ground-water Resources of Miami County, Kansas
Miller, Don E.

Ground Water in the Grand (Neosho) River Basin, Kansas and Oklahoma
Morton, Robert B., and Fader, Stuart W.

Geology and Ground-Water Resources of Montgomery County, Southeastern Kansas
O'Connor, Howard G.

Discharge Estimates in Surface-Mine Areas using Channel-Geometry Techniques
Ostertag, W. R., and Hedman, E. R.

Surface-mining and reclamation practices generally require extensive hydrologic knowledge of an area. Adequate streamflow data from instrumented sites rarely are available for surface-mine areas, and estimates of streamflow based on rainfall-runoff models, drainage area and basin characteristics, or transfer of streamflow records from gaged to ungaged basins, sometimes have proven unreliable. Channel-geometry measurements offer an alternative method of estimating streamflow characteristics at ungaged sites. The method uses the empirical development of simple or multiple power-function equations yielding a discharge value from channel-configuration and channel-material data. The equations have been developed by collecting geometric and sediment data at numerous gaged sites and statistically relating those data to specified discharge characteristics.

The principal advantage of the channel-geometry method is that estimates of discharge can be obtained quickly and inexpensively. Often results are as reliable as 5 to 10 years of continuous streamflow records. Relatively recent changes in flow regimen, such as those caused by depletion of streamflow by ground-water withdrawals or diversion for irrigation, are detectable by channel-geometry techniques.

Discharges of perennial streams in coal-mine areas can be estimated using equations developed from data of the central and western United States. Equations intended specifically for ephemeral channels in areas of stripable coal resources in arid and semiarid areas have been developed from data collected in the western half of the conterminous United States.

Quality-of-water data and statistical summary for selected coal-mine strip pits in Crawford and Cherokee Counties, southeastern Kansas

GEOLGY AND GROUNDWATER RESOURCES OF LINN COUNTY, KANSAS
Seevers, William J.
KANSAS STATE GEOLOGICAL SURVEY, LAWRENCE.

KANSAS GEOLOGICAL SURVEY BULLETIN 193, NOVEMBER 1969. 65 P.

ANNOUNCEMENT: S2RAO301
LINN COUNTY IS LOCATED ALONG THE KANSAS-MISSOURI BOUNDARY IN EAST-CENTER KANSAS AND IS A NEARLY SQUARE AREA OF ABOUT 605 SQUARE MILES. ONLY VERY SMALL QUANTITIES OF WATER ARE OBTAINED FROM PENNSYLVANIAN ROCKS IN LINN COUNTY. YIELDS RARELY EXCEED 1 GALLON PER MINUTE AND ARE NORMALLY BARELY SUFFICIENT FOR DOMESTIC PURPOSES. LIMESTONES ARE THE MOST PRODUCTIVE AQUIFERS AND LIMESTONES OF THE LOWER PART OF THE KANSAS CITY GROUP ARE THE BEST OF THE BEDROCK AQUIFERS. GROUNDWATER BELOW A DEPTH OF ABOUT 100 FEET IN THIS AREA IS NORMALLY TOO HIGHLY MINERALIZED FOR USE. LARGE QUANTITIES (30 TO 100 GPM) OF GOOD QUALITY WATER ARE OBTAINED FROM PROPERLY CONSTRUCTED AND DEVELOPED WELLS IN ILLINOISAN AND WISCONSINAN VALLEY-FILL DEPOSITS MAINLY FROM THIN GRAVEL DEPOSITS NEAR THE BASE. (KNAPP-USGS)

Geology and Ground-Water Resources of Jackson County, Kansas
Walter, Kenneth L.

GEOHYDROLOGY OF ATCHISON COUNTY, NORTHEASTERN KANSAS
Ward, J. P.

GEOLOGICAL SURVEY, WASHINGTON, D.C.
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20242.
PRICE $1.25 PER SET. HYDROLOGIC INVESTIGATIONS ATLAS HA-467.
1973, 2 SHEETS, 1 TAB., 13 REF.

ANNOUNCEMENT: SWRAU712
INFORMATION IS PRESENTED ON THE GROUNDWATER RESOURCES OF ATCHISON COUNTY, KANSAS. BEDROCK OF LATE PENNSYLVANIAN AGE IS EXPOSED THROUGHOUT THE COUNTY. UNCONSOLIDATED GLACIAL DRIFT, LOESS, DEPOSITS BENEATH TERRACES, AND ALLUVIUM OVERLIE THE BEDROCK SURFACE. BOTH TOPOGRAPHY AND TEXTURE OF THE GLACIAL DRIFT EXERT A STRONG INFLUENCE ON RECHARGE TO AND DISCHARGE FROM THE AQUIFERS. DISCHARGE FROM THE AQUIFERS IS PRIMARILY TO STREAMS THAT DRAIN THE COUNTY. SOME DISCHARGE OCCURS FROM SEEPS AND SPRINGS ALONG VALLEY WALLS AND FROM WELLS. A FEW WELLS IN THE COUNTY FLOW CONTINUOUSLY. THE UNCONSOLIDATED PLEISTOCENE

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DEPOSITS ARE THE BEST POTENTIAL SOURCES OF GROUNDWATER IN THE COUNTY. THE MOST FAVORABLE AREAS OVERLIE PERMEABLE SAND AND GRavel FROM WHICH FOUR AREAS EXIST WHERE WATER FLOWS AT THE SURFACE DUE TO ARTESIAN PRESSURE. WELLS ARE COMPLETED IN UPRIGHT, GLACIAL DRIFT, AND ALLUVIAL AQUIFERS. A SUMMARY OF THE CONCENTRATIONS OF SELECTED DISSOLVED SUBSTANCES IS SHOWN ON THE CORRELATION OF STRATIGRAPHY AND WATER QUALITY DIAGRAM, MOST OF THE WATER IS OF THE CALCIUM BICarbonate TYPE. ALTHOUGH HARD, IT GENERALLY CAN BE SOFTENED BY SIMPLE TREATMENT. DISSOLVED SOLIDS CONCENTRATIONS ARE GENERALLY HIGH, BUT ACCEPTABLE. THE HIGHEST CONCENTRATIONS OF DISSOLVED SOLIDS ARE IN WATER FROM THICK GLACIAL DEPOSITS.

GEOHYDROLOGY OF ATCHISON COUNTY, NORTHEASTERN KANSAS

WARD, JOHN R., KANSAS GEOLOGICAL SURVEY, LAWRENCE.

GEOLoGICAL SURVEY OPEN-FILE REPORT, 1971. 22 P., 6 FIG, 3 PLATE, 1 TAB., 12 REF., JOURNAL ANNOUNCEMENT: SWRA0424

DATA CONCERNING GROUNDWATER RESOURCES IN ATCHISON COUNTY, KANSAS ARE PRESENTED. THE UNCONSOLIDATED PLEISTOCENE DEPOSITS ARE THE BEST POTENTIAL SOURCES OF GROUNDWATER IN THE COUNTY, BECAUSE THE WISCONSIN TERRACE DEPOSITS AND THE ALLUVIUM ARE PRINCIPALLY Silt AND CLAY THROUGHOUT MOST OF THE COUNTY. YIELDS ARE GENERALLY SMALL, HOWEVER, ALONG THE MISSOURI RIVER IS COMPOSED OF VERY PERMEABLE SAND AND GRAVEL FROM WHICH WELL YIELDS OF 2,000 GPM ARE POSSIBLE. AN AQUIFER TEST IN THE ALLUVIUM SHOWED A WATER-LEVEL DRAWDOWN OF 11.3 FEET AFTER PUMPING 1,350 GPM CONTINUOUSLY FOR 155 MINUTES. THE SPECIFIC CAPACITY FOR THE TEST WAS 175 GPM PER FOOT OF DRAWDOWN. THE HYDRAULIC CONDUCTIVITY WAS ABOUT 2,050 GPM PER SQUARE FOOT. FOUR AREAS EXIST WHERE WATER FLOWS AT THE SURFACE DUE TO ARTESIAN PRESSURE. DISSOLVED SOLIDS CONCENTRATIONS THROUGHOUT THE COUNTY GLACIAL DEPOSITS.

GEOHYDROLOGY OF JEFFERSON COUNTY, NORTHEASTERN KANSAS

WOODARD, J. D., KANSAS STATE GEOLOGICAL SURVEY, LAWRENCE.

KANSAS GEOLOGICAL SURVEY BULLETIN 202, PART 4, APRIL 1972, 20 P., 1 FIG, 1 PLATE, 1 TAB., 15 REF., JOURNAL ANNOUNCEMENT: SWRA0519

GEOHYDROLOGIC DATA FOR JEFFERSON COUNTY, KANSAS, ARE BASED ON GEOLOGY, INTERPRETATION OF GEODATA, INTERPRETATION OF AERIAL PHOTOGRAPHS, TEST-HOLE LOGS AND DRILLER'S LOGS, INVENTORY OF SELECTED WELLS, AND ANALYSIS OF WATER SAMPLES FROM SELECTED WELLS. THE BEST QUANTITIES OF GROUNDWATER ARE FROM WELLS IN ALLUVIUM IN THE KANSAS RIVER VALLEY WITH YIELDS OF AS MUCH AS 1,350 GPM. BECAUSE THE USE OF GROUNDWATER FOR IRRIGATION IS SEASONAL, AND BECAUSE PUMPING FOR MUNICIPAL OR PUBLIC SUPPLY USE IS SMALL COMPARED WITH THE AMOUNT OF GROUNDWATER AVAILABLE, THE NATURAL SLOPE OF THE WATER TABLE IN

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THE AREA ESSENTIALLY IS UNAFFECTED. THE CONCENTRATION OF DISSOLVED SALTS IS.

WATER RESOURCES DATA FOR KANSAS: PUBLISHED ANNUALLY SINCE 1971

GEOLoGICAL SURVEY, KANSAS WATER RESOURCES DIV.

GEOLoGICAL SURVEY BASIC DATA REPORTS:

GEOHYDROLOGY OF ATCHISON COUNTY, NORTHEASTERN KANSAS


Water Resources Data for Kansas, published annually since 1975


Water resources data for Kansas presented in two volumes, consist of records of stage, discharge, and water quality streams, stage, contents, and water quality of lakes and reservoirs, and water levels and water quality in wells. All data in this report represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Kansas. (USGS).
Public and industrial water supplies of the Eastern Coalfield Region, Kentucky
U.S. Geological Survey Circular 309
About 115,100,000 gallons per day of water is pumped for 119 large public and industrial water supplies in the 29 counties of the Eastern Coalfield Region of Kentucky. About 12 percent of water is used for public supply and about 88 percent for industrial supply. Public supplies provide 191,000 people with water, and per capita consumption ranges from 12 to possibly 460 gallons per day. The quantity of water pumped in a public supply for industrial use is sometimes more than half the total water provided. Industries in the region use water primarily for cooling. The largest amounts are used for coal washing, gas transmission, petroleum processing, railroad supply, coal, and steel products manufacture.

About 6 percent of the water pumped for public and industrial supplies is ground water and about 94 percent is surface water. However, of the total number of cities, industries, and institutions supplied, ground water provides 37 percent of the supply, surface water 52 percent, and ground and surface water combined, 11 percent.

Large ground-water supplies in the region are obtained principally from wells and abandoned coal mines, but a few are obtained from springs. Wells yield from 2 to 330 gallons per minute (gallons per minute) and yet most of their water from sandstone in rocks of Pennsylvanian age and from sand and gravel in alluvial or stream deposits. Most water is of the calcium or magnesium bicarbonate or sodium bicarbonate type; however, some water is high in iron content and some has a large proportion of sulfate.

Most of the surface water pumped in the Eastern Coalfield is from the Big Sandy River and its tributaries, and from the Ohio River. In the future, surface water will be the principal source for towns and industries needing large quantities of water.

Authors' abstract.

Drainage Areas of Streams at Selected Locations in Kentucky
Journal Announcement: SWRA1506
The drainage areas for more than 2,000 selected sites throughout Kentucky were determined. Areas of limestone terrain characterized by sinkholes are indicated in basins where they have been determined. Each location is referenced by U.S. Geological Survey station number (where assigned), latitude, longitude, county code, topographic quadrangle, river distance, and in some cases by nearby town or landmark. All values are given in both English and metric units and an alphabetical index by stream name is provided. (USGS)

Influences of strip mining on the hydrologic environment of parts of Beaver Creek basin, Kentucky, 1955-59
Colliver, C. R., Pickering, R. J., and Mussrey, J. J., editors

Influences of strip mining on the hydrologic environment of parts of Beaver Creek basin, Kentucky, 1955-56
Colliver, C. R., Pickering, R. J., and Mussrey, J. J., editors

a Fluvial Sediment Study of Fishtrap and Dewey Lakes Drainage Basins, Kentucky - Virginia
Available from the National Technical Information Service, Springfield, VA 22161 as A0-1056 753 Price codes: A06 in paper copy, A01 in microfiche, water-resources investigations 77-123, March 1978, 92 p., 28 figs., 9 tables, 50 refs.
Journal Announcement: SWRA1123
Fourteen drainage basins above Fishtrap and Dewey Lakes in the Levisa Fork and Johns Creek drainage basins of eastern Kentucky and southwestern Virginia were studied to determine sedimentation rates and origin of sediment entering the two lakes. The lakes are grouped similarly in magnitude and by season. Disturbed areas were grouped similarly in the numbers of square miles where surface-mining techniques predominated, and from 732 to 3,670 tons per square mile where underground mining methods predominated. Yields, in terms of tons of per acre-foot of runoff, ranged from 2.2 to 15 for surface-mined areas, and from 0.3 to 2.7 for underground mined areas. Water and sediment discharge from direct runoff during storms were compared for selected surface-mined and underground-mined areas. Data points of two extensively surface-mined areas, one from the current project and one from a previous project in Beaver Creek basin, McCreary County, Kentucky, are presented in magnitude and by season. Disturbed areas from mining activities determined from aerial photographs reached 17 percent in one study area where extensive surface mining was being practiced. For most areas where underground mining was practiced, percentage disturbed area was almost negligible. Trap efficiency of Fishtrap Lake was 89 percent, and was 62 percent for Dewey Lake. Average annual deposition rates were 466 and 146 acre-feet for Fishtrap and Dewey Lakes, respectively. The chemical quality of water in the Levisa Fork basin has been altered by man's

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activities. (Woodard-USGS)


Surface mining of coal in the United States increased from 406 million tons to almost 800 million tons from 1978 to 1979, in the coal-rich 1,550-square-mile Tug Fork basin located in Kentucky, Virginia, and West Virginia. There has been a 7250 percent increase since 1950 in areas affected by surface mining activities.

This study used a rainfall-runoff model to determine if land-use changes associated with surface mining in the Tug Fork basin have affected basin streamflow characteristics. The model was calibrated and verified for two periods: one representing 1980-1982 and one representing 1950-1952. Two 29-year synthetic daily streamflow time series representing the two land-use conditions were generated. Statistical tests performed on the two time series at 15 points in the basin showed no difference at the 0.01 percent confidence level at any of the locations.

In addition, analyses were made to determine if future increases in surface-mining activities might affect basin streamflow. One analysis showed that increasing mining in an upland watershed by as much as 200 percent had little effect on streamflow in the intermediate area and no effect on streamflow at downstream locations along the Tug Fork. Even for a scenario where all areas disturbed by mining were assumed totally impervious, the modeling process demonstrated that the increase in streamflow was less than 1% for recurrence intervals of 5, 10, 25, 50, 100, and 100 years was less than 4 percent at the basin outlet.


A detailed investigation of the effects of mine drainage on stream water quality was carried out on the watershed of the Northern Kentucky River in 1975. Specific-conductance measurements were made at 415 sites, repeatedly at some of them. Discharge estimates and pH values were also obtained in most instances while sulfate and chloride data were obtained about half the time.

Based on a daily sulfate record simulated from daily conductivity values, trends in sulfate loads were assessed for the North Fork Kentucky River at Hazard for the 1965 river at Hazard for the 1973 water years. The mean annual sulfate concentration declined from a maximum of 140 milligrams per liter in the 1965 water year to 72 milligrams per liter in the 1973 water year of what it had been 11 years earlier. The irregular appearance of acid and high sulfate discharges in the earlier years indicates that these probably originated as sudden releases of water from underground mines or as water flushed from coal washing ponds.

Over the area as a whole, coal mining has caused the mean annual dissolved-solids concentration to increase from about 50 to 150 milligrams per liter while the most responsive ion, sulfate, increased in concentration from about 8 to 50 milligrams per liter. The most damaging effect of strip mining on water quality appears to be the increased iron content. Even in those watersheds where streams are adequately protected by silt-catchment dams and ponds, both road construction and the dam construction itself may, for a time, introduce large quantities of sediment into the streams. Strip mining of the Hazard number 9 seam near Hazard has introduced large quantities of acid sulfate mine drainage into Lottis Creek, Yellow Creek, and other streams but still only a very small part of the total study area is severely affected by acid water.

The bulk of acid mine drainage produced in the study area is immediately neutralized by carbonate rocks or by exchangeable bases from the aquifer material before it ever reaches the streams. The most acid water sample collected during this study had already lost 83 percent of the acidity presumed to have been washed out with the mine drainage. Usually high concentrations of several trace elements were observed in acid mine drainage and in streams affected by it, but in no cases were these at levels harmful to human health; although both iron and manganese concentrations were commonly high enough to give the water a bad taste and to leave deposits on containers. The highest concentrations observed for some of the trace elements include: 76 micrograms per liter total arsenic, 400 micrograms per liter dissolved cobalt, 100 micrograms per liter dissolved copper, 82 milligrams per liter dissolved iron, 300 micrograms per liter total lead, 22,000 micrograms per liter dissolved manganese, 1,200 micrograms per liter dissolved nickel, and 67 micrograms per liter dissolved vanadium. Some watersheds, especially those where only the Fire Clay and Leatherwood seams have been mined, have recovered to the point where the water draining from them is similar in pH and in concentrations of dissolved solids to that which was present prior to mining.

Effects of coal mining on small streams of the Levisa Fork

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KENTUCKY

Disart, J. E.

U.S. Geological Survey Water-Resources Investigation

Downstream effects of coal mining on the surface-water quality of the Levissa Fork basin. Kentucky-Virginia

Disart, J. E.

U.S. Geological Survey Water-Resources Investigation

EFFECTS OF COAL MINING ON THE WATER RESOURCES OF THE TRADEWATER RIVER BASIN. KENTUCKY

GRUNB, M. F.; RYDER, P. W.

GEOLOGICAL SURVEY, WASHINGTON, D.C.

AVAILABLE FROM GPO, WASHINGTON, D.C., 20402. PRICE $2.10.

MAY 1968, 7 FIG. 1 PLATE. 2 P.

Journal Announcement: SWRA027


FLDGS ON LICKING RIVER IN VICINITY OF SALTERSVILLE, KENTUCKY, WERE STUDIED TO OBTAIN HYDROLOGIC DATA THAT Button THE EXTENT, DEPTH, AND FREQUENCY OF FLOODS THAT AFFECT THE ECONOMY OF DEVELOPMENTS ON THE FLOOD PLAINS. THE DATA PROVIDES A BASIS FOR SOLVING EXISTING FLOOD PLAIN PROBLEMS AND FOR REGULATING FUTURE LAND USE AND DEVELOPMENT TO REDUCE FUTURE FLOOD DAMAGE BY BUILDING AND ZONING REGULATIONS, LOCATING WASTE DISPOSAL AND WATER TREATMENT FACILITIES, AND DEVELOPING RECREATIONAL AREAS. THE AREAS INFLUENED BY 5-, 25-, AND 50-YEAR FLOOIS ARE SHOWN ON A TOPOGRAPHIC MAP, SCALE 1:12,000. HEIGHTS OF FLOODS ARE TABULATED. ANNUAL FLOODS ARE SHOWN GRAPHICALLY PROVING THE IRREGULARITY OF FLOOD MIGRATIONS AND THE TYPICAL MAGNITUDES OF FLOODS. FOR EACH GAGING STATION IN THE AREA, FLOOD DISCHARGES AND GAGE HEIGHTS ARE TABULATED. MAJOR FLOOD PROFILES ARE DRAWN. THE FREQUENCY-GHEIGHT RELATIONSHIP IS SHOWN GRAPHICALLY. (KNAPP-USGS)

Occurrence of fresh water in the Lee formation in parts of Elliott, Johnson, Lawrence, Magoffin, and Morgan Counties, Eastern Coal Field Region, Kentucky

Hopkins, H. T.

U.S. Geological Survey Water Supply Paper 1867, 44 P.

GROUNDRW

Hopkins, H. T.; HULL, D. S.

GEOLOGICAL SURVEY, WASHINGTON, D.C.

MAY 1970, 6 FIG. 1 PLATE. 4 P.

Journal Announcement: SWRA027

THE EFFECTS OF MINING ON THE OCCURRENCE, MOVEMENT, AND QUALITY OF GROUNDWATER WERE STUDIED IN THE CANE BRANCH STUDY AREA, KENTUCKY. GROUNDWATER IN THE ESSENTIALLY UNMINED WEST FORK CANE BRANCH STUDY AREA WAS ALSO INVESTIGATED TO PROVIDE A BASIS FOR COMPARISON. THERE HAS BEEN NO SIGNIFICANT CHANGE IN THE OCCURRENCE AND MOVEMENT OF GROUNDWATER IN THE VICINITY OF THE SOUTHWEST SPOIL BANK SINCE BEGINNINGS OF OBSERVATIONS IN THE SPRING OF 1958. SHALLOW GROUNDWATER IN BEDROCK IS RECHARGED BY PRECIPITATION AND MOVES FROM TOPOGRAPHICALLY HIGH AREAS TO STREAMS. GROUNDWATER IN THE SOUTHWEST SPOIL BANK IS RECHARGED BY DIRECT INFILTRATION OF PRECIPITATION AND SEEPAGE FROM ADJACENT POOLS, AND IT DISCHARGES MOSTLY EASTWARD INTO TRIBUTARIES DRAINAGE THE SPOIL BANK AREA. FLUCTUATIONS OF THE WATER TABLE IN THE SPOIL BANK ARE LARGE CONTROLLED BY DIRECT INFILTRATION OF PRECIPITATION DURING THE WINTER-Spring SEASON, BUT IT ARE STRONGLY INFLUENCED BY SEEPAGE FROM POOLS ADJACENT TO THE SPOIL BANK DURING THE SUMMER-AUTUMN SEASON. THE SHAPE AND SLOPE OF THE WATER TABLE IN THE SPOIL BANK HAVE NOT CHANGED SIGNIFICANTLY SINCE OBSERVATIONS
Kentucky


This report is concerned with acid mine drainage and other forms of chemical water pollution attributed to surface mining in the Eastern Kentucky Coalfield and gives primary emphasis to identifying coal seams with the highest acid-producing potential. The parameters, criteria, and methodology developed and used to achieve this end are described. The research effort included a general evaluation of existing water-quality data for all the major drainage basins in the Eastern Kentucky Coalfields, followed by a concentrated study in Kentucky, Big Sandy, and Cumberland River basins. (Adapted from summary.)


The water resources, water use, water problems, and water law of Kentucky are discussed in a publication intended for educational purposes. The report has a 30-page introduction, 14 pages of water resources, 24 pages of water use, 4 pages of water law, 37 pages of water problems, and 13 pages of water law. The report includes a bibliography of Kentucky water information. (KNAPP-USGS)


PRECIPITATION AND RUNOFF MCCAVER, J. A. GEOLOGICAL SURVEY, WASHINGTON, D.C.


The runoff characteristics of Cane Branch and Helton Branch basins of Kentucky were studied to relate any observed differences between the two basins to differences in their exposure to strip mining. The drainage basin of Cane Branch includes strip-mined areas, whereas the drainage basin of Helton Branch has not been disturbed by strip mining. There were measurable differences in runoff characteristics between the two basins. The fact that similar percentages of annual precipitation go to runoff and evapotranspiration in each basin, application of 10th flow-duration and annual-flood methods to analysis of stream hydrographs, indicated that Cane Branch has greater peak flows per square mile of drainage area and more rapid changes in discharge, but Helton Branch has greater base flows. However, an examination of the hydrologic data for progressive change in runoff characteristics of Cane Branch that could be related to the history of mining in the area failed to indicate any such change. (See also W71-07935) (KNAPP-USGS)


Data on the sources, pumping, treatment, and storage of water for public and industrial water supplies in the 10 counties of the Western Coalfield Region of Kentucky are presented. The total daily pumping of water in the region is about 50,000,000 gallons. Seventy-two percent of this is obtained from wells and 28 percent is obtained from surface supplies. The Quaternary alluvium provides about 91 percent of the ground water used in the region. Of the total pumpage 24 percent is used for all purposes from public supplies. The daily consumption of water pumped from public supplies ranges from 21 to 192 gallons and averages 110 gallons. The chief industrial of water is for coal washing, production of chemicals, distilling, and secondary recovery of petroleum.
The region is the southern part of a large basin of shales and sandstones of Pennsylvanian age which is overlain in places by alluvial sands and gravels and silts of Quaternary and Recent age. The chief aquifers are the Pennsylvanian sandstones and the sands and gravels of the alluvium. The water in the Pennsylvanian sandstones is fresh in the outcrop areas and becomes progressively more mineralized towards the center of the basin. Yields from the Pennsylvanian sandstones range from a few gallons per minute up to 500 gal/min. Water in the alluvium ranges from hard to very hard and may be pumped from vertical wells at rates up to at least 1,000 gal/min. (Author's abstract.)

Reconnaissance study of ground-water resources in the western Coal field region, Kentucky
Maxwell, R. W., and DeVaul, R. W., 1962d

Ground-water resources of the Jenkins-Whitesburg area, Kentucky
Mull, D. S., 1965

Availability and quality of water from underground coal mines in Johnson and Martin Counties, Kentucky
Mull, D. S., Cordoviola, S. J., Risser, D. W.

Public and industrial water supplies of Kentucky 1968-69
Mull, D. S.; Cushman, R. V.; Lambert, T. W., Geological Survey, Louisville, KY.

Ground-water resources of the Jenkins-Whitesburg area, Kentucky
Mull, D. S., 1965

Water resources of the Middlesboro area, Kentucky

Lever in water from below-drainage mines than in water from those above-drainage. (USGS)

Public and industrial water supplies of Kentucky, 1968-69
Mull, D. S.; Cushman, R. V.; Lambert, T. W., Geological Survey, Louisville, KY.

Ground-water resources of the Jenkins-Whitesburg area, Kentucky
Mull, D. S., 1965
TREATMENT THAN IRON REMOVAL. FURTHER DEVELOPMENT OF SURFACE WATER WOULD REQUIRE IMPOUNDMENT. SURFACE WATER QUALITY IS SLIGHTLY IMPAIRED BY ACID MINE DRAINAGE AND WASTE DISPOSAL. FLOOD HAZARDS ARE REDUCED BY CONTROL STRUCTURES.

Description of physical environment and of strip-mining operations in parts of Beaver Creek basin, Kentucky


Description of physical environment and of strip-mining operations in parts of Beaver Creek basin, Kentucky

M. A. area of each study area, in square miles, is as follows: Helton Branch, 0.85; Cane Branch, 0.67; and West Fork Cane Branch, a major tributary to Cane Branch, 0.26. Profiles of the formations, stratigraphic section of the land slopes show that the study areas are similar topographically. The Helton Branch channel has a bedrock floor. Numerous reaches of the Cane and West Fork Cane channel floors are composed of sediment deposits.

The stratigraphic section is divided into three parts, as follows: (1) The strata below the main cliff-forming sandstone that consist mostly of siltstone and gray shale; (2) the main cliff-forming sandstone that makes the steep valley walls; and (3) the strata above the main cliff-forming sandstone that consist of sandstone, siltstone, and gray shale. Downstream from the spoil banks, the stream beds and the lower flood plains are composed of fluvial deposits consisting predominantly of clay and silt-size particles that were derived from the spoil banks. In the Helton Branch basin, fluvial deposits consist of sand- to boulder-size fragments, and in the West Fork Cane Branch basin these deposits consist of silt- to boulder-size fragments. Several great soil groups occur within the study areas, including the Red-Yellow Podzolic group, the Planosol group, and the Alluvial group. The main soil series present are the Muskingum, Hertsel's, Wellston, Johnsburg, Tills, and Enders, which have formed from parent sandstone, siltstone, and claystone beds. The hydrologic classification of soils indicates that the Helton and Cane Branch study areas are similar in terms of potential runoff, insofar as the soils are concerned.

The climate of southeastern Kentucky is virtually continental in character. The temperature ranges annually from about 35 to 100 degrees F. The mean annual precipitation is 46 inches. Thunderstorms are common during the spring and summer months. The mean annual snowfall is about 11 inches. Annual runoffs average the largest number of stems per acre than the Cane Branch area. (2) From 1955 to 1960s, (3) From May 1955 to April 1956, (4) From May 1955 to April 1956, a third operator took place in the Cane and West Fork Cane Branch study areas. From 1955 to 1956, the Barren Fork coal seam was stripped mined the study area on the Cane Branch area. After mining was completed, the spoil bank resulting from the operation and cleared two ditches to allow drainage into the Cane Branch.

From October 1957 to January 1959, a second operator diverted the coal seam in the highwall on the southwest side of the Cane Branch area. Acid water was frequently pumped from the drift mine into Cane Branch during the mining operation. From the fall of 1958 to August 1959, the mine operator leveled the spoil bank resulting from the operation and cleared two ditches to allow drainage into the Cane Branch.

During February and March 1960s, a fourth operator, in prospecting for coal along the divide between the Cane and West Fork Cane Branch basins, built a small spoil bank in each of these basins. No coal was mined in the areas during this activity.
Geochemistry of water by Collier, C. K., and others, Influences of strip mining on the hydrologic environment of parts of Beaver Creek basin, Kentucky
Musser, J. J., and Whetstone, G. W. 1964


Journal Announcement: SURAU416
One of the environmental factors most obviously influenced by strip mining in the Cane Branch basin of Kentucky is the chemical composition of the water. Cane Branch is an acid stream heading mining. This report describes and evaluates (1) changes in the chemical composition of water in the Cane Branch study area, (2) the chemical composition of water in nearby study areas unaffected by mining, and (3) the general persistence of acidic water downstream from the Cane Branch mining area. Although fluctuations of annual mean concentrations due to climatic variations have made it difficult to identify a definite trend during the period 1962-66, apparently there was little change in the rate of chemical weathering or in the chemical composition of the water in Cane Branch during the last year of the study. As the acid mine drainage from the Cane Branch area moves downstream, it is diluted and neutralized by inflow from streams containing bicarbonate alkalinity. The effects of the mine drainage are almost undetectable at the point where water from Little Hurricane Fork enters Cane Branch, and Cane Branch below this point has a slightly acidic pH like that of neighboring streams unaffected by acid mine drainage. (See also WP71-07935) (KNAPP-USGS)

Geology and ground-water resources of the Pittsburgh quadrangle, Kentucky, Price, W. E., Jr., Mullis, D. S., and Kilburn, Chabot, 1955


The availability of ground water in different parts of this region was determined chiefly by analyzing ground-water data collected during the reconnaissance. The resulting water-availability maps, published as Hydrologic Investigations Atlases, were designed to be used in conjunction with this report.

Water from wells and springs in the Eastern Coalfield Region varies widely in chemical character, but most of the water is of the calcium magnesium bicarbonate or sodium bicarbonate type. Chloride and iron are the most objectionable constituents in the ground water of the region. Salty water is known to occur at depths of less than 300 feet in all the physiographic sections of the region, except the Cumberland Mountain section. In general, the chloride content of the ground water becomes higher with increasing depth below drainage, and water that is salty enough to be called a brine eventually will be met in wells drilled deep enough in any part of the region.

Iron is present in noticeable quantities in the water from wells and springs in all formations in the region. Areas in which vadose water drains through beds of black shale or coal, or in which acidic mine drainage recharges the ground water, probably will have a high iron content. Under these circumstances, the iron-bearing water probably will occur only at shallow depths.

Hydrology of Area 34, Eastern Coal Province, Kentucky

Hydrology of Area 34, Interior Coal Province, Eastern Region, Kentucky
Quinones, F., York, K. L., and Plebuch, R.
U.S. Geological Survey

Synthetic fuels development, earth science considerations. (Duplicated see Alabama)

Flooding of April 1977 in the Appalachian Region of Kentucky, Tennessee, Virginia, and West Virginia (Duplicated see Virginia)
Runzer, G. S., and Chin, E. D., 1980

INDEX TO WATER-QUALITY DATA AVAILABLE FROM THE U.S. GEOLOGICAL SURVEY IN MACHINE-READABLE FORM TO DECEMBER 31, 1972, SOUTHEASTERN REGION
SHOWERS, C. H., WILLIAMS, O. O.
GEOLoGY SURVEY, RESTON, VA. PAPER COPY, $2.25 IN
in selected basins are also provided. The information is preliminary and subject to revisions. (Woodard-USGS)

LOW-FLOW CHARACTERISTICS OF KENTUCKY STREAMS
SWRA117, R. V., Jr.
GEOLOGICAL SURVEY, WASHINGTON, D.C.
OPEN-FILE REPORT, 1974. 1 SHEET, 1 MAP.
Journal Announcement: SWRA876
LOW-FLOW DATA ARE GIVEN FOR STREAMS THROUGHOUT KENTUCKY. WHERE MORE THAN 10 YEARS OF RECORD ARE AVAILABLE, THE 7-DAY ANNUAL LOW FLOWS ARE USED TO DEFINE A FREQUENCY CURVE. THE DISCHARGE AT 10-YEAR RECURRENCE INTERVAL FROM THAT CURVE IS THE 7-DAY Q10. THIS REPORT PRESENTS THE 7-DAY Q10 DISCHARGE AT 85 CONTINUOUS-RECORD STATIONS AND AT 49 PARTIAL-RECORD STATIONS. THESE VALUES ARE SHOWN ON A MAP ALONG WITH THE STATION NUMBER AND THE DRAINAGE AREA. (KNAPP-USGS)

Water Levels in Observation Wells in Kentucky 1935 Through 1976
White, J. L.; Kernodle, J. M. Jr.
Journal Announcement: SWRA1117
Hydrographs show water levels in observation wells in Kentucky from 1935 through 1976. The water levels in these wells are measured as part of the national observation well network and in cooperation with the University of Kentucky. Kentucky Geological Survey. The hydrographs are arranged by the five physiographic regions of Kentucky, alphabetically by county, and in ascending order of latitude. The collection and tabulation of ground-water levels and aquifer data are used to determine short-term changes and long-range trends in water-level fluctuations which reflect the changes in storage within ground-water reservoirs. (Woodard-USGS)

YIELDS AND SPECIFIC CAPACITIES OF BEDROCK WELLS IN KENTUCKY
Whitesides, D. V.
GEOLOGICAL SURVEY, LOUISVILLE, KY.
KENTUCKY GEOLOGICAL SURVEY INFORMATION CIRCULAR 21, 1971. 18 P., 5 FIG., 1 TAB, 57 REF.
Journal Announcement: SWRA950
SPECIFIC-CAPACITY AND WELL-YIELD DATA ARE PRESENTED FROM CONTROLLED PUMPING TESTS ON 106 SELECTED BEDROCK WELLS IN 41 COUNTIES IN KENTUCKY. OCCURRENCE AND MOVEMENT OF GROUNDWATER IN BEDROCK AQUIFERS ARE DISCUSSED. DEPTHS OF WELLS TESTED RANGE FROM 21 TO 125 FEET AND YIELDS RANGE FROM AQUIFERS WILL NEED TO BE DEVELOPED AND UTILIZED AS DEMAND FOR WATER INCREASES ALONG WITH POPULATION GROWTH AND INDUSTRIAL EXPANSION IN KENTUCKY. ADEQUATE GROUNDWATER SUPPLIES FROM BEDROCK WELLS FOR DOMESTIC AND SMALL INDUSTRIAL USE COULD IN ALL PROBABILITY BE DEVELOPED IN SOME AREAS WHICH ARE FAR REMOVED
Kentucky

FROM MAJOR STREAMS AND EXISTING SURFACE RESERVOIRS, THE COST OF INSTALLING LONG STRETCHES OF PIPELINE, FILTRATION AND TREATMENT FACILITIES, OR BUILDING NEW SURFACE RESERVOIRS. (WOODARD-USGS)

Water Temperatures of Kentucky

The U.S. Geological Survey in cooperation with the Kentucky Geological Survey has been gathering temperature data on streams throughout Kentucky under a number of different programs for several years. Periodic water temperature observations, which were made at a frequency of approximately once per month during the past 15 years, were analyzed with the aid of a computer program to describe the annual water temperature cycle at sites in the Commonwealth. Shown on a map of Kentucky, at each site of water-temperature collection, are maximum median monthly temperatures, minimum median monthly temperatures, and annual average temperatures. Stream temperatures in Kentucky vary between 0 and 18 degrees Celsius (deg C) during the year. Maximum median monthly water temperatures occur in July, and are typically between 23 and 27 deg C, whereas minimum median monthly water temperatures are recorded in January and are usually within the 2 to 6 deg C range. Annual average water temperatures are between 10 and 18 deg C. (Woodard-USGS)

A Compilation of Groundwater Quality Data for Kentucky

This report provides most of the data in the files of the U.S. Geological Survey on the quality of groundwater in Kentucky. All analyses through 1979 are included except for some special purposes, reconnaissance analyses and some with a very limited number of constituents. County location maps are included with the analyses. These include location, distribution, and density of sampling sites in each county. Most of these data in this report resulted from cooperative studies made with the Kentucky Geological Survey and with other Federal, State, and local agencies. (USGS)

Selected Chemical Quality Characteristics in Streams of Kentucky, 1970-75

Water Resources Data for Kentucky, published annually since 1975

Water resources data for Kentucky consist of records of stages, discharges, and water quality of streams; stage and contents of lakes; and water levels and water quality of wells and springs.

Data collected at various miscellaneous sites is also published. These data represent part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Kentucky. (USGS)

WATER RESOURCES INVESTIGATIONS IN KENTUCKY, 1972
GEOLoGICAL SURVEY, WASHINGTON, D.C.
GEOLoGICAL SURVEY REPORT OF INVESTIGATIONS FOLDER, 1 SHEET, 1972, 5 FIG., 1 MAP.
Journal Announcement: SWAD514


Water Resources Investigations in Kentucky, 1976
Journal Announcement: SWA1018

Water resources studies and investigations made in Kentucky
during 1976 by the U.S. Geological Survey in cooperation with State and local agencies are summarized. A bibliography of selected material concerning these investigations is included. The investigations include collections of basic information through a hydrologic data network, areal hydrologic or interpretative studies, and research projects. The hydrologic data network consists of surface-water stations, groundwater observation wells, and water quality observation sites. Small State maps give a broad picture of variations in some of the hydrologic characteristics pertaining to Kentucky's water resources. A larger map shows the hydrologic data network and investigations in the State. (Woodard-USGS)
HYDROLOGY OF THE EASTERN COAL PROVINCE, PENNSYLVANIA, AND WEST VIRGINIA

Hydrologic data are presented for areas of the Eastern Coal Province (27,864 square miles) Monongahela River basin in western Pennsylvania, western Maryland, and north-central West Virginia. One hundred thirty-four streams were sampled about three times during the 1979 and 1980 water years for specific conductance, pH, acidity, alkalinity, dissolved iron, manganese, sulfate, and dissolved solids. Benthic invertebrate populations were determined and bottom material samples were analyzed for metals. Eleven streams had pH, acidity, alkalinity, total iron, total manganese, and dissolved-sulfate levels indicating the importance of sidemine drainage. These streams were most common in the Tygart Valley River basin, although indicators of sidemine drainage were found throughout the Monongahela basin. No benthic invertebrates were found in 25 of 129 streams sampled. Such streams were most common in the Cheat and Tygart Valley River basins. Low flow, mean flow, peak flow, and flow duration data are presented for gaging stations in area 5. Techniques for estimating these data for ungaged sites are presented and referenced. The functions of access to the National Water Data Exchange, WATSTORE, and indexes to water-data activities in coal provinces are presented.

Journal Announcement: SWRA1510

The U.S. Geological Survey is monitoring the water quality of streams within the Eastern Coal Provinces. This report contains streamflow, water-quality, and biological data collected in the North Branch Potomac River basin and in the Maryland portion of the Troughophen and Casmelam River basins. Data collected from 64 streams from April 1979 to June 1980 are presented in tables. Other sources of hydrologic information within the study area are also described in the report. (USGS)


GEOHYDROLOGIC RECONNAISSANCE OF THE UPPER POTOMAC RIVER BASIN: IN THE CENTRAL APPALACHIAN REGION IN PENNSYLVANIA, MARYLAND, VIRGINIA, AND WEST VIRGINIA IS A HUMID TEMPERATE REGION OF DIVERSE FRACURED ROCKS. THREE GEOHYDROLOGIC TERRANES, WHICH UNDERLIE LARGE PARTS OF THE BASIN, ARE DESCRIBED IN TERMS OF THEIR AQUIFER CHARACTERISTICS AND OF THE MAGNITUDE AND DURATION OF THEIR BASE RUNOFF: (1) FRACTURED ROCK HAVING A THIN REGOLITH; (2) FRACTURED ROCK HAVING A THICK REGOLITH; AND (3) CARBONATE ROCK. CRYSTALLINE AND SEDIMENTARY ROCKS IN MOUNTAINOUS PART OF THE BLUE RIDGE PROVINCE AND SHALE WITH TIGHT SANDSTONE IN THE FOLDED APPALACHIANS ARE COVERED WITH THIN REGOLITH. WATER IS STORED IN AND MOVES THROUGH FAIRLY UNIFIED FRACURED, ESTIMATED TO BE 150 SQ FEET PER DAY, AND AVERAGE STORAGE COEFFICIENT (5) 0.005. CRYSTALLINE AND SEDIMENTARY ROCKS IN THE PRECIPITATION OF STREAMFLOW, EACH YEAR ABOUT 14,000 BILLION GALLONS OF WATER LEAVE THE STATE AS STREAMFLOW. SOME 11,000 BILLION GALLONS OF THIS WATER ORIGINATES OUTSIDE OF MARYLAND. MARYLAND IS NOT IN FLOOD-PREDOMINATED REGION AND FLOODS ARE RARELY A PROBLEM. MARYLAND'S WATERS ARE GENERALLY OF EXCELLENT QUALITY. (KNAPP-USGS)
This report is a compilation of selected water-well records, selected spring records, gas-well records, chemical-quality data, water-use data, coal test-hole records, and surface-water data for Garrett County, Maryland. Included are records of about 1,100 water wells, 120 springs, 210 gas wells, 70 coal test holes, 56 chemical analyses of ground water, surface-water data from 5 continuous-record sites, and miscellaneous measurements from 11 sites. (USGS)

Water Resources Data for Maryland and Delaware, Published annually since 1975, Geological Survey, Towson, MD, Water Resources Div, Available from the National Technical Information Service, Springfield, VA 22161.

Water resources data for Maryland and Delaware consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground-water wells. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Maryland and Delaware, (USGS)
Evaluation of Missouri's Coal Resources

Missouri possesses coal resources of 31.7 billion tons as determined by mapping and exploration. This ranking ninth among the states of the USA. In total, there are 2.1 billion tons of thick (42 inches) coal, 8.5 billion tons of intermediate thickness (28 to 42 inches), and 21.1 billion tons of thin (12 to 28 inches) coal. Remaining reserves, which total 10.4 billion tons, include 2.1 billion tons of thick coal, 5.0 billion tons of intermediate thickness and 3.3 billion tons of thin coal. Remaining reserves are classified according to sulfur content, and indicate that no significant areas of low-sulfur coal are present in Missouri. Approximately half of the State's coal reserve contains from 4 to 5 percent sulfur, and one-fourth has from 3 to 4 percent sulfur. Less than one-tenth contains less than 3 percent sulfur and the remainder has more than 5 percent. An estimated additional possible coal resource of 18.2 billion tons is present in untested areas, giving a total coal resource of 49.9 billion tons.

RECONNAISSANCE OF THE GROUND-WATER RESOURCES OF THE MISSOURI RIVER ALLUVIUM BETWEEN JEFFERSON CITY AND MIAMI, MISSOURI

EMMETT, L. F.; JEFFERY, M. G.
GEOPHYSICAL SURVEY, WASHINGTON, D.C.
REPORT AVAILABLE FOR SALE FROM U.S. GEOLOGICAL SURVEY, DEPT. OF INTERIOR, WASHINGTON, D.C.
GEOPHYSICAL SURVEY HYDROGEOLOGICAL INVESTIGATIONS ATLAS HA-340, 1 SHEET, 1969. TEXT, 3 FIG., 1 TAB., 1 MAP., 14 REF.
Journal Announcement: SWAO329

This hydrologic atlas describes the thickness, areal extent, and lithology of the alluvial deposits of the Missouri River between Jefferson City and Miami, Missouri, and provides information on the occurrence, availability, use, and chemical quality of the water contained in the alluvial aquifer. Flood-plain widths vary from 1.8 to 0.64 miles and have a total surface area of approximately 285 square miles. The flood plain is underlain by alluvium consisting of clay, silt, sand, and gravel which has been deposited by the river. The sand and gravel in the lower part of the alluvium is saturated with water and forms the alluvial aquifer. The water in this aquifer is in hydraulic connection with the Missouri River. Graphs, tables, illustrations and a hydrologic map (scale 1:125,000) are included in the atlas. (Woodard-USGS)

RECONNAISSANCE OF THE GROUNDWATER RESOURCES OF THE MISSOURI RIVER ALLUVIUM BETWEEN MIAMI AND KANSAS CITY, MISSOURI

EMMETT, L. F.; JEFFERY, M. G.
GEOPHYSICAL SURVEY, WASHINGTON, D.C.
REPORT AVAILABLE FOR SALE FROM U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. - PRICE $0.50. U.S. GEOLOGICAL SURVEY HYDROGEOLOGICAL INVESTIGATIONS ATLAS HA-336, 1 SHEET, 1969. TEXT, 3 FIG., 1 TAB., 19 REF.,
Journal Announcement: SWAO322

This hydrologic atlas is to provide information on the occurrence, availability, use, and chemical quality of the water contained in the alluvial aquifer. Flood-plain widths vary from 2 to 10 miles and has a total surface area of approximately 440 square miles. Underlying the flood plain are clay, silt, sand, and gravel hydraulically connected with the river, constitutes a large and productive aquifer, which for the most part is presently undeveloped. Eleven cities pump approximately 13.6 million gallons of water per day from the alluvial aquifer in this reach of the river. Industrial use of groundwater is confined to the Kansas City area and amounts to about 13 MGD (milllion gallons per day). A rough approximation of water used for irrigation is about 1.75 MGD; combined municipal, industrial, and irrigation use amounts to about 35 MGD. 85 percent of this is pumped from the alluvium between Kansas City and Independence. Irrigation wells in the area have reported pumping rates of around 1,000 GPM, and specific capacities ranging from 50 to 150 GPM per foot of drawdown. Water in alluvium in this reach of the valley is a calcium bicarbonate type, characterized by a high hardness and high iron content. (KNAP-U5S)

RECONNAISSANCE OF THE GROUNDWATER RESOURCES OF THE MISSOURI RIVER ALLUVIUM BETWEEN KANSAS CITY, MISSOURI AND THE IOWA BORDER (Duplicated see Iowa and Missouri)

EMMETT, L. F.; JEFFERY, M. G.
GEOPHYSICAL SURVEY, WASHINGTON, D.C.
GEOPHYSICAL SURVEY HYDROGEOLOGICAL ATLAS HA-336, 1 SHEET, 1969. TEXT, 8 FIG., 2 MAP., 3 TAB., 19 REF.,
Journal Announcement: SWAO322

Geochemical Survey of Waters of Missouri

FEDER, G. L.
Journal Announcement: SWAO317

A reconnaissance geochemical survey of surface and ground waters of the State of Missouri was made to provide epidemiologists with information on the state-wide distribution and variability of chemical constituents. Results from the state-wide sampling program based on a
A hierarchical analysis of variance design and randomly chosen samples show that the concentrations of many chemical constituents in waters of Missouri vary both among and within the major geohydrologic units, if statistically significant amounts are found. The concentrations in surface waters are statistically significantly different between geohydrologic units than the ground waters, and in some geohydrologic units the surface water is chemically quite different from the ground water, especially in its trace element content, where geohydrologic units overlie one another, there may be large differences in the quality of water obtained from closely spaced wells, pumping water from different geohydrologic units. Analysis of the ground-water data by the Mode factor analysis indicates that general chemical character of the waters can be moderately well described in terms of four water-types. These include: (1) a Ca-Mg-HCO₃ water with relatively low C (2) a Na-HCO₃-C1 water with high K, Li, Al, and Sr. (3) a Ca-HCO₃-SO₄ water with high Fe and Mn, and (4) a water low in total dissolved solids and with low concentrations of trace elements. (Kosco-USGS)

WATER RESOURCES OF NORTHERN MISSOURI
GANN, E. E.; HARVEY, E. J.; BARKS, J. H.
GEOLOGICAL SURVEY, WASHINGTON, D.C.
FOR SALE BY: U.S. GPO, WASHINGTON, D.C. 20435.
HYDROLOGIC INVESTIGATIONS ATLAS HA-444, 4 SHEETS, 1973, 26 FIGS, 7 TAB., 48 REF., $1.50
Journal Announcement: SWA0713
A GENERAL SUMMARY IS PRESENTED OF INFORMATION CONCERNING THE OCCURRENCE, AVAILABILITY, USE, AND QUALITY OF WATER IN NORTHERN MISSOURI. ALSO INCLUDED IS A DEFINITION OF PROBLEMS AND POTENTIALS WHICH SHOULD BE CONSIDERED IN THE DEVELOPMENT OF THE WATER RESOURCES OF THE AREA. THE ATLAS COVERS AN AREA OF APPROXIMATELY 10,000 SQUARE MILES. THE PHYSICAL SOURCES OF FRESH GROUNDWATER ARE THE ALLUVIUM OF THE MISSOURI RIVER VALLEY, THE ALLUVIUM OF TRIBUTARY VALLEYS, AND THE OUTWASH DEPOSITS IN BURIED BEDROCK VALLEYS. THE EXISTING WATER NETWORK HAS BEEN DEVELOPED IN THE UNCONSOLIDATED MATERIALS OVERLYING THE BURIED BEDROCK VALLEYS. HYDRAULIC CONNECTION BETWEEN THE ALLUVIUM OF TRIBUTARY VALLEYS AND THE BURIED BEDROCKS IS POOR IN MOST AREAS Owing TO RELATIVELY IMPERVIOUS SILT AND CLAY DEPOSITS SEPARATING THE TWO Aquifers. However, toward the lower end of the Grand River Valley the two Aquifers may be connected. ARTESIAN CONDITIONS EXIST IN MOST OF THE BURIED VALLEYS AND IN SOME AREAS IN THE MISSOURI RIVER VALLEY AND TRIBUTARY VALLEYS. WATER FROM BURIED Aquifers IN NORTHERN MISSOURI IS GENERALLY TOO HIGHLY MINERALIZED FOR MOST USES. THE FLOW OF STREAMS IN NORTHERN MISSOURI IS HIGHLY VARIABLE. THE AVERAGE FLOW FOR A PARTICULAR MONTH MAY VARY FROM YEAR TO YEAR BY A FACTOR OF 3/4. MINIMUM MONTHLY MEAN FLOWS OF MOST STREAMS IN THE AREA OCCURRED DURING
Large water supply, induced increase in recharge, and water resources occur in sand and gravel alluvium, glacial drifts, dune sands, dastinfill deposits of sand and gravel, sandstone, siltstone, fractured sandy clay, limestone, and dolomite. Ground water is undeveloped in many areas. Unconsolidated and semi-consolidated aquifers have potential for conjunctive use with surface water, reuse of available supplies, artificial recharge, and salvage of evapotranspiration. Sandstone aquifers have potential for artificial recharge. Induced interaquifer leakage, conjunctive use with surface water, and temporary mining of ground water. Limestone and dolomite aquifer have potential for development of a large water supply, induced increase in recharge, and induced interaquifer leakage. Saline ground water occurs throughout the region but is most abundant in deep aquifers in Wyoming, North Dakota, and South Dakota. Improved water use in the Missouri basin region would require a periodic inventory of current supplies in precipitation, streamflow, surface-water storage, and ground water; an awareness of the possibilities to meet the demands; and implementation of sound water-management plans.

Physical Environment and Hydrologic Characteristics of Coal-Mining Areas in Missouri
Vailla, J. E. and Parks, J. M.

Journal Announcement: SWA1413

Hydrologic information for the north-central and western coal-mining regions of Missouri is needed to define the hydrologic system in these areas of major coal deposits and planned coal development. This report describes the physical setting, climate, coal-mining practices, general hydrologic system, and the current (1980) hydrologic data base in these coal-mining regions. Streamflow in both mining regions is poorly sustained. Stream water quality generally varies with location and the magnitude of coal-mining activity in a watershed. Streams in nun coal-mining areas generally have dissolved-solids concentrations less than 400 milligrams per liter. Acid-mine drainage has seriously affected some streams by reducing the pH to less than 4.0 and increasing the dissolved-solids concentrations to greater than 1,000 milligrams per liter. This has resulted in fish kills in some instances. Groundwater movement is impeded both laterally and vertically in water-resources regions, especially in western Missouri, because of the low hydraulic conductivity of the rocks of Pennsylvanian age. The quality of groundwater varies widely depending on location and depth. Groundwater commonly contains high concentrations of iron and sulfate, and dissolved-solids concentrations generally are greater than 1,000 milligrams per liter. (USGS)

Water Resources Data for Missouri, published annually since 1975
Available from the National Technical Information Service, Springfield, VA 22161.

Water-Resources Investigations of the U.S. Geological Survey in Missouri--Fiscal Year 1981

Journal Announcement: SWA1505

Water-Resources Investigations of the U.S. Geological Survey in Missouri consist of collecting hydrologic data and making interpretative investigations. The data and the results of the investigations are published or released by either the U.S. Geological Survey or by cooperating agencies. The report describes the data-collection activities and investigations in Missouri for the 1981 fiscal year and provides an extensive list of water-resources references for the State. (USGS)

Water-Resources Investigations of the U.S. Geological Survey in Missouri--Fiscal Year 1980

Journal Announcement: SWA1412

Water-resources investigations of the U.S. Geological Survey in Missouri consist of collecting hydrologic data and conducting interpretative investigations. The data and the
results of the investigations are published or released by either the U.S. Geological Survey or by cooperating agencies. The report describes the data-collection activities and investigations in Missouri for the 1980 fiscal year and provides an extensive list of water-resources references for the State. (USGS)
TEMPERATURE OF SURFACE WATERS IN MONTANA

AGAARD, FERN C.

GEOLOGICAL SURVEY, HELENA, MONT.

MONTANA FISH AND GAME DEP REP , 1969, 613 P., 4 FIG, 3 TAB.

Journal Announcement: SWA0304

THIS PUBLICATION IS A COMPILATION, IN TABULAR AND GRAPHIC FORM, OF ALL AVAILABLE SURFACE WATER TEMPERATURE DATA IN THE STATE OF MONTANA THROUGH 1965. THE DATA WERE OBTAINED FROM FEDERAL AND STATE AGENCIES, CITIES AND PRIVATE INDUSTRIES. THE REPORT INCLUDES RECORDS OF WATER TEMPERATURES AT 272 SITES ON STREAMS AND LAKES HANDED FROM SPOT OBSERVATIONS AT TIME OF DISCHARGE MEASUREMENTS OR WATER QUALITY SAMPLES TO CONTINUOUS RECORD BY A RECORDING THERMOMETER. COPIES ARE AVAILABLE FROM THE MONTANA FISH AND GAME DEPARTMENT, HELENA, MONT. (AGAARD-USGS)

Ecology and distribution of major diatom ecotypes in the southern Fort Union coal region of Montana

Hahls, L. L., WEBER, E. E., and JARVIE, J. O.

U.S. Geological Survey Professional Paper

The Ashland coal field, Rosebud-Powder River, and Custer Counties, Montana, Part 2:

Contributions to economic geology

Bass, L. W., 1932


This report describes the stratigraphy of the Fort Union Formation in the geology of about 975 square miles in southeastern Montana. It includes a detailed township-by-township description of the coal resources, and a geologic map at a scale of 1:62,500 showing the outcrop of coal beds and the location of 839 measured coal sections. Compliation and Testing of Madison Limestone Test Well 3, SWA1424

Journal Announcement: SWA1424

SELECTED INTERVALS IN THE LOWER AND UPPER PARTS OF THE MISSION CANYON LIMESTONE OF MISSISSIPPIAN AGE AND THE ASHBY FORMATION AND TENNESSEE SANDSTONE OF PENNSYLVIANIAN AGE, CONTAINING WATER WITH DISSOLVED-TOLIUS CONCENTRATIONS OF 3500 MILLIGRAMS PER LITER OR LESS, WERE PERFORATED THROUGH 7-1/2-7 INCH CASING THAT WAS CEMENTED TO THE WELLS OF THE BOREHOLE.

TOTAL FLOW FROM ALL PERFORATED INTERVALS AFTER DEVELOPMENT OF EACH INTERVAL BY SWABGING AND FLOWING WAS 125 GALLON PER MINUTE. TOTAL FLOW INCREASED TO 24900 GALLONS PER MINUTE AFTER ACIDIZING AND FRACURING EACH UNIT THROUGH PERFORATIONS. KALINE TRACER SURVEYS INDICATE ABOUT 50 PERCENT FLOW WAS FRO M PERFORATIONS IN THE UPPER PART OF THE MISSION CANYON LIMESTONE. BASED ON ANALYSIS OF DATA FROM A STEP-DRAWDOWN TEST, THE VALUES OF TRANSMISSIVITY AND COEFFICIENT OF STORAGE CONSIDERED AS MOST REASONABLE ARE 38,000 GALLONS PER DAY PER FOOT AND 0.00024 RESPECTIVELY. MAXIMUM TEMPERATURE OF WATER, MEASURED AT LAND SURFACE, WAS 56.6 DEGREES CELSIUS. (USGS)

PRELIMINARY DATA FOR MADISON LIMESTONE TEST WELL 3, SWA1424

SELECTED INTERVALS IN THE LOWER AND UPPER PARTS OF THE MISSION CANYON LIMESTONE OF MISSISSIPPIAN AGE AND THE ASHBY FORMATION AND TENNESSEE SANDSTONE OF PENNSYLVIANIAN AGE, CONTAINING WATER WITH DISSOLVED-TOLIUS CONCENTRATIONS OF 3500 MILLIGRAMS PER LITER OR LESS, WERE PERFORATED THROUGH 7-1/2-7 INCH CASING THAT WAS CEMENTED TO THE WELLS OF THE BOREHOLE.

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stratigraphic, structural, geophysical, and hydrologic information. The test well was drilled in the SE 1/4 SE 1/4 sec. 18, T. 1 N., R. 54 E., Custer County, Montana, to a depth of 9,378 feet below land surface. The well is cased with 13-3/8-inch casing from land surface to 4,661 feet and 9-5/8-inch casing from 4,519 to 6,487 feet below land surface. It is an 8-1/2-inch-diameter open hole from 6,487 feet to 8,422 feet. The well is plugged below that depth by two cement plugs—one from 9,378 to 9,084 feet and the other from 8,884 to 8,422 feet. The well is so constructed that additional hydrologic tests and geophysical logs can be made at a later date.

Nineteen cores were taken from selected intervals totaling 754 feet; 722.4 feet of core was recovered. The cores were photographed, slabbed, and plugged, and selected parts were tested for density, porosity, and vertical and horizontal permeability. Gamma and density scans of the cores were made, and thin sections are being prepared for detailed examination.

Seventeen conventional drill-stem tests and packer-swabbing tests were attempted, 13 of which give clues to the pressure heads of water in the intervals tested. Water samples were obtained during 10 of the tests, 7 of which were flow tests. Water from the open-hole part of the well had a shut-in pressure of 333 pounds per square inch and flowed about 44 gallons per minute. The temperature of the water, measured at the surface, was about 48 degrees Celsius.

With the possible exception of the Dakota Sandstone, no major potential sources of ground water were found in the test well. Also, no freshwater (less than 1,000 milligrams per liter dissolved solids) was found in any of the zones tested in the well. Water salinities ranged from about 2,000 to 46,500 milligrams per liter dissolved solids.

Additional geophysical logs and tests will be made in the test well during the summer and fall of 1977. The logs may include televiwer, gamma spectrometer, trace ejector, and spinner-surveys. A vertical seismic profile will be made in the well in August.

The Coalwood coal field, Powder River County, Montana
Bryson, R. P., 1952
This report contains a geologic map at a scale of 1:63,360 for a large area along the crest and western flank of the Black Hills uplift. Shown on the map are the outcrop areas of 30 coal beds. Also included are analyses of two coal samples; measured stratigraphic sections for the 1,520 ft of exposed Hell Creek and Fort Union Formations; a table of fossil-collection sites; and diagrams showing correlations, ranges in thickness, and average intervals between coal beds. The text describes the stratigraphy of the geologic units and the characteristics of the coal beds.
A township-by-township discussion of coal resources and estimated reserves is accompanied by 264 graphic coal sections.

Geology of Roosenead coal fields, Powder River and Rosebud counties, Montana. Montana
Bryson, R. P., and Bass, W. W., 1973
This report contains a geologic map (2 sheets) at a scale of 1:63,360 of the Will Creek, Fort Union, and Wasatch Formations for a large area along the northeast flank of the Powder River Basin. Shown on the map are the outcrop and burned area for 33 coal beds more than 2 ft thick. Also included are analyses of 10 coal samples, measured stratigraphic sections for the entire 2,250-ft column of exposed rocks in the map areas, and a diagram showing the stratigraphic positions of the coal beds. The text describes the major structural features and stratigraphy of the map units. A township-by-township discussion of the coal resources and reserves is accompanied by more than 1,000 graphic coal sections.

Geology of certain lignite fields in eastern Montana. II
Contributions to economic geology, 1910-Part II
Calvert, W. R., 1912
This report is the introductory report for the Baker, Terry, Glendive, Sidney, and Culbertson lignite fields reports that are in U.S. Geological Survey Bulletin 471. The report mostly describes the stratigraphy of the area and includes descriptions of the Pierre Shale, Lance Formation equivalent, and Fort Union Formation. Included are lists of fossils and three sections of rocks with lithologic descriptions.

Potential effects of surface coal mining on the hydrology of the Cook Creek area, southeastern Montana
Cannon, R. H.
U.S. Geological Survey Water-Resources Investigations Open-File Report 82-4051, 28 P.
The Cook Creek area of the Ashland coal field contains large reserves of federally owned coal that have been identified for potential lease sale. A hydrologic study has been conducted in the potential lease area to describe existing hydrologic systems and to assess potential impacts of surface coal mining on local water resources. Hydrogeologic data collected from wells, springs, and drill holes indicate that shallow aquifers exist within the Tongue River Member of the Fort Union Formation (Paleocene age) and

within valley alluvium (Pleistocene and Holocene age). Shallow aquifers within the Tongue River Member include coal beds, clinkers, and lenses of sandstone and siltstone. The knobloch coal bed, a principal shallow aquifer used for stockwatering in the area, averages about 55 feet in thickness and is completely saturated throughout most of its extent. Coarse alluvial deposits are the most extensive aquifers and are a major source of stock water in the Cook Creek basin.

Surface-water resources are limited to the upstream reach of Cook Creek, which flows intermittently. The downstream reach of Cook Creek, plus all other small drainages that originate in the study area, are ephemeral.

Mining of the knobloch and sawyer coal beds would remove two alluvial springs, one bedrock spring, and two wells, which are all used for watering of livestock. The potentiometric surface within the knobloch coal aquifer and the alluvial aquifer in the downstream reach of the Cook Creek would be lowered during mining. Lowered water levels in these aquifers might substantially affect water levels in five wells outside the mine boundary. After mining, water in the alluvial aquifer downgradient from the mine area might show a long-term degradation in quality as a result of leaching of soluble salts from overburden materials used to backfill mine pits. Although mining would alter the existing hydrologic systems and remove several springs and shallow wells, alternative ground-water supplies are available that could be developed to replace those lost by mining.

Potential effects of surface coal mining on the hydrology of the Snider Creek area, Rosebud and Ashland coal fields, southeastern Montana
Cannon, R. H.
U.S. Geological Survey Water-Resources Investigations Open-File Report 82-4051, 28 P.
The Snider Creek area of the Rosebud and Ashland coal fields contains stripable reserves of Federal coal that have been identified for potential lease sale. A hydrologic study has been conducted in the potential lease area to describe the existing hydrologic systems and to assess potential impacts of surface coal mining on local water resources.

Hydrogeologic data collected from wells, observation wells, and drill holes show that shallow aquifers exist within the Tullock, Lebo Shale, and Tongue River Members of the Fort Union Formation (Paleocene age) and within valley alluvium (Pleistocene and Holocene age). Most of the wells in the area are completed in the basal part of the Tongue River Member or in the upper part of the Lebo Shale Member and are used for watering of livestock. Small stock reservoirs are the primary source of surface water; Snider Creek and all other streams that originate in the area are ephemeral.

188 189
The Terrett coal bed of the Tongue River Member is the primary coal bed of the area and is located above the water table. Mining of the Terrett coal bed would destroy one stock well and several small reservoirs. Four other wells near the coal outcrop might be destroyed by mining. Alternative ground-water supplies are available to replace those lost by mining. Degradation of the quality of ground water, caused by the leaching of soluble salts from mine spoil, is not anticipated.

Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980
Cary, L. E.; Johnson, J. D.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $10.00 in paper copy; $3.50 in microfiche.
Open-File Report 82-273, March 1982, 74 p, 2 Fig, 42 Tab, 4 Ref.
Journal Announcement: SWRA1601

Hydrologic and climatologic data are being collected in a 25-square-mile (65-square-kilometer) basin in southeastern Montana to provide a base for development, calibration, and verification of a precipitation-runoff model. The study area and data-collection stations within the area are shown on a map. A summary of data collected at each station during the second year, beginning in October 1979, is provided in tables. The data include precipitation, snow depth and water content, air temperature, relative humidity, wind speed and direction, solar radiation, soil temperature and moisture, stream discharge, chemical analyses of water, and suspended sediment. (USGS)

The coal resources of McCone County, Montana
Collier, A. J.; and Knechtel, W. K., 1939
This report contains a generalized stratigraphic section of the exposed rocks from the top of the Bearpaw Shale through the Tongue River Member of the Fort Union Formation; a regional-scale structure map; a geologic map of the area at a scale of 1:125,000, and three geologic sections. The text describes the general structural features and the stratigraphy of the map units although formation terminology has since been revised. A lengthy township-by-township discussion of coal resources for the county is accompanied by 531 graphic sections of 11 coal beds.

The Flaxville gravel and its relation to other terrace gravels of the northern Great Plains, in Shorter contributions to general geology 1917
Collier, A. J., and Thom, W. T., 1917

Coal resources of Montana

Three deposits of strippable lignite west of the Yellowstone River, Montana
Culbertson, W. C., 1954
This report describes three lignite deposits that are suitable for strip mining in an area of about 700 square miles. The lignite is mapped on the basis of overburden in categories of less than 60 ft, 60 to 90 ft, and 90 to 120 ft. Nine analyses of lignite samples are given. A columnar section shows the stratigraphic position and correlation of lignite beds. Thirty-seven coal sections were measured. Included are three maps that show the coal deposits, the amount of overburden, and the coal-section sites.

Measurements of discharge, gain or loss in flow, and chemical quality of the Poplar and Redwater Rivers, Northeastern Montana,
October 24-25, 1979
Bogue, R. A.; Levingston, G. W.
Geological Survey Open-File Report 80-1210, November 1980, 16 p, 2 Fig, 3 Tab.
Journal Announcement: SWRA1414
Discharge, specific conductance, and water temperature were measured at 37 sites on the Poplar and Redwater Rivers in northeastern Montana on October 24-25, 1977, to provide data on the interaction between surface-water and groundwater systems. Streamflow gains or losses were computed for those stream reaches not significantly affected by irrigation. Water samples were collected at 17 of the sites for detailed chemical-quality analysis. The tabulated data provide an areally broad data base of concurrent base-flow conditions. (USGS)


Base-flow discharge and chemical-quality measurements were made at 233 selected sites on streams during October-November 1977, August-September 1978, and October 1978 to provide data on the interaction between surface-water and ground-water systems in the northern Great Plains area of Montana and Wyoming. The tabulated data provide an areally broad data base of concurrent base-flow conditions.

Streamflow gains or losses were computed for stream reaches not significantly affected by irrigation. On October 24, 1977, the change in flow of the upper Powder River between Sussex and Arvada, Wyoming, was a loss of 14 cubic feet per second. On the same date, the change in flow of the lower Powder River between Arvada, Wyoming, and Moorhead, Montana, was a gain of 6 cubic feet per second. Except for August-September 1978, major subbasins showed little significant differences in water discharge, chemical character, or dissolved-solids concentrations.


Journal Announcement: SWRA1509


Journal Announcement: SWRA1304

The aquifer system studied in the upper Poplar River basin in Montana ranges in age from late Cretaceous to Holocene. Most wells obtain water from the Paleocene Fort Union Formation or younger rocks. The potentiometric surface of the Fort Union and overlying rocks indicates movement of water from the high interstream areas toward principal stream valleys. Recharge is principally through sand and gravel deposits of the Flaxville Formation, which occurs as large terrace remnants, and the Wota Gravel. Water in these formations locally recharges the underlying Fort aquifers. Of the sodium bicarbonate, magnesium bicarbonate, or calcium bicarbonate type. The range in dissolved-solids concentration for the measurements of the Poplar River and East Fork Poplar River from the international boundary to the south edge of the study area. In October 1977 showed a net gain of 2.0 cubic feet per second from a total flow of 11.7 cubic feet per second. This gain is discharge of water from the alluvium to the rivers. (Woodard-USGS)


Journal Announcement: SWRA1601
Selected Hydrogeologic data from Sweet Grass County south of the Yellowstone River have been compiled to show baseline ground-water conditions. Included are records from a 1981 onsite inventory of 94 water wells and 30 springs. Chemical analyses of water show the major cation and anion...
concentrations for 40 wells and 14 springs. Concentrations of 17 trace elements in water from 12 of the wells and 9 of the springs were determined by an argon coupled emission spectrometer. (USGS)

Mean Annual Streamflow of Selected Drainage Basins in the Coal Area of Southeastern Montana

Ferriter, R. F.


Journal Announcement: SWA1510

Streamflow characteristics of drainage basins within the Fort Union coal area of southeastern Montana were estimated to provide preliminary data for evaluating the future effects of mining on the environment. Estimated annual mean streamflow at 22 data-collection stations for water years 1975-77 ranged from 0 to 887 cubic feet per second. These estimates are based on miscellaneous-streamflow records at each station and continuous-streamflow records from other stations in the study area. Estimated mean annual streamflow for a 10-year period (water years 1968-77) ranged from 0 to 572 cubic feet per second. These long-term estimates were based on data from stations in the area having continuous-streamflow records. Estimates mean annual runoff in inches for selected drainage basins within the study area showed no discernible pattern. Many of the drainage basins had a mean annual runoff of less than 0.60 inch; the maximum observed mean annual runoff was 4.45 inches. (USGS)

Restored stratigraphic cross sections and coal correlations in the Tongue River Member of the Fort Union Formation, Powder River area, Montana

Flores, R. H., 1979


Geology and coal resources of the Foster Creek coal deposit, eastern Montana


WATER RESOURCES OF THE YELLOWSTONE RIVER VALLEY, BILLINGS TO PARK CITY, MONTANA


Geological Survey, Washington, D.C.

HYDROLOGIC INVESTIGATIONS ATLAS HA-454, 2 SHEETS, 1973, 7 FIG.
Montana

IRRIGATION OF HIGHER TERRACES IS ATTEMPTED.

(WOODARD-USGS)

The Glendive lignite field, Dawson County, Montana, 10 Contributions to economic geology, 1910—Part II

HANCOX, J. W., 1912


This report consists of a township-by-township description of the occurrence of coal in the Fort Union Formation for the areas delineated by Tps. 13 and 14 N., Rs. 53 to 60 E.; Tps. 15 and 16 N., Rs. 53 to 58 E.; and T. 17 N., Rs. 53 to 57 E. The physical properties and chemical composition are given for six coal samples. Included is a map at a scale of 1:125,000 showing geology and the outcrops of coal and burned areas.

The Terry lignite field, Custer County, Montana, 10 Contributions to economic geology, 1910—Part II

Herald, F. A., 1912


This report consists of a township-by-township description of the occurrence of coal in the Fort Union Formation for a strip of land in Tps. 9 to 16 N., that is bounded on the west by the Powder and Yellowstone Rivers and on the east by the State line. Included are stratigraphic sections of the Lance Formation equivalent and Fort Union Formation as well as descriptions of 21 coal samples. One coal sample was analyzed. Included is a map at a scale of 1:125,000 showing geology, coal outcrops, and burned areas.

WATER RESOURCES OF THE NORTHERN CHEYENNE INDIAN RESERVATION AND ADJACENT AREA, SOUTHEASTERN MONTANA

HOPKINS, W. B.

GEOLOGICAL SURVEY, WASHINGTON, D.C.

FOR SALE BY USGS. WASHINGTON, D.C., 20242. PRICE $1.00 PER SET.

HYDROLOGIC INVESTIGATIONS ATLAS H-468, 1973. 2 SHEETS, 2 MAPS, 2 TAB., 6 REF.

Journal Announcement: SWAU078

WATER RESOURCES OF THE NORTHERN CHEYENNE INDIAN RESERVATION, MONTANA, AND ADJACENT AREA ARE DESCRIBED IN TERMS OF SOURCES, AMOUNTS AVAILABLE, AND QUALITY. THE STUDY AREA INCLUDES ABOUT 2,500 SQUARE MILES OF THE UNGlaciated MISSOURI PLATEAU, PART OF THE GREAT PLAINS PROVINCE IN SOUTHEASTERN MONTANA. PRESENT WATER USE IS SMALL AS ONLY ABOUT 2,500 PEOPLE LIVE ON THE RESERVATION, AND APPROXIMATELY 7,000 MORE LIVE ON RANCHES IN THE REST OF THE AREA. THE AVERAGE ANNUAL PRECIPITATION DRAINED FROM 1960 THROUGH 1968 WAS 14.47 INCHES. WELLS AND SPRINGS YIELD WATER FOR DOMESTIC OR STOCK SUPPLIES FROM THE ALLUVIUM IN STREAM VALLEYS; FROM CLINKER BEDS, SANDSTONE AND COAL BEDS IN THE TONGUE RIVER MEMBER OF THE FORT UNION FORMATION.

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AND FROM SANDSTONE BEDS IN THE TONGUE CREEK FORMATION, WELLS THAT WOULD YIELD MORE THAN 50 GPM WOULD BE LIMITED TO THE ALLUVIUM ALONG THE PERENNIAL STREAMS. MOST OF THE REPORT AREA IS DRAINED BY THE TONGUE RIVER AND ITS TRIBUTARIES. THE CONCENTRATION OF DISSOLVED SOLIDS IN THE TONGUE RIVER IN WATER-RESOURCES DATA FOR DEEP AQUIFERS ON EASTERN MONTANA

HOPKINS, W. B.

GEOLOGICAL SURVEY, HELENA, MONT. WATER RESOURCES DIV.

WATER-RESOURCES INVESTIGATION 76-40 (OPEN-FILE REPORT), JUNE 1976. 37 P. 6 FIG., 5 TABS, 6 REF.

Journal Announcement: SWAU1006

Water from aquifers of Mesozoic and Paleozoic age in eastern Montana is little used. This report presents maps and tables to assist in the evaluation of the water in terms of possible utility. In the southern third of eastern Montana water from the Madison Group or from the Tensleep Sandstone contains less than 2,000 milligrams per liter dissolved solids and is available in amounts of as much as 3,700 gallons per minute (230 liters per second) from individual wells. Elsewhere, dissolved-walls concentrations of water from Mesozoic and Paleozoic aquifers commonly exceed 1,000 milligrams per liter, well yields range from 5 to about 1,500 gallons per minute (0.3 to 95 liters per second) and well depths generally are greater than 1,500 feet (460 meters).

(AWOODARD-USGS)

A METHOD FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN MONTANA

JOHNSON, M. V.; O'MANG, R. J.

GEOLOGICAL SURVEY, HELENA, MONT.

OPEN-FILE REPORT 75-650, JANUARY 1976. 35 P. 6 FIG., 3 PLATES, 3 TAB. 1 REF. APPEND.

Journal Announcement: SWAU1007

METHODS ARE PROVIDED FOR ESTIMATING FLOOD CHARACTERISTICS AT MOST NATURAL FLOW SITES ON RURAL STREAMS IN MONTANA. FLOOD DATA AND RELATED INFORMATION FOR MANY GAGED SITES ON MONTANA STREAMS ALSO ARE PRESENTED. FREQUENCY CURVES ARE INCLUDED FOR 442 GAGED SITES AS DEFINED BY LOG-PEARSON TYPE III ANALYSIS. TO ALLOW ESTIMATES AT UGAGED SITES, MATHEMATICAL EQUATIONS RELATE THE 2-, 5-, 10-, 25-, 50-, AND 100-YEAR FLOOD MAGNITUDES TO MAIN CHANNEL SLOPE, AND MEAN ANNUAL PRECIPITATION WERE THE MOST SIGNIFICANT ESTIMATING VARIABLES. EQUATIONS PRESENTED ARE LIMITED TO USE ON STREAMS WITH DRAINAGE AREAS FROM ABOUT 0.1 TO 1,000 SQUARE MILES, AND THEIR ACCURACY DEPENDS ON THE PRECIPITATION FROM 10 TO 100 IN. SIMPLE GRAPHICAL MEANS OF SOLVING THE ESTIMATING RELATIONS, AND ILLUSTRATIVE EXAMPLES ARE PRESENTED. (WOODARD-USGS)

Evaluation and Correlation of Water-Quality Data for the
North Fork Flathead River, Northwestern Montana

Knapton, J. R.


Journal Announcement: SWR8124

This report is a compilation and evaluation of water-quality measurements that have been made by the U.S. Geological Survey at two stations on the North Fork Flathead River in Montana. Historical streamflow records show an annual median daily discharge of 3,000 cubic feet per second near the mouth. A threefold increase compared to discharge at the international boundary. The chemical character of the water is dominated by calcium and magnesium cations and the bicarbonate anion. Base flow in contrast to high flows from runoff, is characterized by relatively dissolved constituents and lower concentrations of suspended sediment. The several lakes that contribute water throughout the middle and lower drainage have a dampening effect on both streamflow and constituent concentrations, using the available data and computer techniques, regression equations were developed between certain water-quality variables.

Quality of Streams in the Bull Mountains Region, South-Central Montana

Knapton, J. R.


Journal Announcement: SWR8105

In October 1977, water-quality monitoring stations were established on five small streams that drain the Bull Mountains and also on the Musselshell River to document present water-quality conditions in a coal area of south-central Montana. Relatively static water-quality conditions exist throughout the annual flow cycle on the small streams but water quality varies with time on the Musselshell River. The near absence of surface runoff in the small streams during the study and the dominance by the base-flow component account for stability of water quality in the small streams. High-mountain runoff coupled with storms and prairie runoff impact the base flow of the Musselshell River. Bicarbonate and sulfate were the principal anions and are present in nearly equal proportions in all small streams. Except for west Parrot Creek where magnesium was the most dominant cation, west Parrot Creek which consistently contained the smallest levels of dissolved solids, had sodium rather than magnesium as the principal cation. Fat-tailed Creek was highest in dissolved solids with an approximate concentration range of 900 to 2,100 milligrams per liter. Suspended-sediment discharge in the stream was highest following a heavy rain on the Precipitation and the dominance by the Musselshell River. The Musselshell River had dissolved solids concentrations that ranged from about 450 milligrams per liter during spring runoff to 1,800 milligrams per liter during periods of base flow. The sodium sulfate type water, which is common in Montana, is diluted during runoff with water having principal ions of calcium, magnesium, and bicarbonate. Suspended-sediment loads ranged from 0.56 to 37,360 tons per day and correlated directly to stream discharge. (USGS)

RESULTS OF PHYTOPLANKTON SAMPLING AT NATIONAL STREAM QUALITY ACCOUNTING NETWORK STATIONS IN MONTANA—1975 WATER YEAR

Knapton, J. R.; BocJoe, B. M.

Geological Survey, Helena, MT.

OPEN-FILE REPORT 76-219, MARCH 1976, 27 P. 2 FIG. 2 PAT. 4 REF., APPENDIX.

Journal Announcement: SWR8107

Twelve national stream quality accounting network stations were operated in Montana during the 1975 water year (Oct. 1, 1974—Sept. 30, 1975). The network was established to acquire a base of hydrologic data for use by agencies engaged in water-resources planning on a national or regional scale. Among the characteristics analyzed were phytoplankton identification and cell counts. Samples consisted of composites of equal aliquots, collected at the center of each quartile of flow, using modified suspended-sediment samplers and sediment collection techniques. Identification and counting were done using the sedgwick-rafter cell technique. Cell counts ranged from 1 to 900 per milliliter at Flathead River at Flathead, British Columbia to 27,000 cells per milliliter at Yellowstone River near Sidney. The class Bacillariophyceae was most abundant in both number and variety at all sampling sites. Cyanophyceae and aphanizomenon of the Phylum Cyanophyta were found at six stations and two stations respectively, these two genera of blue-green algae often become abundant in enriched waters resulting in nuisance conditions. (WOODARD-USGS)

Statistical Analyses of Surface Water-Quality Variables in the Coal Area of Southeastern Montana

Knapton, J. R.; Ferreira, R. F.


Journal Announcement: SWR8107

Since 1974 a network of water-quality stations has been operated in the coal area of southeastern Montana.
report updates a previous report with 2 years of additional data collection and presents statistics and regression equations for water-quality variables. The most apparent feature of the study is the variability of water quality. Time-trend differences are most noticeable, with area differences being present but more subtle. In comparing stations at the mouths of the five major drainages entering the Yellowstone River from the study area, water from the Powder River ranks near the middle of the group in dissolved-solids concentration (mean the best overall quality with respect to dissolved constituents). Extremes are moderated by mixing in the Tongue River Reservoir. Suspended sediment increase in dissolved-solids concentration from the most upstream station to the mouth. Arneys and Sarpy Creeks, smallest of the five drainages, have a pool-riffle configuration that influences both dissolved and suspended constituents. Pools permit greater evaporation, thus increasing dissolved-constituent concentrations. They also act as sediment traps. (USGS)

Water Quality of Selected Streams in the Coal Area of southeastern Montana

Knapton, J. R.; McKinley, F. W.


This report summarizes and evaluates water-quality data collected at 35 stream sites in the coal region of southeastern Montana. Sarpy Creek, Arneys Creek, and Rosebud Creek, sometimes have dissolved-solids concentrations that cause water to be marginal for agricultural purposes. At times of rainfall and snowmelt, the runoff of the streams mixes with the base-flow component to improve the overall quality. Water in the Tongue River generally showed a downstream degradation in which some changes were related to lithology of the area. Aquifers contributing water to streamflow from Pumpkin Creek and Mispah Creek are used mostly for cattle watering. To some extent water is used for irrigation although this is a secondary hazard. The chemical quality of the Powder River changed little during flow downstream. High sediment loads of the river acted as transporting agents for many of the plant nutrients and trace-element constituents. (Woodard-USGS)

Preliminary digital model of ground-water flow in the Madison Group, Powder River Basin of southeastern Montana, South Dakota, and Nebraska

Konikow, L. F., 1976


Geochemistry of water in the Fort Union Formation of the Northern Powder River Basin, southeastern Montana

Lee, R. W.


Shallow water in the coal-bearing Fort Union Formation of southeastern Montana was investigated to provide a better understanding of the geochemistry. Springs, wells less than 200 feet deep, greater than 200 feet deep were observed to have different water qualities. Overall, the ground water exists as two systems: a mosaic of shallow, chemically dynamic, and localized recharge-discharge cells superimposed on a deeper, chemically static regional system. Water chemistry is highly variable in the shallow system, whereas sodium and bicarbonate water characterizes the deeper system. Within the shallow system, springs, and wells less than 200 feet deep show predominantly sodium and sulfate enrichment processes from recharge to discharge. These processes are consistent with the observed aquifer mineralogy and aqueous chemistry. However, intermittent mixing with downward moving recharge waters or upward moving deeper waters, and bacterially catalyzed sulfate reduction, may cause apparent reversals in these processes. (USGS)

Ground-water-quality data from the Northern Powder River Basin, southeastern Montana

Lee, R. W.


Water-quality data collected during 1973-77 for hydrologic studies in the Northern Powder River basin of southeastern Montana provide a data base for shallow ground water. The 665 water samples collected were analyzed for major cations and anions, dissolved oxygen, and selected trace elements. The samples were collected from springs. About 10 percent of the samples were also analyzed for 30 elements and 149 were from springs. The majority of analyses were performed by the Montana Bureau of Mines and Geology laboratory in Butte, Montana. The remaining analyses...
of the base flow indicate

Montana

Quality Laboratory in Denver, Colorado. (Kosco-USGS)

The chemical Quality of the groundwater may

The chemical data were


The chemical data were

Selected hydrogeologic data from the Judith basin, central Montana


Journal Announcement: SWRA1505

Selected hydrogeologic data from the Judith basin, central Montana have been compiled for use as the physical basis of a ground-water model prepared as part of a 4-year study of Cenozoic and Mesozoic aquifers of the northern Great Plains area of Montana. Records of Cenozoic and Mesozoic aquifers of the northern Great Plains area of Montana. Records of 1,124 wells and 540 springs are tabulated in the report; most of these
data have been collected since 1959. Lithologic logs of 68 wells are also included. Chemical data for wells and springs include 290 water samples analyzed for major cation and anion concentrations and 282 water samples analyzed for miscellaneous-constituent concentrations. The locations of wells and springs listed in the report are shown on a map at a scale of 1:250,000. (USGS)

Selective Annotated Bibliography of Geology and Groundwater Resources for the Montana Part of the Northern Great Plains Regional Aquifer-System Analysis


Available from the OFS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $13.75 in paper copy, $4.00 in microfiche.


Journal Announcement: SWRA1420

Increasing demand for water to meet needs for energy, industry, irrigation, domestic, and municipal uses has resulted in a study of the geochemistry and hydrology of rocks of Mesozoic and Cenozoic age. This report presents the results of a literature search for the part of the study area in Montana. It consists of an annotated listing of pertinent published reports, a partial subject and area index of the reports, and a correlation chart of geologic and aquifer units listed in the annotations. (USGS)

Geology and Water-Yielding Characteristics of Rocks of the Northern Powder River Basins, Southeastern Montana

Litke, David W. and Roberts, Robert S.


Suspected Sediment in Selected Streams of Southeastern Montana

Litke, David W.


Suspected-sediment data collected from October 1974 through September 1979 for 44 stations in the Powder River drainage basin of southeastern Montana were statistically summarized to define sediment relationships between stations and basins and to identify environmental factors that are important in determining sediment yield. Sediment-transport curves were developed for 30 of these stations. Mean-annual suspended-sediment discharges were determined at 15 stations using the flow-duration sediment-transport curve method. Sediment discharges ranged within 20 percent at three stations where alternative calculation by daily sampling methods was possible. Mean sediment discharges ranged from 770 to 5,470-000 tons per year. Mean sediment yield ranged from 1.09 to 647 tons per square mile per year and were somewhat less than yields predicted by the Lungbein-Schum precipitation-sediment-yield relation. Low delivery ratios for small drainage areas indicate that drainage may be upgrading. Geographic variations in sediment yield are attributed to precipitation and geology.

Use of Geophysical Logs to Estimate Water-Quality Trends in Carbonate Aquifers

MacCary, L. M.


Available from the National Technical Information Service, Springfield, VA 22161 as PB80-221424, Price codes: A05 in paper copy, A01 in microfiche.


Journal Announcement: SWRA1407

The water quality in carbonate aquifers can be determined by analysis of resistivity and porosity logs. When supporting data from water analyses are available, the value of the cementation exponent m can be determined more precisely. Data for this study were taken from logs of oil-test wells. Amstrad sample studies, drill-stem tests and water test wells in parts of Montana, North and South Dakota, and Wyoming. The preferred resistivity curves for apparent water resistivity (Rwa) analyses are the deeply focused laterolog and the induction log. The standard electric log can be used if the drilling mud is not saturated with salt. The preferred porosity logs are the sonic, sideway neutron, compensated neutron, and the density logs. Older, uncalibrated neutron curves can be empirically calibrated in some instances, however, resulting porosities are frequently too high or too low. Resistivity porosity ratios for apparent water resistivity (Rwa) analyses are controlled to outline areas of recharge, direction of probable ground-water movement, and location and salinity of brine areas. (USGS)

Hydrology of the Prairie Dog Creek Drainage Basin, Rosebud and Big Horn Counties, Montana

McClymonus, N. E.


Available from the National Technical Information Service, Springfield, VA 22161 as PB82-124850, Price codes: A05 in paper copy, A01 in microfiche.

Geological Survey Water-Resources Investigations 81-37, March 1982, 64 p., 15 fig., 2 tabs. 18 ref.

Journal Announcement: SWRA1603

The Prairie Dog Creek drainage basin in southeastern Montana was investigated during 1978-79 to establish a basic understanding of its surface-water and ground-water resources and to determine the quality of water and its coal-mining potential. The principal minable coal is the 40- to 60-foot-thick Wall and lower Wall coal beds near the middle
part of the Tongue River Member of the Fort Union Formation (Paleocene age), Prairie dog Creek, which originates from springs and seeps from coal and sandstone layers, maintained perennial flow with its upstream and middle reaches. Water in the channel near its mouth had only standing water or was dry. The dissolved-solids concentration of streamwater during periods of dense flow (1 cubic foot per second) was about 700 to about 1,600 milligrams per liter; during periods of lesser flow (0.5 cubic foot per second) ranged from about 1,300 to 1,600 milligrams per liter. Relatively clean sandstone aquifers had transmissivities of about 15 feet square per day and water of the magnesium sulfate or sodium sulfate type, with dissolved-solids concentrations ranging from about 2,200 to about 2,000 milligrams per liter. The water was of a different type, sodium bicarbonate; it also contained large concentrations of chloride (more than 10 milligrams per liter) and had a very high sodium-adsorption ratio (more than 60). (USGS)

Potential effects of surface coal mining on the hydrology of the Coral Creek area, Hanging Woman Creek coal field, southeastern Montana (in review), McClymonds, N. E., U.S. Geological Survey Open-File Report


In October 1975 the U.S. Geological Survey established a network of nine data-collection stations on eight streams in Montana to monitor water quality in potential coal-mining areas. The report summarizes and evaluates the water-quality data that have been collected during the first 2 years (3 years for 1 station) of network operation. Big Dry Creek, Little Dry Creek, Timber Creek, and Nelson Creek are the principal streams forming the Big Dry Creek basin, which is tributary to the Missouri River. These streams all contain water of the sodium sulfate type. Concentrations were high for elements, Prairie Elk Creek, Sand Creek, and the Redwater River flow directly into the Missouri River. Prairie Elk and Sand Creeks have mainly southwestern water, whereas the Redwater River is predominately sodium sulfate water. All three streams contain water of high and trace-element concentrations. Burns Creek is tributary to the Yellowstone River. The water type is generally sodium sulfate during the spring and summer and sodium bicarbonate during the fall and winter. Water (Woodard-USGS)


Yields from wells in carbonate rocks of the Madison Group in southeastern Montana range from about 50 gpm (gallons per minute) at several places to 1,400 gpm from a flowing well on the north side of the Porcupine dome. Yields estimated or reported from drill-stem tests range from about 1 to 157 gpm. Dissolved solids in water from the study area range from less than 50 percent of the dissolved constituents in the Williston basin sodium, potassium, and chloride ions constitute more than 75 percent of the total. (Woodard-USGS)

Water Resources of the Central Powder River Area of Southeastern Montana, Miller, W. R., U.S. Geological Survey Bulletin 108, Water for domestic, stock, and public use is available from the Fox Hills-lower Hell Creek aquifer of Late Cretaceous age. Water for irrigation can be obtained from alluvium of Holocene and Pleistocene age along the Powder River. The Fox Hills-lower Hell Creek aquifer yields as much as 188 gallons per minute to wells as deep as 599 feet, but most well yields are 20 gallons per minute or less. The upper part of the Hell Creek Formation yields as much as 12 gallons per minute to wells as deep as 605
The lower part of the Fort Union Formation yields a maximum of 25 gallons per minute to wells as deep as 573 feet. The alluvium of the Powder River yields 601 gallons per minute to the only known irrigation well, which is 40 feet deep.

Water from the Fox Hills-Lower Hell Creek aquifer generally contains sodium and bicarbonate, or sulfate as the major ions; dissolved-solids concentration was as much as 1,470 milligrams per liter. Sodium, bicarbonate, and sulfate were the major ions in two samples from the upper part of the Hell Creek Formation; the dissolved-solids concentration was 840 milligrams per liter in each sample. Water from the Fort Union Formation contains principally sodium, sulfate, and bicarbonate ions; the dissolved solids concentration ranges from 780 to 2,300 milligrams per liter.

One water sample from the alluvium contained principally sodium and sulfate ions and had a dissolved-solids concentration of 2,300 milligrams per liter. The Powder River is the only perennial stream in the study area. The average annual discharge of the Powder River near Locate for the period of record, 1938-69, was 601 cubic feet per second. Instantaneous discharge ranged from 0 to 31,000 cubic feet per second. Dissolved-solids concentration of water from the Powder River for the period of record, 1949-63, ranged from 278 to 5,430 milligrams per liter. Calcium, sodium, and sulfate were the major ions.


Annual Peak Discharges from Small Drainage Areas in Montana for Stations Discontinued Before 1978


Annual peak stage and discharge data have been tabulated for crest-stage gaging sites in Montana. The crest-stage program was begun in July 1955 to investigate the magnitude and frequency of floods from small drainage areas. The program has expanded from 45 crest-stage gaging stations initially to 172 stations maintained in 1981. Data in the report are tabulated for the period of record.

Occurrence of Ground Water in the Judith River Formation, North-Central Montana


The Richley-Lambert coal fields, Richland and Dawson Counties, Montana

Parker, F. S., 1936, U.S. Geological Survey Bulletin 847-C, p. 121-174. This report describes the coal resources of a 900 square mile area. It includes a description of the geologic structure and stratigraphy and a township-by-township description of the occurrence of coal. Two hundred seventy-six coal sections were measured, and generalized geologic sections show the relative position of the coal beds with respect to one another. The geologic map at a scale of 1:62,500 shows outcrops of coal beds, burned areas, and sites of measured coal sections.

CO 80225, Price: $15.75 in paper copy, $4.50 in microfiche.


A 1-SHEET HYDROLOGIC ATLAS DESCRIBES THE OCCURRENCE OF GROUNDWATER IN THE CRETACEOUS JUDITH RIVER FORMATION, NORTH-CENTRAL MONTANA. A GEOHYDROLOGIC MAP SHOWS GEOLOGY, GEOLOGIC STRUCTURE CONTOURS, LOCATIONS OF LISTED WELLS, POTENTIOMETRIC SURFACE CONTOURS, AND AREAS OF FLOWING WELLS. CHEMICAL ANALYSES OF 4 REPRESENTATIVE WELLS ARE LISTED. A LIST OF 114 WELLS INVENTORIED FOR THE STUDY INCLUDES LOCATION, OWNERSHIP, ALTITUDE, WELL DEPTHS, STATIC WATER LEVEL, SHUT-IN PRESSURE OF FLOWING WELLS, ALTITUDE OF POTENTIOMETRIC SURFACE, ALTITUDE OF THE TOP OF THE JUDITH RIVER FORMATION, WATER TEMPERATURE, SPECIFIC CONDUCTIVITY, AND USE. GEOLOGIC CROSS SECTIONS SHOW STRATIGRAPHIC AND POTENTIOMETRIC RELATIONS. A GEOLOGIC COLUMN SHOWS CRETACEOUS MONTANA GROUP STRATIGRAPHY, LITHOLOGY, TOPOGRAPHY, AND GEOLOGIC SETTING, AND HYDROLOGY. THE RICHLEY-LAMBERT FORMATION, A THICK BED OF COAL, IS INJECTED WITH FLOW CAUSED BY SHALES. IT YIELDS 1 GPM PER 10 FT OF DRAWDOWN TO WELLS; PROBABLY THE HIGHEST YIELD TO BE EXPECTED IN A 6-INCH WELL IS LESS THAN 200 GPM. FEW WELLS FLOW OVER 10 GPM. SODIUM, SULFATE, BICARBONATE, AND TOTAL DISSOLVED SOLIDS CONCENTRATIONS ARE HIGH. (KNAPP-USGS)

The Richley-Lambert coal fields, Richland and Dawson Counties, Montana

Parker, F. S., 1936, U.S. Geological Survey Bulletin 847-C, p. 121-174. This report describes the coal resources of a 900 square mile area. It includes a description of the geologic structure and stratigraphy and a township-by-township description of the occurrence of coal. Two hundred seventy-six coal sections were measured, and generalized geologic sections show the relative position of the coal beds with respect to one another. The geologic map at a scale of 1:62,500 shows outcrops of coal beds, burned areas, and sites of measured coal sections.
The Mizpah coal field, Custer County, Montana

Paul F. S. and Andrews, B. A., 1930


This report contains a geologic map and three geologic sections at a scale of about 1:62,500 of the Fort Union and Hell Creek Formations, whose boundaries have since been revised. Shown on the map are the outcrop and burned area for 24 coal beds. Also included are analyses of seven coal samples and a correlation chart for the coal beds with those in adjacent fields. The text discusses the stratigraphy of the map units and characteristics of the coal beds. A township-by-township description of coal sections is accompanied by more than 1,500 graphic coal sections.

The Rosebud coal field, Rosebud and Custer Counties, Montana

Pierce, W. G., 1936


This report describes the coal resources for a 1,050 square mile area. It includes a description of the stratigraphy including 10 measured sections in the Tullock, Lebo Shale, and Tongue River Members of the Fort Union Formation. The township-by-township description of the occurrence includes 700 measured coal sections and the physical and chemical properties of 5 coal samples. The geologic map at a scale of 1:62,500 shows the outcrops of coal beds, burned areas, and sites of measured coal sections. Two generalized sections show the relative position of the coal beds with respect to one another.

Proposed 20-year plan of mining and reclamation, Westmoreland Resources Tract III Crow Indian ceded area, Montana


Geology and ground-water resources of central and southern Rosebud County, Montana, with chemical analyses of the waters by W. G. Riffenburg and E. T., 1929


In the northwest corner of the area covered by this report the Claggett, Judith River, and Bearpaw formations of the Montana group (Upper Cretaceous) named in ascending order, crop out. These formations are about 450-300 and 950 feet thick, respectively. The Bearpaw Shale is overlain without observable stratigraphic hiatus by the fresh-water Lance formation (Tertiary) age, which has a total thickness of about 925 feet. In the upper part of the Lance formation there are thin unworkable coal beds. Overlying the Lance is the Fort Union formation (Tertiary), which consists of the dark-colored Lebo shale member at the base (100 to 100 feet thick) and a younger light-colored member known as the Tongue River member (1,460 feet thick) with a layer of alternating beds of sandstone, shale, and coal. Many of these beds of coal are workable. In most of central and southern Rosebud County either the Lance formation or the Fort Union lies at the surface. Terrace gravel of Tertiary and Pleistocene age is present on many of the higher hills. Adjacent to the streams, especially the larger ones, there are belts of alluvium consisting of gravels, sands, and clays which are derived from the consolidated rocks and from the terrace gravel.

The most pronounced structural feature in this region is the Porcupine dome, which is located on the northwest corner of the area shown on the map. There are minor faults on the flanks of the dome. South of the Porcupine dome is a southeastern prolongation of the Bull Mountain syncline. Along the flanks of the syncline and in the vicinity of Hopsonville there are faults of slight displacement. It is probable that the faulting was coincident with the deformation that resulted in the uplift of the Porcupine dome.

The chief water-bearing formations in this area are the sandstone and coal beds of the Lance formation and the sandstone, coal, and clinker beds of the Fort Union formation. A supply of water can generally be had where the Lance and Fort Union formations are thick enough to extend below the water table. In the Lance and Fort Union formations the underlying Cretaceous formations water from shallow depths (that is, less than perhaps 125 feet) contains considerable calcium and magnesium. Therefore, where there is a hard crust of calcium and magnesium, and is therefore soft. This natural softening with increase in depth is due to the urac' of water through the hard crust as it moves downward and moves laterally, the silicate minerals in the rocks exchange their sodium for calcium and magnesium in the water. The hard water from the Lance and Fort Union formations, which is a sodium bicarbonate water generally satisfactory for domestic purposes, although in many places not entirely satisfactory for cooking, but it foams when used in boilers and is unfit for irrigation, as it produces a hard crust of black alkali on the surface of the land. The hard water from shallow depths in the areas of Lance and Fort Union domestic purposes, but it contains a considerable amount of scale-forming constituents.

The Colorado, Clagett, Judith River, and Bearpaw formations consist chiefly of highly mineralized shales that yield either no water or only very meager supplies of poor water. The Judith River formation contains some beds of water-bearing sandstone, which is the younger of these sandstones and is not covered by the mineralized shales of the Judith River or Bearpaw formations, they yield water of good quality, which is satisfactory for domestic use for stock and irrigation. Such water generally contains less dissolved
mineral matter than the water in the Lance and Fort Union formations. The Kootenai (?) formation contains water-bearing sandstones, but so far as known the water in these sandstones is highly mineralized and generally unsatisfactory for all uses. In much of the area where the Pleistocene and older terrace gravel is present it is of sufficient thickness to extend below the water table and will yield considerable supplies of water. This water contains less dissolved mineral matter than the water from any other formation in the region and is satisfactory for domestic use, stock, and irrigation, but is somewhat hard and contains an appreciable amount of scale-forming ingredients. The alluvium along the Yellowstone River, the Tongue River, and the other streams in the region of Lance and Fort Union rocks yields hard water to shallow dug or bored wells. Such water is generally satisfactory for stock, for drinking, and for irrigation but is rather hard for domestic use and is generally unsatisfactory for industrial uses because of the relatively large amount of scale-forming constituents that it contains.

Flowing artesian wells along the flood plain of the Yellowstone River in the eastern part of the area derive their water from the Lance formation; those along the flood plain of the Tongue River in the vicinity of Ashland and Birney derive their water from the Fort Union formation. The water from all the artesian wells in both areas is soft. It is probable that flowing wells may be obtained by drilling into the Tongue River member at some places along the flood plain of the Tongue River between Ashland and Birney, but it is not feasible to predict exactly where such flows may be obtained.

Many of the flowing wells along the Yellowstone and Tongue Rivers yield water that contains carbonates, mostly methane derived from the coal and carbonate material in the Lance and Fort Union formations. In places there is evidence that the methane reduces the solubility in the ground water, with the resulting formation of hydrogen sulfide and carbonate or bicarbonate.

Hydrogeologic Data for Selected Coal Areas, East-Central Montana

Hydrogeologic data were collected in selected coal areas of East-Central Montana to provide a basis for evaluating the effects of future coal development on the groundwater resources. Inventory records for 916 domestic stock, public supply, commercial, and test wells are tabulated in the report. The data were collected principally from 1975 through 1976.

Locations of the wells are shown on a map at a scale of 1:250,000. Lithologic logs are also included for 149 wells. Chemical analyses of water samples from selected wells consist of 167 samples analyzed for major cations and anions and 24 samples analyzed for miscellaneous constituents. (USGS)


This report consists of a hydrogeologic map at a scale of 1:500,000 showing the configuration of the top of the Bearpaw confining layer, a regional-scale map showing the structural features of eastern Montana, three geologic sections, a table describing the stratigraphy and water-yielding characteristics of the map units from the Bearpaw confining layer through the alluvial aquifer, and representative electric logs correlating geologic and hydrogeologic units.

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Geology and ground-water resources of the Missouri River valley in northeastern Montana, with a section on the quality of the ground water by W. H. Duram.

Swozyn, F. A., 1955


POSSIBLE DEVELOPMENT OF WATER FROM MADISON GROUP AND ASSOCIATED ROCK IN POWDER RIVER BASIN, MONTANA-WYOMING

Swozyn, F. A., GEOLOGICAL SURVEY, DENVER, COLO.

Report in the Northern Great Plains Resources Program, July 1, 1974. 6 p., 4 PLATE.

Journal Announcement: SWAC008

THE POTENTIAL FOR DEVELOPING LARGE GROUNDWATER SUPPLIES FOR INDUSTRIAL USE IN THE POWDER RIVER BASIN OF WYOMING AND MONTANA IS SUMMARIZED, RECORDS OF MANY OIL TESTS AND SEVERAL WATER TESTS INDICATE THAT THE MADISON GROUP AND THE UNDERLYING CARBONATE ROCKS ARE HYDROLOGICALLY CONNECTED AND TRANSPORT WATER AS A UNIT. ALSO, IN MANY LOCALITIES, THE OVERLYING TENSELLEP AND MINNELUSA SANDSTONES ARE ALSO CONNECTED WITH THE MADISON. THESE ROCKS UNDERLIE THE ENTIRE HASIN AND ARE EXPOSED ON THE FLANKS OF THE SURROUNDING MOUNTAINS. THE MADISON ROCKS, AND TO A CONSIDERABLE EXTENT THE UNDERLYING CARBONATES, ARE FRACTURED AND CAVES. LARGE QUANTITIES OF WATER HAVE BEEN DERIVED FROM THESE ROCKS IN THE MIDWEST, WYOMING AREA SINCE 1917. THE MADISON AND UNDERLYING CARBONATES CONTAIN WATER OF MODERATE-TO-GOOD QUALITY THAT IS PROBABLY SUITABLE FOR INDUSTRIAL USE. IT CONTAINS TOO HIGH A PERCENTAGE OF SODIUM FOR IRRIGATION USE.

(Knap-USGS)

POTENTIAL OF MADISON GROUP AND ASSOCIATED ROCKS TO SUPPLY INDUSTRIAL WATER NEEDS, POWDER RIVER BASIN, WYOMING AND MONTANA.

(Duplicated see Wyoming)

Swozyn, F. A., GEOLOGICAL SURVEY, DENVER, COLO.

IN: WATER RESOURCES PROBLEMS RELATED TO MINING: AMERICAN WATER RESOURCES ASSOCIATION PROCEEDINGS SERIES NO 18, P 210-218, JUNE 1974, 5 FIG., 4 REF./

Journal Announcement: SWAC002

GROUND WATER RESOURCES OF THE NORTHERN POWDER RIVER VALLEY, SOUTHEASTERN MONTANA

Taylor, James O.

U. S. GEOLOGICAL SURVEY, MONT. BUREAU OF MINES AND GEOLOG. HULL, 66p, 34 P., MAY 1968, 17 FIG., 1 PLATE, W. T. 92, 32 REFL, 1 APPENDIX.

Journal Announcement: SWAC003

THE DOMESTIC, STOCK, INDUSTRIAL, AND MUNICIPAL WATER SUPPLIES OF THE NORTHERN POWDER RIVER VALLEY DEPEND ON GROUNDWATER FROM THE AQUIFERS IN THE LATE CRETACEOUS FOX HILLS SANDSTONE AND HELL CREEK FORMATION, THE PALEOCENE FORT UNION FORMATION, AND PLEISTOCENE TO RECENT TERMECE DEPOSITS. THE PEACEFUL AND DEPENDABLE AQUIFER IS THE FIX HILLSBASAL HELL CREEK ARTESIAN AQUIFER WHICH AVERAGES 250 FT IN THICKNESS, HAS A MODERATE TRANSMISSIVITY, AND A STORAGE COEFFICIENT OF ABOUT .00026. THE RECHARGE AREA IS IN THE SOUTHEASTERN MONTANA, AND WATER MOVES NORTHWEST TO DISCHARGE INTO THE YELLOWSTONE RIVER VALLEY BY LEAKAGE THROUGH OVERLYING CONFINING BEDS. THE ARTESIAN AQUIFERS IN THE FORT UNION FORMATION ARE DISCONTINUOUS AND ARE CHARGED AT VARIOUS PLACES, BUT THE DIRECTION OF MOVEMENT IS ALSO NORTHWARD TO DISCHARGE THROUGH SPRINGS. DISSOLVED SOLIDS CONTENT IN THE GROUNDWATER IS LESS THAN 1,000 PPM. WATER FROM THE HIGHER FORMATIONS IS HARD. DISSOLVED GAS, MOSTLY NITROGEN, IS FOUND IN THE FOX HILLS-FOX CREEK HELL CREEK AQUIFER. IN GENERAL THE WATER IS SATISFACTORY FOR DOMESTIC AND STOCK USE BUT UNSATISFACTORY FOR IRRIGATION. SUPPLIES ARE ADEQUATE FOR PRESENT AND PROJECTED FUTURE USE.

(Knap-USGS)

Geology of Big Horn County and the Crow Indian Reservation with special reference to the water, coal, oil, and gas resources.


Geology and ground-water resources of the lower Yellowstone River valley between Glendive and Sidney, Montana, with a section on Chemical quality of the water by H. A. Swozyn


This report contains a geologic map at a scale of about 1:27,000 and a table describing the stratigraphy and the water-bearing characteristics of the Fox Hills Sandstone, the Hell Creek, and Fort Union Formations, and the Quaternary deposits. Except for a short discussion of geology, the text primarily describes the hydrology and chemical quality of ground and surface waters.

Ground-water resources of the lower Yellowstone River valley between Miles City and Glendive, Montana, with a section on the chemical quality of the water by H. A. Swozyn

Torrey, A. E., and Swenson, F. A., 1951


This report describes the geology and hydrology of exposed bedrock and alluvial deposits in the Yellowstone River valley. The text contains a description and a generalized section of the lithology and water-bearing properties of the Pierre Shale through the Fort Union Formation and alluvial deposits. Included
is a geologic map of the Yellowstone River valley at a scale of 1:263,360.

PROSPECTS FOR DEVELOPING STOCK-WATER SUPPLIES FROM WELLS IN NORTHEASTERN GARFIELD COUNTY, MONTANA

VAN LEWEN, M. C. & KING, H. J.

GEOLICAL SURVEY, WASHING, D. C.

AVAILABLE FROM SUP DOC, GPO, WASH, D. C. 20402 - PRICE 75 CENTS.

A PRACTICAL AND RELIABLE SOURCE OF LIVESTOCK WATER EXISTS ON BOTH PUBLIC AND PRIVATELY OWNED GRAZING LAND IN NORTHEASTERN GARFIELD COUNTY, MONTANA. THIS COMPRISSES AN AREA OF SOME 1,200 SQUARE MILES. THE PRINCIPAL BEDROCK AQUIFER IS THE FOX HILLS SANDSTONE FORMATION OF UPPER CRETAEOUS AGE. IT IS EXPOSED ON THE SURFACE IN THE NORTHERN AND NORTHWESTERN PART OF THE COUNTY PENETRATING THIS AQUIFER REACH WATER AT ABOUT 200 FEET. AMPLE WATER IS AVAILABLE FOR LIVESTOCK USE FROM WELLS DRILLED IN THIS AQUIFER. MOST OF THESE WELLS REACH THE AQUIFER AT 195 FEET. UNDERFLOW IN ALLUVIAL DEPOSITS ALONG THE LARGER STREAM VALLEYS IS ANOTHER SOURCE OF LIVESTOCK WATER. CHEMICAL ANALYSIS OF SAMPLES COLLECTED AT 63 WELLS AND 3 SPRINGS SHOW THE WATER QUALITY TO BE GENERALLY POOR. WATER FROM THE FOX HILLS AQUIFER AND OTHERS ASSOCIATED WITH IT CONTAINS 50-50, 340 MILLIGRAMS PER LITER OF TOTAL DISSOLVED SOLIDS. THE PRINCIPAL CONSTITUENTS ARE SODIUM, BICARBONATE, AND SULFATE. ALL WATER SUPPLIES TESTED WERE SUITABLE FOR LIVESTOCK USE.

Bibliography of Geology and Ground-water Resources for the Montana Part of the Northern Great Plains Regional Aquifer System Analysis.


- U.S. Geological Survey Miscellaneous Field Studies Map MF-590, 1 sheet.

- Plan of study of the hydrology of the Madison Limestone and associated rocks in parts of Montana, Nebraska, North Dakota, South Dakota, and Wyoming.


This report summarizes the present (1975) knowledge of the geohydrology of the Madison and associated rocks, identifies the need for additional data, and outlines a 5-year plan for a comprehensive study of the hydrology of these rocks.
Shallow ground water in selected areas in the Fort Union Coal region
U.S. Geological Survey, 1974

Ground Water of the Fort Union Coal Region, Eastern Montana
Journal Announcement: SWA0820

The hydrologic findings of numerous studies recently completed or currently underway by the Montana Bureau of Mines and Geology and the U.S. Geological Survey are described. Pertinent facts are given on the occurrence, movement, and quality of ground water in the Fort Union Coal Region of Montana. The present development, effects of seismic shotholes on ground-water movement, and effects of strip mining on shallow ground-water systems are also described. The primary purpose of the report is to provide basic factual material on ground-water conditions to assist nontechnical readers in understanding the complex ground-water problems existing in eastern Montana. (Woodard-USGS)

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1970: PART 6
MISSOURI RIVER BASIN
GEOLOGICAL SURVEY, RESTON, VA.
AVAILABLE FROM SUPP. OF DOCUMENTS, GPO, WASHINGTON, D.C., 2003, 504 P., 1 FIG., 41 REF.
Journal Announcement: SWA0824

During the year ending September 30, 1970, the GEOLOGICAL SURVEY MAINTAINED 258 STATIONS ON 123 STREAMS IN THE MISSOURI RIVER BASIN FOR THE STUDY OF CHEMICAL AND PHYSICAL CHARACTERISTICS OF SURFACE WATER. SAMPLES WERE COLLECTED AT DAILY AND MONTHLY AT 226 OF THESE LOCATIONS FOR CHEMICAL-QUALITY STUDIES. SAMPLES ALSO WERE COLLECTED LESS FREQUENTLY AT MANY OTHER POINTS. WATER TEMPERATURES WERE MEASURED CONTINUOUSLY AT 35 AND DAILY AT 67 STATIONS. DAILY WATER TEMPERATURES WERE MEASURED AT MOST OF THE STATIONS AT THE TIME SAMPLES WERE COLLECTED FOR CHEMICAL OR SEDIMENT CONTENT. SO FAR AS PRACTICABLE, THE WATER TEMPERATURES WERE TAKEN AT ABOUT THE SAME TIME EACH DAY. QUANTITIES OF SUSPENDED SEDIMENT ARE REPORTED FOR 40 STATIONS DURING THE YEAR ENDING SEPTEMBER 30, 1969. SEDIMENT SAMPLES WERE COLLECTED AT DAILY OR MORE TIMES DAILY AT MOST STATIONS, DEPENDING ON THE RATE OF FLOW AND CHANGES IN STAGE OF THE STREAM. PARTICLE-SIZE DISTRIBUTIONS OF SEDIMENTS WERE DETERMINED AT 44 STATIONS. THE STREAM DISCHARGE REPORTED FOR A COMPOSITE SAMPLE IS USUALLY THE AVERAGE OF DAILY MEAN DISCHARGES FOR THE COMPOSITE PERIOD. THE DISCHARGES REPORTED IN THE TABLES OF SINGLE ANALYSES ARE EITHER DAILY MEAN DISCHARGES OR DISCHARGES OBTAINED AT THE TIME SAMPLES WERE COLLECTED AND COMPUTED FROM A STAGE-DISCHARGE RELATION OR FROM A DISCHARGE MEASUREMENT. (Woodard-USGS)

QUALITY OF GROUND WATER OF THE UNITED STATES: 1969; PART 6
MISSOURI RIVER BASIN
GEOLOGICAL SURVEY, RESTON, VA.
WATER-SUPPLY PAPER 2145, 1974, 441 P., 1 FIG., 40 REF.
Journal Announcement: SWA0823


DISCHARGE MEASUREMENT. (WOODARD-USGS)

QUALITY OF SURFACE WATER OF THE UNITED STATES, 1969: PART 6
MISSOURI RIVER BASIN
GEOLOGICAL SURVEY, RESTON, VA.
WATER-SUPPLY PAPER 2145, 1974, 441 P., 1 FIG., 40 REF.
Journal Announcement: SWA0823


Water resources data for Montana consist of records of stage, discharge, and water quality of streams, stage, contents, and water quality of lakes and reservoirs; and water levels in wells. Additional water data were collected at various sites of the systematic data-collection programs, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Montana. (USGS)

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY
in Montana published annually since 1975.


Available from the OFS, USGS, Box 25425, Fed. Ctr., Denver, CO, 80225.

These reports describe the investigative efforts of the U.S. Geological Survey toward the water resources of Montana, hydrologic information and knowledge of the water resources are gained and disseminated principally by programs of (1) collecting hydrologic data on a continuing basis, (2) conducting water-resources appraisals of surface and ground water, (3) conducting supportive research in hydrology and related fields, (4) disseminating water data and results of investigations to the public, (5) coordinating acquisition of water data by Federal agencies, and (6) providing technical assistance in hydrologic fields to other government agencies.

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN THE NORTHERN GREAT PLAINS COAL REGION OF EASTERN MONTANA, 1975-76

GEOL OGY SURVEY, HELENA, MONT.

OPEN-FILE REPORT, JANUARY 1976. 29 P., 10 FIG., 1 TABLE.

This report presents the water data-collection program and interpretive hydrologic investigations that are being conducted by the U.S. Geological Survey in the northern great plains region of eastern Montana. The area is of intense interest for coal, coalbed methane, natural gas, and environmental groups. In October 1975 there were 45 streamflow and 64 water-quality data-collection stations in the region. Groundwater investigations are being conducted to determine the areal hydrology of the Madison Group and associated paleoecologic rocks and the areaal and site hydrology of shallow aquifers in the Fort Union formation, including the coal beds. Available data, mostly from oil tests, indicate that the Madison may yield water suitable for use in energy developments in the northern great plains coal region. Fieldwork in the shallow groundwater study consists principally of an inventory of wells and springs and construction of wells for water sampling, aquifer testing, and water-level measurements. A computer model is being constructed to determine the effect on stream temperature of selected increases in withdrawal rates, and thus reduced flow, of the Yellowstone River from Billings to Sidney, Mont. (Woodard-USGS)

Preliminary study of the coal deposits in the Circle area, McCone, Dawson, and Garfield Counties, Montana

Wincentsen, Herbert, 1978


Coal geology of the northeast Circle area, McCone and Dawson Counties, Montana

Wincentsen, Herbert, 1979


Documentation of a dissolved-solids model of the Tongue River, southeastern Montana

Woods, P. F., 1981a


A computer model has been developed for assessing potential increases in dissolved solids of streams as a result of leaching of overburden materials used to backfill pits in surface coal-mining operations. The model allows spatial and temporal simulation of streamflow and dissolved-solids loads and concentrations under user-defined scenarios of surface coal mining and agricultural development. The model specifically addresses the Tongue River from the Tongue River Dam to Miles City, Montana, and its three major tributaries, Hanging woman, Otter, and Pumpkin Creeks.

The model routes an input quantity of streamflow and dissolved solids from the upstream end to the downstream end of a stream reach while algebraically accounting for gains and losses of streamflow and dissolved solids within the stream reach. Input data needed to operate the model include the following: simulation number, designation of hydrologic conditions for each simulated month, either user-defined or regression-defined concentrations of dissolved solids input by the Tongue River Reservoir, number of irrigated acres, number of mined acres, dissolved-solids concentration of mine leachates, and quantity of other water losses.

The computer program is written in FORTRAN language. A listing of the computer program definitions of all variables in the model, and an example output will permit use of the model by interested persons.

Modeled impacts of surface coal mining on dissolved solids in the Tongue River, southeastern Montana

Woods, P. F., 1981b


A computer model has been developed for assessing potential increases in dissolved solids of streams as a result of leaching of overburden materials used to backfill pits in surface coal-mining operations in southeastern Montana. The model allows...
Preliminary study of the coal deposits in the Circle area, McCone, Dawson, and Garfield Counties, Montana

Wincentzen, Herbert. 1978


Coal geology of the Northeast Circle area, McCone and Dawson Counties, Montana

Wincentzen, Herbert. 1979


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- simulation number
- designation of hydrologic conditions for each simulation month
- user-defined regression-defined concentrations of dissolved solids input by the Tongue River Reservoir
- number of irrigated acres, number of mined acres, dissolved-solids concentration of mine leachates, and quantity of other water losses.

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Woods, P. F., 1981b


A computer model has been developed for assessing potential increases in dissolved solids of streams as a result of leaching of overburden materials used to backfill pits in surface coal-mining operations in southeastern Montana. The model allows...
The 3,200-acre Bear Creek site is above the northern Powder River Basin where the strata dip southwardly less than 3 degrees. Nearly 166 million tons of coal are in the Anderson, Dietz and Canyon coal beds, 90 percent of which are more than 10 feet thick, and are covered by less than 200 feet of overburden. The site is mostly gently sloping valley floors merging laterally into steep, semi-badlands and irregular remnants capped by sandstone. The semiarid (precipitation less than 15 inches per year) site is mostly drained by Bear Creek and partly by Vance Creek, both intermittent. Stream dissolved solids ranges from 140 (at 53 cubic feet per second of snowmelt runoff) to 2,330 milligrams per liter at near-low flow. Solids dissolved in alluvial water (5 gallons per minute from one of the test holes) ranged from 2,720 to 5,040 milligrams per liter. Water also was found under water-table, semiconfined, and confined conditions in discontinuous sandstones and persistent coal layers. Yields are small, less than 3 gallons per minute, and dissolved solids ranged from 1,110 to 4,760 milligrams per liter. The site is a recharge area and large yields should not be expected from these aquifers. Madison Group aquifers 10,000 feet below the site have produced more than 1,000 gallons per minute from a single well nearby. Surface mining would dewater the shallow aquifers, reducing stream flow and affecting 8 stock and domestic wells. Replacement wells and discharge of mine water would mitigate these impacts.

Hanging Woman Creek Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in the Hanging Woman Creek Coal Field, south-central Montana

The 34.3 square-mile Hanging Woman Creek study area is coincident with the elongate drainage basin of East Trail Creek. Relief is as much as 600 feet from the alluvium-entrained creek, up gentile to moderately steep slopes to sandstone-supported flat ridges. Intermittent East Trail Creek slopes to Trail Creek, also intermittent, a tributary to Hanging Woman Creek. Precipitation ranges from about 12 to 19 inches depending on elevation. Most coal is found in two beds of the Fort Union Formation's Tongue River Member. The Anderson coal bed ranges from 26 to 33 feet thick and the Dietz bed, 50 to 100 feet below, is from 9 to 12 feet thick. More than 433 million tons of coal in these two beds underlie less than 200 feet of overburden. Perched and semi-confined aquifers in and above the coal beds yielded as much as 10 gallons per minute during fractional day pump tests. One test of 30 feet of
alloxium produced 18 gallons per minute for more than 9 hours. Dissolved solids in water from wells in bedrock ranged from 438 to 9,460 milligrams per liter and in East Trail Creek alluvium from 1,500 to 4,510 milligrams per liter. Surface mining would drain the shallow aquifers at a diminishing rate beginning at 0.7 cubic feet per second, and dry up 17 stock wells or springs and remove 15 perennial and 4 ephemeral stock ponds. All could be replaced. Water would not be needed for reclamation.

This document assesses relative impacts of surface mining of coal on two tracts involved in an exchange of coal ownership between the Meridian Land and Mineral Company and the Bureau of Land Management. About 856 million tons of strippable coal underlie the 69.5 square miles of both tracts. The lignite coal is in two beds of the Tongue River Member of the Fort Union Formation, part of the Circle West coal deposit. The tracts are drained by tributaries to through-flowing ephemeral creeks. Annual runoff of 0.4 inch ranges from 300 to 7,700 milligrams per liter dissolved solids. The tracts contain 37 small stock ponds, most of which are dry by fall. Small amounts of water containing between 1,000 and 4,000 milligrams per liter of total dissolved solids occur in the coal layers and in sandstone lenses above the coal. One well obtains water from alluvium where water quality ranges from good to poor. No data is provided for the 19 observation and 18 stock wells in the tracts. Nearby wells tap the Cretaceous Fox Hills Formation, 1,200 to 1,500 feet below the surface and yield as much as 200 gallons per minute of sodium bicarbonate water ranging from 500 to 2,000 milligrams per liter of total dissolved solids. Mining would remove most existing wells which could be replaced by more productive wells into deeper aquifers. Lowered water levels temporarily could extend as much as three miles downgradient to the north. No significant changes in quality or quality of surface water are anticipated. Sedimentation ponds could be left to replace destroyed stock ponds. Water requirements could be obtained from Fort Peck Reservoir several miles to the northeast.

Otter Creek Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in the Otter Creek Coal Field, southeastern Montana

BLM, Denver, Colorado
EMRIA Report No. 1-75

The Otter Creek Coal Field underlies a dissected ridge sloping westward to the Otter Creek Valley, and is bounded on the north and south by Home and Threemile Creeks, intermittent tributaries to Otter Creek. Coal occurs chiefly as the 60-foot thick Knoblock bed, in this beds above, and as the 10-foot thick Flowers-Goodale bed, 120 feet below the Knoblock, all in the Tongue River member of the Eocene age Fort Union Formation. The recoverable resource, the Knoblock coal, is covered by less than 200 feet of overburden, and can be surface-mined. Small quantities of poor quality unconfined water occur in thin sandstone and coal beds above the Knoblock coal. Slightly better quality water occurs in the coal. Yields to wells in these shallow aquifers are generally less than 10 gallons per minute and may not be sustainable for many uses. Confined water occurs about 150 feet below the Knoblock coal, and in various deeper aquifers, including those in the Madison Group, about 8,000 feet below land surface. Potential yields range from low in the shallower confined aquifers, to moderately high (several hundred gallons per minute) in the Madison. Potentiometric heads of deeper aquifers may be about 300 feet above land surface. Water quality is poor, ranging from more than 1,000 to as much as 6,000 milligrams per liter of total dissolved solids. Surface mining would dewater as much as 60 feet of saturated coal, affecting 6 stock wells. Special practices would prevent increased stream sedimentation. Water needed for operation could be obtained from impounded good-quality runoff supplemented by poorer quality ground water.

Pumpkin Creek Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in the Pumpkin Creek Coal Field, southeastern Montana

BLM, Denver, Colorado
EMRIA Rept. No. 11-78

The Pumpkin Creek site consists of 17 square miles of the Pumpkin Creek Coal Field, part of the Coalwood Coal Field in the northern Powder River Basin, southeastern Montana. Its semi-badland upland areas of buttes and steep, rocky outcrops drain by ephemeral tributaries to intermittent Pumpkin Creek on the northeast, Mixapah Creek on the southeast—eventually to the Yellowstone River via the Tongue River. Maximum relief from the bounding creeks to the elongate drainagc divide is 350 feet. Annual precipitation is 13.8 inches. Nearly 1,370 million tons of coal in beds more than 5 feet thick are covered by less than 200 feet of overburden. Most runoff is intercepted for irrigation and stock watering by ditches and small reservoirs. The coal is in the lower Tongue River Member of the Fort Union Formation and consists of Sawyer, Mackin-Walker and A beds. Small amounts of perched, unconfined and semi-confined water was found sporadically in the coal and intervening and overlying discontinuous sandstone layers. Dissolved solids ranged from 397 to 4,340 milligrams per liter. The Lebo Shale Member, lower Fort Union Formation, hydraulically isolates the shallow aquifers from lower aquifers. Surface mining would dewater the shallow aquifer, and remove 6 wells, 3 springs, and 12 perennial and 25 ephemeral reservoirs.
This action would lease to the Decker Coal Company 440 acres of Federal coal, 160 acres of which would be surface-mined as an extension of its existing operations, and would provide access to an additional 11 million tons of coal. The mine is four miles northeast of Decker, Montana, and 21 miles northeast of Sheridan, Wyoming. The lease area consists of steep-sloped ridges adjacent to gentle slopes, draining ephemerally by ditches to intermittent Pond and Pearson Creeks. Annual runoff range is from 0.2 to 0.4 inches. The coal, in the Tongue River Member of the Paleocene Fort Union Formation, is about 52 feet thick, and dips slightly eastward into the Powder River Basin. The coals yield adequate water for domestic and stock use near the area, but no wells exist on the site. Depth to water in an observation well less than one-half mile from the site was 1,818 feet. Dissolved solids in nearby wells were 1,529 and 1,621 milligrams per liter. Dissolved solids in nearby creeks ranged from about 1,200 milligrams per liter at high flow to about 2,500 milligrams per liter at low flow. The proposed mining in the application area would have no erosion or sedimentation impact in addition to that occurring from existing mining operations. Surface water quality should be as good if not better than pre-mined conditions. Occurrence and flow of ground water in the mine spoils would not be significantly different from pre-mined conditions. Spoil water would contain three times the dissolved solids of nearby ground water but would be acceptable for livestock.

Western Energy Coal Lease Modification, southeast Montana
BLM, Miles City, Montana
EA, 1976

This analysis evaluates impacts of allowing surface mining of 320 acres containing 12.6 million tons of recoverable Federal coal that otherwise would be by-passed. The mine area is immediately west of Colstrip and 36 miles south of Forsyth, Montana. The general area includes buttes, mesas, dissected plateaus and long narrow divides. The lease modification area is similar but lacks ridges and buttes, and its relief is only about 200 feet. Runoff from annual precipitation drains through normally dry gullies to East Fork Armello Creek. The recoverable coal, the Rosebud seam in the the Tongue River Member of the Paleocene Fort Union Formation, averages 24 feet thick and is covered by less than 150 feet of sandstone, thin shale and coal layers. Little or no water occurs in the Rosebud seam or above. Productive aquifers occur beneath the Rosebud. No wells exist in the lease modification area. Mining of the lease modification area would not significantly increase impacts to water resources.
WATER RESOURCES OF NEW MEXICO. OCCURRENCE, DEVELOPMENT AND USE.
BALANCE. J. C; SORENSON, EARL F.; TITUS, F. B.; BORTON, R. L.;
MOURANT, W. A.
STATE PLANNING OFFICE, SANTA FE, NEW MEX.; AND
GEOLOGICAL SURVEY, WASHINGTON, D. C.
NEW MEX STATE PLANNING OFFICE, 1967. 131 P., 46 FIG., 4
PLATE, 63 TAB, 209 REF.

Journal Announcement: SWRA211
NEW MEXICO'S WATER RESOURCES AND WATER RESOURCE DEVELOPMENT ARE
DESIRED. THE WATER LAW OF THE STATE IS BASED ON PRIOR
APPROPRIATIONS TO ENSURE ORDERLY DEVELOPMENT. THE UTILIZATION OF
WATER, STREAMFLOW, GEOLOGY, GROUNDWATER HYDROLOGY, SETTLEMENT
AND HISTORY, ECONOMICS, AGRICULTURE, MINING, AND WATER
PROBLEMS OF THE STATE ARE DESCRIBED IN REPORTS ON EACH OF THE
STATE'S DRAINAGE BASINS. THE AREAS DISCUSSED IN DETAIL ARE THE
ARKANSAS RIVER BASIN, PECOS RIVER BASIN, CENTRAL CLOSED BASINS,
RIO GRANDE BASIN, WESTERN CLOSED BASINS, SAN JUAN RIVER BASIN,
LOWER COLORADO RIVER BASIN, AND SOUTHWESTERN CLOSED BASINS.
(KNAP-USGS)

STRUCTURE AND STRATIGRAPHY IN THE VICINITY OF THE SHELLOIL CO.
SANTA FE PACIFIC NO. 1 TEST WELL. SOUTHERN SANDOVAL COUNTY, NEW
MEXICO
BLACK, R. A.; HISS, W. L.
GEOL O GICAL SURVEY, ALBUQUERQUE, N. MEX.
NEW MEXICO GEOLOGICAL SOCIETY GUIDEBOOK, 25TH FIELD
CONFERENCE, GREAT RANCH (CENTRAL-NORTHERN NEW MEXICO), P
365-370, 1974. 4 FIG., 2 PLATE, 2 TAB, 12 REF.

Journal Announcement: SWRA803
THE STRATIGRAPHIC SECTION BENEATH THE SANTA FE GROUP IN THE
NORTHERN PART OF THE ALBUQUERQUE-BELEN BASIN, NEW MEXICO, WAS
OBTAINED FROM A WILDCAT OIL-TEST WELL. A GENERALIZED
GEOL O GICAL SECTION EXTENDING APPROXIMATELY 60 MILES FROM THE
RIO PUEBLO ON THE WEST ACROSS MESA PRIETA AND TERMINATING IN THE
CERILLOS HILLS IS SHOWN. THE POTENTIAL FOR DEVELOPMENT OF
ADDITIONAL OIL, GAS, URANIUM, COAL, GEOTHERMAL, AND
GROUNDWATER RESOURCES MAKES THE GEOLOGIC UNDERSTANDING OF THIS
AREA NOT ONLY OF ACADEMIC INTEREST BUT ALSO OF GREAT ECONOMIC
IMPORTANCE FOR THE FUTURE OF NEW MEXICO. (KNAP-USGS)

Effects of uranium development on erosion and associated
sedimentation in southern San Juan Basin, New Mexico
Cooley, M. E., 1979

GEOL O GY AND GROUND-WATER OCCURRENCE IN SOUTHEASTERN MCKINLEY
COUNTY, NEW MEXICO
COOPER, JAMES B.; JOHN, EDWARD C.

US GEOLOGICAL SURVEY.
NEW MEX STATE ENG TECH REP 35, 108 P., 1968. 7 FIG., 2 PLATE, 5
TAB, 56 REF.

Journal Announcement: SWRA802
GEOL O GIC CONDITIONS AND THE GENERAL AVAILABILITY AND CHEMICAL
QUALITY OF GROUNDWATERS IN SOUTHEASTERN MCKINLEY COUNTY, NEW
MEXICO ARE DESCRIBED WITH PARTICULAR EMPHASIS ON AREAS WHERE
LARGE BODIES OF URANIUM ORES ARE PRESENT. THE PRINCIPAL
AQUIFERS, THEIR AREAL EXTENT, AND THEIR AREAS OF DISTINCT
AQUIFERS, MOSTLY ARTESIAN, IN ROCKS THAT RANGE IN AGE FROM
PERMIAN TO QUARTERNARY. YIELDS OF 300 GPM ARE OBTAINED FROM WELLS
THAT TAP AQUIFERS IN THE GLORETTA SANDSTONE AND SAN ANDRES
LIMESTONE. GROUNDWATER IN ADEQUATE QUANTITIES AND OF USABLE
QUALITY FOR STOCK AND DOMESTIC USE IS AVAILABLE THROUGHOUT
SOUTHEASTERN MCKINLEY COUNTY. URANIUM MINES DISCHARGE MILLIONS
OF GALLONS OF WATER; SOME OF THE WATER IS USED IN THE MILLS,
BUT MOST OF IT IS PUMPED TO WASTE. GROUNDWATER ASSOCIATED
WITH THE URANIUM DEPOSITS IS SLIGHTLY RADIOACTIVE. SEVERAL
SAMPLES FROM MINES OR WELLS CONTAINED CONCENTRATIONS OF
RADIUM SOMEWHAT ABOVE THE RECOMMENDED MAXIMUM LIMIT FOR DRINKING
WATER. RECHARGE TO AQUIFERS IN SOUTHEASTERN MCKINLEY COUNTY
IS MAINLY FROM PRECIPITATION ON OUTCROPS OF THE ROCKS AND FROM
WATER ALONG FAULT ZONES.

Preliminary Data Report for the San Juan Basin-Crownpoint
Surveillance Study
Frenzel, Peter F.; Crane, S. D.; Padgett, E. T.
Available from OFSS, USGS Box 25425, Denver, CO
80225, in paper copy, 86,000 $, microfiche.
FIG., 5 PLATES, 3 TAB, 4 REF.

Journal Announcement: SWRA420
Geology data that may be used to predict the effects of
mining on Navajo water resources in the San Juan structural
basin are reported as well as the current availability of data
from both mining and geologic investigations. Emphasis is on the
vicinity of Crownpoint, New Mexico, (USGS)

Estimates of vertical hydraulic conductivity and regional
groundwater flow pathways, in rocks of Jurassic and cretaceous age,
San Juan Basin, New Mexico and Colorado
Frenzel, Peter F., and Lyford, Forest P.
U.S. Geological Survey Water-Resources Investigations 82-6015
The San Juan structural basin in northwestern New Mexico was
modeled in three dimensions using a finite-difference
steady-state model. The modeled space was divided into seven
layers of square prisms that were 6 miles on a side in the
horizontal directions. In the vertical directions, the layers
of prisms ranged in thickness from 300 to 1,500 feet. The model
included the geologic section between the base of the Entrada
Sandstone and the middle of the Lewis Shale. Principal aquifers

GEOL O GY AND GROUNDWATER OCCURRENCE IN SOUTHEASTERN MCKINLEY
COUNTY, NEW MEXICO
COOPER, JAMES B.; JOHN, EDWARD C.
in this section are mostly confined and include the Entrada Sandstone, the western Canyon Member of the Morrison Formation, and the Gallup Sandstone in the lower part of the Mesaverde Group.

Values for vertical hydraulic conductivities from 10 exp(-12) to 10 exp(-11) ft per sec for the confining layers gave a good simulation of head differences between layers, but a sensitivity analysis indicated that these values could be between 10 and 100 times greater. The model-derived steady-state flow was about 30 cubic feet per second. About one-half of the flow was in the San Juan River drainage basin about one-third in the Rio Grande drainage basins and one-sixth in the Puerco River drainage basin.


The San Juan River, the second largest tributary to the Colorado River, originates on the west slope of the Continental Divide in southwestern Colorado and flows westward through Colorado, New Mexico, Arizona, and Utah. Long-term streamflow and water-quality records are available at the U.S. Geological Survey gaging station, San Juan River at Shiprock, New Mexico. Mean values were calculated for daily measurements of streamflow, specific conductance, water temperature, sediment concentration, and sediment load for the period prior to 1963 and the period since 1963. The t-test procedure was used to compare the pre-1963 mean and post-1963 mean. Results show the means of daily streamflow and sediment load measurements for the San Juan River at the Shiprock gaging station have decreased for the post-1963 period due in part to the construction of San' Juan River Reservoir. Other causes of this decrease may be related to increasing population, changes in agricultural irrigation, increased industrialization, climatic conditions, or a combination of these factors. The time-weighted mean of daily specific-conductance measurements appears to have decreased for the post-1963 period, but the reason for this change is not apparent. The discharge-weighted mean of daily specific-conductance measurements has increased for the post-1963 period. The means of daily water temperature and sediment concentration are not statistically different for the two time periods.

Hydrologic Investigations and Data-Collection Network in Strippable Coal Areas in Northwestern New Mexico Neal, H. R., Jr.

This report presents hydrologic investigations and data collections conducted by the U.S. Geological Survey in the strippable coal areas of northwestern New Mexico. Streamflow, ground-water, and quality-of-water data were collected to provide a baseline or prevailing hydrologic conditions. A network of hydrologic data-collection sites in the strippable coal areas of the Fruitland Formation was designed to meet the need of detailed investigations, including site-specific studies, and to provide hydrologic data in support of the expanding mining activity. The network consists of 34 continuous-record streamflow-gaging stations (32 included water-quality sampling), 20 miscellaneous water-quality streamflow stations, 12 annual maximum discharge stations, 27 observation wells completed in strata associated with the strippable coal seams, and 24 observation wells completed in channel alluvium downstream from strippable coal areas. (USGS)


Regression equations are presented to predict ephemeral streamflow characteristics in the San Juan Basin in northwestern New Mexico. The standard error of estimate for predicting runoff for water year 1976 using drainage area as the independent variable was 152 percent. Indications are that reliable equations for predicting potential runoff can be developed and the standard error of estimate might be reduced significantly with additional years of record. The coefficient of regression when relating drainage area to discharge was significant at the 1-percent level. Preliminary results also indicate it is feasible to predict streamflow characteristics using hydrologic soil-group classifications based on runoff potential. The standard error of estimate for predicting peak discharges with recurrence intervals of 2, 5, 10, 25, 50, and 100 years using active-channel width as the independent variable averaged about 50 percent, and the regression coefficient was significant at the 1-percent level. Using drainage area to predict peak discharges resulted in a standard error of estimate that averaged about 60 percent and a regression coefficient significant at the 5-percent when active-channel width and drainage area were related to peak discharges in multiple regression analyses.

INTERPRETATION OF GEOLOGIC AND HYDROLOGIC DATA FROM THE RAY-1 WELL, CITY OF GALLUP, MCKINLEY COUNTY, NEW MEXICO MESS, W. L., MARSHALL, J. C.
GEOLOGICAL SURVEY, ALBUQUERQUE, N. MEX.
OPEN-FILE REPORT 75-733, NOVEMBER 1975, 38 P. 5 FIG. 1 TAB. 4 REF.
JOURNAL AL: SWRA 1990

Coal Resources of the Raton coal field, Colfax County, New Mexico

Ground Water in the San Juan Basin, New Mexico and Colorado Lyford, Forest P.
U.S. Geological Survey, WRI 79-73

Principal aquifers in the San Juan Basin of New Mexico and Colorado are the Entrada Sandstone, Westwater Canyon Member of the Morrison Formation, Gallup Sandstone of the Mesaverde Group, several sandstones in the Mesaverde Group above the Gallup Sandstone, and the Cretaceous Pelton Sandstone Member of the Green River Formation. These formations are approximately 500 feet thick, similar to the other wells in the YAH TA-HAY FIELD, is anticipated from the same aquifers when the AIT-1 replacement well is completed. (Woodard-USGS)

Reclamation Act of 1977. Methodologies for assessment of the effects of mining and reclamation on the hydrologic system are presented for a potential permit area of 640 acres in the Tsosie Swale. A small tributary of Escalada Wash in northeastern New Mexico. Escalada Wash is the principal tributary of the upper Chaco River, which is the stream that drains much of the San Juan Basin. Small and moderate rainfall in the area are of the character of a low relief landscape with a sandy mantle that is moderately vegetated with shrubs and grasses.

Reclamation soils, vegetation, geology, and hydrology of Tsosie Swale are described as a basis for evaluation of changes that may occur. Soil-moisture-vegetation relations show that the most grass cover occurs where 1 to 2 feet of sandy surface soils are underlain by fine-textured, less-permeable layers that retain soil moisture.

Estimates are made of premining and postmining peak discharges and runoff volumes by the empirical Soil Erosion Loss Equation (USLE) and a basin-characteristic model. The USLE method was found to be superior because it considers infiltration rates. Postmining peak discharge estimates are 30 to 70 percent of premining estimates, and runoff volumes are 30 to 70 percent of premining values.

Methods are demonstrated for estimating soil loss by use of the Universal Soil Loss Equation (USLE) and by simulation of an intense rainstorm on a microwatershed. Estimates of sediment yield from the basin for premining conditions are made using reservoir sedimentation surveys and a watershed-factors rating method. USLE soil-loss estimates and a sediment delivery ratio is used to estimate postmining sediment yield. Estimated postmining sediment yield is about 50 percent of the premining estimate.

Changes in the topography resulting from removal of coalsheets and expansion of the overburden are shown to vary from a lowering of peaks by about 20 feet to a high relief of 200 feet or more in other parts as much as 20 feet. The primary factors responsible for the reductions in streamflow and sediment yield are the assumptions that the minor areas now consisting of alluvial plains, from which runoff is high, would be eliminated, and the lower area would be covered with about 2 feet of sandy soil.


The San Juan Basin of northwestern New Mexico contains a wealth of energy resources, although petroleum reserves are nearly depleted, vast reserves of uranium and coal may be extracted. In this arid to semiarid region, surface-water resources are limited and fully appropriated. New water supplies for energy development and growing municipalities must therefore...
be derived from unconsolidated surface water or ground water. Major aquifers include Quaternary valley fill and sandstones of Tertiary, Cretaceous, Jurassic and Triassic age. Ground water in these aquifers is generally confined, but some interaquifer leakage occurs; transmissivities between 100 ft²/d and 200 ft²/d are characteristic. Specific conductance of ground water is variable (less than 500 uhos to more than 30,000 uhos). Regional flow is from elevated recharge areas on the basin margin toward discharge areas along the San Juan River in the northwest and along the Rio Puerco in the southeast. Occurrence, movement, and quality of ground water are subject to considerable geologic control provided by the distribution and characteristics of the sandstone aquifers, geologic structure, and regional stratigraphy. The principal orebody is also a regional aquifer. Uranium-mine dewatering has caused water-level declines; greater declines will accompany construction of deeper mines. Persistence of toxic substances is unknown, but such material may remain near the mine cavity because of local geochromic conditions. Water is not generally encountered in strip mining; supply is the major water problem in coal development. Potential sources of water include deep aquifers, excess uranium-mine effluent, and Tertiary sandstone aquifers in areas adjacent to the coal belt. Impact of return flow from the Arizona Indian Irrigation Project on San Juan River quality may be difficult to distinguish from impacts of energy development and municipal activities. Irrigated acreage in river valleys is expected to expand as water rights are translated to new uses, such as energy development. Future water needs of municipalities growing in response to energy development may be met in some areas by tapping deeper aquifers and in others by obtaining uranium-mine effluent. Water treatment may be required in both cases.

Erodibility of Selected Soils and Estimates of Sediment Yields in the San Juan Basin, New Mexico


Journal Announcement: SWRA-1511

Onsite rainfall-simulation experiments were conducted to derive field-erodibility indexes for rangeland and soils disturbed by mining in coal fields of northwestern New Mexico. Mean indexes on rangeland soils range from 0 grams (of detached soil) on dune soil to 521 grams on wash-transport zones. Mean field-erodibility index values of soils disturbed by mining range from 16 to 32; they can be extrapolated to nearby coal fields where future mining is expected. Because field-erodibility-index data allow differentiation of erodibilities across a variable

landscapes, these indexes were used to adjust values of K, the erodibility factor of the Universal Soil Loss Equation. Estimates of soil loss and sediment yield were then calculated for a small basin following mining. (USGS)

Techniques for Estimating Flood Discharges for unregulated Streams in New Mexico

Thomas, Richard P., and Gold, Robert L.


Geology and fuel resources of the southwestern part of the Raton coal field, Colfax County, New Mexico


Bibliography of Geology and Hydrology, Southwestern New Mexico

Wright, A. F.


Journal Announcement: SWRA-1401

The southwestern part of New Mexico is recognized as a source of abundant and varied natural resources. This bibliography of over 2,700 references concerned with geology, hydrology, chemistry, and geography has been compiled to assist physical science researchers in their study and development of this region. (USGS)
Most of the Bisti 4-square-mile site in the San Juan Basin is a 50-foot-per-mile sloping, sandy plain dissected by dry washes. It is bounded on the northwest by the 100-foot escarpment of Alamo Mesa. Soils are thin, poor, and in places absent. Vegetation is primarily northern desert shrub having low vegetative yields. Large amounts of ground are bare. Measured cover ranges from 5.7 to 37 percent. Coal is found in the northwestward dipping Cretaceous Fruitland Formation on the southeast side of the Basin. More than 81 million tons of coal occur in beds thicker than 2.5 feet less than 200 feet beneath the site. Annual precipitation is 8 inches and annual evapotranspiration is about 30 inches. Runoff from the site may range between 22 and 54 acre-feet annually. The little water that occurred in the coal and in layers above contained 3,000 to 4,000 milligrams per liter of total dissolved solids. Water in deeper aquifers below the coal is too saline for irrigation, except for the Morrison Formation where water containing less than 1,000 milligrams per liter of total dissolved solids and yielding 300 gallons per minute has been found. Water for operation could be purchased and piped lined at least 8 miles, possibly supplemented by ground water or impounded local runoff. Normal water-handling and restoration practices would minimize or prevent erosion, sedimentation and water-quality deterioration.

The proposed action is to lease 75,510 acres in northwestern New Mexico for 26 Preference Right Leases to mine coal. About 22,000 acres would be surface mined. About 26,650 acres would be mined underground. The area is in the south-central part of the San Juan Basin and consists of west-southwest sloping poorly dissected, moderately rolling plain. Isolated steep-sided mesas and buttes and badlands remain in places. The area is underlain by the nearly flat-lying sedimentary upper Cretaceous Kirkland and Fruitland Formations. About 1.9 billion tons of recoverable coal in the lower Fruitland Formation underlie eight of the 13 townships in the area. Data is inadequate to quantify reserves in the remaining 5 townships. The climate is semiarid. Annual precipitation ranges from 8 to 11 inches and the annual moisture deficit ranges from about 10 to 14 inches. All drainages in the area are ephemeral. Drainage west of the Continental Divide is to Chaco Wash and to the Colorado River. The small part of the area east of the Divide drains to Torreon Wash and to the Rio Grande via Rio Puerco. Numerous ephemeral stock ponds and four plays lakes furnish water for stock and wildlife when water is present. Small quantities of water occur in shallow sandstone layers and is frequently under artesian pressure. Larger quantities are found in deeper sandstones, also under pressure. Quality ranges from good (less than 1,000 milligrams per liter total dissolved solids) at some places in the Morrison formation, 5,000 to 6,000 feet deep, to poor (more than 2,000 milligrams per liter total dissolved solids) in other deeper formations. Depending on reclaimed surface treatment, infiltration could increase and runoff reduce, or the opposite could occur. Surface mining could destroy as many as 23 shallow domestic and stock wells. Water quality in 16 of the wells ranged from 2,000 to 17,000 milligrams per liter total dissolved solids.

The 19 square-mile Kimbeto study area in the southwest part of the Central San Juan Basin consists of badlands, boldly scarped mesas, and sand dunes. It is drained by three sand-choked ephemeral dry washes originating miles upstream. Relief is about 260 feet and annual precipitation is 8.6 inches. Surficial deposits are underlain by the Cretaceous Kirkland (shale) Formation and the Fruitland Formation. The Fruitland contains 61.6 million tons of coal in several beds more than 2.5 feet thick covered by less than 400 feet of overburden beneath the site. Most runoff from the site derives from the shale badlands. Water in the alluvium may yield as much as 50 gallons per minute of moderately mineralized (about 1,500 milligrams per liter dissolved solids) water to wells. Larger quantities of water are available from deeper aquifers more than 1,000 feet below the coal but mineralization increases with depth to as much as 14,000 milligrams per liter dissolved solids at 6,000 feet below land surface. Mining would temporarily impact current water uses—livestock grazing and wildlife—and downstream flow by increased infiltration in reclaimed areas. Water supply for operation, and irrigation, if needed, would be a combination of ground water and stored surface water.
feet. The site is ephemerally drained by southeast trending dry washes. Coal is in the lower part of the late Cretaceous Fruitland Formation. The Fruitland Formation contains 133 million tons of coal in three beds ranging in thickness from 5 to 21 feet, covered by less than 300 feet of overburden. No water was encountered in the overburden. Coal seams and interbedded sandstone could yield up to 20 gallons per minute of water containing about 2,400 milligrams per liter of dissolved solids. Several hundreds of gallons per minute of moderately saline water, specific conductance ranging from 2,000 to 15,000 micromhos, can be obtained in deeper aquifers from 500 to 6,500 feet below land surface. No long term adverse effects are expected from surface mining.

Public Service Company of New Mexico's Proposed New Mexico Generating Station and Possible New Town

BLM, Santa Fe, New Mexico

DEIS, 1982

This EIS evaluates the impacts of constructing and operating a 2,000 megawatt coal-fired steam electric generating station in San Juan County in northwestern New Mexico, and a possible new town. Impacts of surface mine sites to be developed nearby in the San Juan Basin for the source coals (9 million tons per year) are not discussed. The proposed action would require 35,000 acre-feet per year (48 cubic feet per second) of water from the Navajo Reservoir to be taken from the San Juan River, either at Farmington or 14 miles upstream at Bloomfield. Average annual flow and minimum flow are 2,400 and 700 cubic feet per second at Farmington. During drought, an additional 48 cubic feet per second would be released from the Navajo Reservoir. Water quality decreases downstream—total dissolved solids of 266 milligrams per liter at Bloomfield and 449 at Shiprock, 35 miles downstream. Salinity would increase 4 milligrams per liter at Imperial Dam. An alternative would produce 15,000 acre-feet per year of the required water from 16 wells in the Westwater Canyon Member of the Morrison Formation. This report analyzes the impacts of proposed 2,000 megawatt electric generating plant, of 35,000 acre-feet per year from the proposed New Mexico Generating Station EIS. This report analyzes the impacts of construction and operating a 2,000 megawatt electric generating plant, of 35,000 acre-feet per year from the proposed New Mexico Generating Station EIS. This report analyzes the impacts of construction and operating a 2,000 megawatt electric generating plant, of 35,000 acre-feet per year from the proposed New Mexico Generating Station EIS.
San Juan Action Plan, northwestern New Mexico
BLM, Santa Fe, New Mexico
TR, Water Quality, 1982

The report assesses the water quality effects of consumption of 35,000 acre-feet per year of water from the San Juan River Navajo Reservoir by a proposed 2,000 megawatt coal-fired electric generating plant, 35 miles south of Farmington. An alternative would be to obtain 15,000 acre-feet per year from the Westwater Canyon Member of the Upper Jurassic Morrison Formation, and only 20,000 acre-feet from the reservoir. Construction of the river intake would have little or no effect on the suspended sediment load of the San Juan River.

The U.S. Bureau of Reclamation Colorado River Simulation System was used to evaluate salinity impacts of the two levels of withdrawal at the year 2010, with and without proposed Colorado River system salinity control projects. Without the salinity control projects, the proposed annual withdrawals of 35,000 and 20,000 acre-feet would increase salinity at Imperial Dam by 0.39 and 0.22 percent over the baseline of 1,019 milligrams per liter. If the salinity control measures are implemented, the same withdrawals would increase salinity at Imperial Dam by 0.37 and 0.21 percent over an 859 milligram per liter base. The large drawdowns resulting from use of groundwater from the Westwater Canyon Member could induce leakage of poorer quality water in adjacent aquifers and might increase its dissolved solids content by about 5 percent over present levels, which are now so high as to be unsuitable for stock watering. Although ground water usage would decrease flow by less than one percent in the San Juan River and Rio San Jose, salinity increase would be negligible. Runoff from evaporation ponds and waste sites could degrade shallow groundwater in the immediate vicinity of the plant.

San Juan River Regional Coal, northwestern New Mexico
BLM, Santa Fe, New Mexico
DEIS, 1982

The San Juan River Region is a low plateau that approximates the New Mexican part of the San Juan structural basin. It is characterized by subdued low mesas, buttes and broad cuestas. The continental divide extends southwesterly across the southern part of the region. The Chaco River drains most of the region to the northwest into the San Juan River (Colorado-Pacific drainage). The Puerco and Zuni Rivers drain a small area in the southwest, eventually to the Colorado River. A small area in the southeast drains by Arroyo Chico via Rio Puerco to the Rio Grande (Atlantic drainage). The San Juan River is the only perennial stream in the area, receiving most of its flow from the San Juan Mountains to the north in Colorado. Stream water quality ranges widely, both in time and from stream to stream. Annual precipitation ranges from 10 to 14 inches. The annual moisture deficit is 10 to 12 inches. Highly lenticular coal beds occur in the late Cretaceous Fruitland, Menefee and Crevasse Canyon Formations, overlain and underlain by layers of sandstone, shale and siltstone. The formations dip gently northward and crop out in concentric arcs on the basin's southern border. Small quantities of marginal quality water occur locally in the coal and in shallow aquifers above. Water in alluvium ranges from less than 1,000 milligrams per liter dissolved solids in headwaters to more than 2,000 milligrams per liter in downstream reaches. Several potential sandstone aquifers below the coals contain water ranging from less than 200 to more than 44,000 milligrams per liter of total dissolved solids. Surface mining, allowed by all alternatives, would disrupt shallow aquifers used mostly for stock watering. A series of maps shows predicted drawdowns in the deeper aquifers of the No Action Alternative and differences in drawdowns between this and four other alternatives through the year 2040.

Star Lake - Bisti Regional Coal
BLM, Albuquerque, New Mexico
FEIS, 1979

Anticipated coal and coal-related activities in the 4.8-million-acre Star Lake - Bisti region of northwestern New Mexico are discussed. The region includes the Chaco, Rio Puerco, and San Juan Planning Units administered by the Bureau of Land Management and encompasses parts of McKinley, Rio Arriba, Sandoval, and San Juan Counties. Potential coal production in the region is analyzed with respect to existing mines, coal development on existing Federal leases, coal development not requiring Federal authorization, and other related developments occurring or expected to occur within the region by 1990. At full implementation of Federal, state, and private actions, the region could produce 75 million tons of coal annually. Anticipated coal and coal-related development would alter the topography on 28,000 acres. Mining activities would require withdrawal of 59,000 acre-feet of groundwater annually. Each mine would discharge an estimated 13,700 tons of sediment annually, destroying many stream channels.
Ground-Water Basic Data for Morton County, North Dakota

Ackerman, D. J.


Journal Announcement: SWA1110

The purpose of this ground-water investigation in Morton County, N.Dak., was to determine the quantity and quality of ground water available for municipal, domestic, livestock, industrial, and irrigation uses. Specifically, the objectives were: (1) determine the location, extent, and nature of the major aquifers; (2) evaluate the occurrence and movement of ground water, including the sources of recharge and discharge; (3) estimate the quantities of water stored in the aquifers; (4) estimate the potential yields to wells tapping the aquifers; and (5) determine the chemical quality of the ground water. Most data in this report were collected between 1972 and 1975. All data-collection points are shown. The data consist of the following: (1) Geologic and hydrologic data for 1,209 wells, test holes, and springs; (2) water-level measurements for 148 observation wells; (3) lithologic and geophysical logs for 247 test holes and wells; (4) chemical analyses of 353 water samples; and (5) analyses of physical properties of 42 core samples. (Woodard-USGS)

Ground-Water Resources of Morton County, North Dakota

Ackerman, D. J.


Journal Announcement: SWA1324

A study of the occurrence and characteristics of aquifers and the movement, quantity, and quality of water in aquifers in Morton County found that aquifers in the glacial drift and alluvium underlie only 10 percent of the county but have the greatest potential for large-scale development. These aquifers, composed of sand and gravel, occur in buried valleys and in major river valleys. In some localities yields may exceed 500 gallons per minute of water suitable for irrigation, however, where a hydraulic connection exists between bedrock aquifers and the glacial-drift aquifers. Withdrawals of water from the glacial-drift aquifer will result in increased dissolved solids and percent sodium. Bedrock aquifers, consisting of very fine to fine-grained sandstones, yield less than 100 gallons per minute of water that is generally soft, moderately saline, and useful for domestic, livestock, and some industrial uses. The Fox Hills aquifer underlies all the county and is the most extensive and continuous bedrock among the bedrock aquifers.
Ground-Water Data for Billings, Golden Valley and Slope Counties, North Dakota

The purpose of the investigation in Billings, Golden Valley, and Slope Counties, ND, was to determine the availability and quality of ground water for municipal, domestic, industrial, and irrigation uses. Specifically, the objectives were to:

1. Determine the location, extent, and nature of the major aquifers and confining beds;
2. Evaluate the occurrence and movement of ground water, including the sources of recharge and discharge;
3. Estimate the quantities of water stored in the aquifers;
4. Estimate the potential yields of wells tapping the major aquifers;
5. Determine the chemical quality of the ground water; and
6. Estimate the water use. The data in this report were collected between 1974 and 1977. The data consist of the following:

- Geologic and hydrologic records for 723 wells, test holes, springs, and miscellaneous data-collection sites;
- Water-level measurements in 48 observation wells;
- Lithologic and geophysical logs of 367 test holes and wells;
- 275 chemical analyses of surface water for trace constituents;
- 799 chemical analyses of ground water for dissolved gases; and
- 62 analyses of core samples for hydraulic parameters and particle-size distribution.

Ground water from the smaller aquifers is generally more saline than water from the major aquifers. The majority of all withdrawals are from the Upper and Lower aquifers in the Morrow County of southeastern North Dakota, the Middle Valley of northeastern North Dakota, and the Little Missouri valley in west-central North Dakota. All of these aquifers are composed of sands and gravel and yield less water than the major aquifers.

Ground Water of Williams County, North Dakota: Part 1 - Hydrology

The major aquifers in the three-county area are the Fox Hills-lower Hell Creek aquifer system, the upper Hell Creek-Lower Ludlow aquifer system, and aquifers in the upper part of the Ludlow Tongue River and Sentinel Butte Members of the Fort Union Formation. The Fox Hills-lower Hell Creek aquifer system has a transmissivity of 313 feet squared per day and may yield as much as 500 gallons per minute of sodium bicarbonate type water. The other aquifers generally yield less water, but the water is also predominantly a sodium bicarbonate type, with withdrawals of water from flowing wells along the valley of the Little Missouri River have created a condition of depression and major deflection in the potentiometric surface of all the major aquifers.

Geology and Ground Water Resources of Williams County, North Dakota: Part 2 - Hydrology

Major aquifers consist of interbedded sandstone, siltstone, clays, and lignite. The major aquifers in the three-county area are the Fox Hills-lower Hell Creek aquifer system, the upper Hell Creek-Lower Ludlow aquifer system, and aquifers in the upper part of the Ludlow Tongue River and Sentinel Butte Members of the Fort Union Formation. The Fox Hills-lower Hell Creek aquifer system has a transmissivity of 313 feet squared per day and may yield as much as 500 gallons per minute of sodium bicarbonate type water. The other aquifers generally yield less water, but the water is also predominantly a sodium bicarbonate type, with withdrawals of water from flowing wells along the valley of the Little Missouri River have created a condition of depression and major deflection in the potentiometric surface of all the major aquifers.

Ground Water Resources of Burke and Mountrail Counties

Aquifers, which are in rocks of Late Cretaceous and Tertiary age, consist of interbedded sandstone, siltstone, clays, and lignite. The major aquifers in the three-county area are the Fox Hills-lower Hell Creek aquifer system, the upper Hell Creek-Lower Ludlow aquifer system, and aquifers in the upper part of the Ludlow Tongue River and Sentinel Butte Members of the Fort Union Formation. The Fox Hills-lower Hell Creek aquifer system has a transmissivity of 313 feet squared per day and may yield as much as 500 gallons per minute of sodium bicarbonate type water. The other aquifers generally yield less water, but the water is also predominantly a sodium bicarbonate type, with withdrawals of water from flowing wells along the valley of the Little Missouri River have created a condition of depression and major deflection in the potentiometric surface of all the major aquifers.

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 3 - HYDROLOGY

Journal Announcement: SWRA1401

The major aquifers in the three-county area are the Fox Hills-lower Hell Creek aquifer system, the upper Hell Creek-Lower Ludlow aquifer system, and aquifers in the upper part of the Ludlow Tongue River and Sentinel Butte Members of the Fort Union Formation. The Fox Hills-lower Hell Creek aquifer system has a transmissivity of 313 feet squared per day and may yield as much as 500 gallons per minute of sodium bicarbonate type water. The other aquifers generally yield less water, but the water is also predominantly a sodium bicarbonate type, with withdrawals of water from flowing wells along the valley of the Little Missouri River have created a condition of depression and major deflection in the potentiometric surface of all the major aquifers.

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 2 - HYDROLOGY

Journal Announcement: SWRA3035

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 1 - HYDROLOGY

Journal Announcement: SWRA1420

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 2 - HYDROLOGY

Journal Announcement: SWRA1420

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 3 - HYDROLOGY

Journal Announcement: SWRA1401

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 2 - HYDROLOGY

Journal Announcement: SWRA1420

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 3 - HYDROLOGY

Journal Announcement: SWRA1401

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 2 - HYDROLOGY

Journal Announcement: SWRA1420

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 3 - HYDROLOGY

Journal Announcement: SWRA1401

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 2 - HYDROLOGY

Journal Announcement: SWRA1420

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 3 - HYDROLOGY

Journal Announcement: SWRA1401

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 2 - HYDROLOGY

Journal Announcement: SWRA1420

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 3 - HYDROLOGY

Journal Announcement: SWRA1401

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 2 - HYDROLOGY

Journal Announcement: SWRA1420

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 3 - HYDROLOGY

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GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 2 - HYDROLOGY

Journal Announcement: SWRA1420

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 3 - HYDROLOGY

Journal Announcement: SWRA1401

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 2 - HYDROLOGY

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GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 3 - HYDROLOGY

Journal Announcement: SWRA1401

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 2 - HYDROLOGY

Journal Announcement: SWRA1420

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 3 - HYDROLOGY

Journal Announcement: SWRA1401

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 2 - HYDROLOGY

Journal Announcement: SWRA1420

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 3 - HYDROLOGY

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GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 2 - HYDROLOGY

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GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 2 - HYDROLOGY

Journal Announcement: SWRA1420

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 3 - HYDROLOGY

Journal Announcement: SWRA1401

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 2 - HYDROLOGY
Quintets of Geological potential. The water quality of the water varies from a sodium sulfate to a calcium sulfate type. Aquifers in the upper Cretaceous bedrock and Quaternary glacial drift. Bedrock aquifers have a greater areal distribution, but those in the glacial drift provide a greater potential yield to individual wells. The major bedrock aquifers are the Fox Hills aquifer system and the Fox Hills aquifer system. Yields from these aquifers are not expected to exceed 50 gallons per minute. The water generally is soft and a sodium bicarbonate type. Aquifers in the glacial drift--Lake Sakakawea system. Martin system. Butter Painted Woods Creek, and North Burleigh--Underlie about 300 square miles in Sheridan County. Well yields of more than 500 gallons per minute may be generally is hard. (USGS)

1980 Geologic map of North Dakota
Clayton, Lee
U.S. Geological Survey Map G77220

The purpose of the investigation in Sheridan County, ND, was to determine the availability and quality of ground water for municipal, domestic, industrial, and irrigation uses. Specifically, the objectives were to: (1) determine the location, extent, and nature of the major aquifers; (2) evaluate the occurrence and movement of ground water, including the sources of recharge and discharge; (3) estimate the quantity of water stored in the aquifers; (4) estimate the potential yields of wells tapping the major aquifers; (5) evaluate the chemical quality of the ground water; and (6) estimate the water use. The data in this report were collected between 1976 and 1979. The data consist of the following: (1) Geologic and hydrologic records for 320 wells and test holes; (2) water-level measurements in 61 observation wells; (3) lithologic and geophysical logs of 108 test holes and wells; and (4) chemical analyses of 93 ground-water samples. (USGS)

Groundwater Resources of Sheridan County, North Dakota
Burkart, R. A.

Journal Announcement: SWRA1420

Groundwater in Sheridan County, ND., is obtainable from aquifers in the upper Cretaceous bedrock and Quaternary glacial drift. Bedrock aquifers have a greater areal distribution, but those in the glacial drift provide a greater potential yield to individual wells. The major bedrock aquifers are the Fox Hills aquifer system and the Fox Hills aquifer system. Yields from these aquifers are not expected to exceed 50 gallons per minute. The water generally is soft and a sodium bicarbonate type. Aquifers in the glacial drift--Lake Sakakawea system. Martin system. Butter Painted Woods Creek, and North Burleigh--Underlie about 300 square miles in Sheridan County. Well yields of more than 500 gallons per minute may be generally is hard. (USGS)

1980 Geologic map of North Dakota
Clayton, Lee
U.S. Geological Survey Map G77220

GEOLOGY OF MOUNTAIL COUNTY, NORTH DAKOTA
CLAYTON, L.
GEOLoGICAL SURVEY, Grand Forks, N.D.
NORTH DAKOTA GEOLOGICAL SURVEY BULLETIN 55 -- PART IV, AND NORTH DAKOTA STATE WATER COMMISSION COUNTY GROUNDWATER STUDY 14 -- PART IV, 1972, 70 P., 9 FIG. 2 MAP, 1 TAB, 27 REF.

Journal Announcement: SWRA1324

This is Volume IV of a four-volume report on the geology and groundwater resources of Burke and Mountrail counties. This volume is divided into two sections. Section A is a description of the topography, the rock and sediment, and the general hydrology of Mountrail County. In addition, section A contains a brief summary of the age and origin of the topography, rock, and sediment of the county. Section B is a more detailed discussion of the problems involved in determining the age and origin of the geologic materials and landforms in Mountrail County. This section is written for those especially geologists) who are interested in the physical nature of the near-surface earth materials underlying the county. Section B is a more detailed discussion of the problems involved in determining the age and origin of the geologic materials and landforms in Mountrail County. This section is written for those especially geologists) who are interested in the physical nature of the near-surface earth materials underlying the county.
It dissolved solids. Surface-runoff water-level declines toward the east and retention aquifer. Water levels in the Antelope Creek aquifer are the most important aquifers of the Dakota County. The water is generally clear and lower in dissolved solids and sulfate than water in the overlying aquifer systems. Dissolved solids in water samples analyzed ranged from 50 to 1,680 milligrams per liter and averaged 1,050 milligrams per liter. (Woodard-USGS)

GROUND-WATER RESOURCES OF MERCER AND OLIVER COUNTIES, NORTH DAKOTA
CROFT, M. G.
GEOLOGICAL SURVEY, BISMARCK, ND. WATER RESOURCES DIV.

Journal Announcement: SWRA0610

In Mercer and Oliver Counties, North Dakota, Artesian aquifers consisting of fine- to medium-grained sandstone occur in the Fox Hills and Hell Creek Formations of late Cretaceous age. The Tongue River Formation of Tertiary age. The water is suitable for livestock, domestic, and some industrial uses. The total withdrawal from the Artesian aquifers is about 1 million gallons per day. Glacial and alluvial deposits of sand and gravel form potentially productive aquifers beneath the Valleys of Goodman, Antelope, Square Butte, and Elm Creeks and the Knife and Missouri Rivers. The aquifers, which are relatively undeveloped, are 1 to 5 miles in width, have a maximum thickness of about 250 feet, and contain about 2-660,000 acre-feet of water. The Bismarck formations have a transmissivity of 107,000 to 121,000 GPD per foot and a storage coefficient of 0.003. The Missouri River aquifer near Stanton has a transmissivity of 176,000 GPD per foot and a storage coefficient of 0.003. The Missouri River aquifer near Hensler has a transmissivity of 107,000 to 121,000 GPD per foot and a storage coefficient of 0.02. Approximately 137,000 acre-feet of water was used in Mercer and Oliver Counties in 1968. Most of this water was taken from the Missouri River for cooling purposes in electric-generating plants and for irrigation. About 2,270 acre-feet was obtained from groundwater sources for industrial, livestock, and domestic use. (Woodard-USGS)

GROUND-WATER BASIC DATA, PART 2 OF GEOLOGY AND GROUNDWATER RESOURCES OF MERCER AND OLIVER COUNTIES, NORTH DAKOTA
CROFT, M. G.
GEOLOGICAL SURVEY, BISMARCK, ND. COMMISSION GROUND WATER STUDIES 15. 1970. 268 P., 2 Figs, 1 Plate, 6 Tabs, 11 Ref.

Journal Announcement: SWRA522

Data were collected to be used to: (1) determine the

North Dakota

North Dakota
LOCATION, EXTENT, AND NATURE OF THE MAJOR AQUIFERS OF MERCER AND OLIVER COUNTIES, NORTH DAKOTA: (2) EVALUATE THE OCCURRENCE AND MOVEMENT OF GROUNDWATER, INCLUDING THE SOURCES OF RECHARGE AND DISCHARGE; (3) ESTIMATE THE QUANTITIES OF WATER STORED IN THE AQUIFERS; (4) ESTIMATE THE POTENTIAL YIELDS TO WELLS TAPPING TO MAJOR AQUIFERS; AND (5) DETERMINE THE CHEMICAL QUALITY OF THE GROUNDWATER. THE INFORMATION IN THIS REPORT WAS COLLECTED CHIEFLY BETWEEN 1966 AND 1969, AND CONSISTS OF THE FOLLOWING: (1) DATA ON ABOUT 1,300 WELLS AND TEST HOLES; (2) DATA ON 9 SPRINGS; (3) WATER-LEVEL MEASUREMENTS IN 29 OBSERVATION WELLS; (4) LOGS OF 299 TEST HOLES AND SELECTED WELLS; (5) CHEMICAL ANALYSES OF 160 WATER SAMPLES; AND (6) 25 PARTICLE-SIZE DISTRIBUTION CURVES. (KNAPP-USGS)

MAGNITUDE AND FREQUENCY OF FLOODS IN SMALL DRAINAGE BASINS IN NORTH DAKOTA

CROSBY, O. A.

GEOLICAL SURVEY, BISMARCK, N. D.

AVAILABLE FROM THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VA 22161 AS PD-248 480, $4.00 IN PAPER COPY, $2.25 IN MICROFICHE. WATER-RESOURCES INVESTIGATIONS 19-27 MAY 1975. 24 P. 2 PLATES, 7 FIGS., 2 TABS. 17 REF. (+)

Journal Announcement: SWRA0909

METHODS ARE PRESENTED FOR ESTIMATING FLOOD-PEAK DISCHARGES AT 2- TO 50-YEAR RECURRENCE INTERVALS ON NORTH DAKOTA STREAMS DRAINING LESS THAN 100 SQUARE MILES (259 SQUARE KILOMETRES). FOR GAGED SITES, FREQUENCY ESTIMATES ARE PROVIDED DIRECTLY. FOR UNGAGED SITES, THE METHOD RELATES DRAINAGE AREA AND (OR) SOIL-INFECTION INDEX TO PEAK DISCHARGES. THE EQUATIONS PRESENTED ARE FOR SITES ON STREAMS WITH NATURAL FLOW AND ARE NOT APPLICABLE TO URBAN AREAS OR BASINS AFFECTED BY MAN-MADE REGULATION. INFORMATION IS ALSO PROVIDED ON THE MAXIMUM FLOOD MAGNITUDE EXPERIENCED. (WOODARD-USGS)

Progress Report on the Effects of Surface Mining on the Surface Water Hydrology of Selected Basins in the Fort Union Coal Region, North Dakota and Montana

Emerson, D. G.


Journal Announcement: SWRA1509

The purpose of the investigation is to provide a means to assess the impact on surface-water hydrology due to changes in land use resulting from surface mining of coal in the Fort Union Coal Region, North Dakota and Montana. The objectives of the study are as follows: (1) Determine premining hydrologic conditions in small representative drainage basins and provide historical data with which to compare the magnitude of changes resulting from mining and (2) develop the capability of making reasonably accurate projections of hydrologic effects resulting from the various land-use changes caused by surface mining. Data collection has been underway since October 1976 for the West Branch Antelope Creek study area in western North Dakota and since March 1978 for the Hay Creek study area in eastern Montana. Data collected during the premining period are being analyzed using statistical methods for the evaluation of the premining conditions. A digital model with the capability of making hydrologic projections is being developed. Most of the model components have been tested during 1979 and 1980. (USGS)

Hydrologic Analysis of High Flow from Snowmelt on Small Basins in the Fort Union Coal Region

Emerson, Douglas G., Horbeck, Steven W., and Bresnphlug, Kelvin L.

U.S. Geological Survey

Data from the Surface-Water Hydrologic Investigations of the Hay Creek Study Areas, Montana, and the West Branch Antelope Creek Study Areas, North Dakota, October 1976 Through April 1982

Emerson, Douglas G., Horbeck, Steven W., and Bresnphlug, Kelvin L.


Data are provided for the Hay Creek study area near Willmar, Minnesota, and the West Branch Antelope Creek study area near Beldahl, N. D. The report contains data on the following: Air temperature, relative humidity, wind direction, wind run, solar radiation, precipitation, soil temperature, snowpack temperature, snowpack density, and water content; streamflow; water quality; soil moisture; land use; and basin characteristics. Detailed descriptions of the location of the data-collection sites, instrumentation, and methods used to collect data are included.

Statistical Summaries of Streamflow and Water-Quality Data for Streams of Western North Dakota 1977-80

Haffield, N. O.


Journal Announcement: SWRA1510

Statistics for the streamflow and water-quality data collected at 67 stations in western North Dakota from October 1977 through September 1980 are presented in a format that will make the data more useful to those who are making water-resources planning and development decisions. (USGS)

Hydrogeology and Geochemistry of the Wilbaur-Bleinhie Deposit Area, Eastern Montana and Western North Dakota (Knapp-USGS)

Hosaka, W. F.

U.S. Geological Survey

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deterioration of shallow aquifers mined in recharge areas may be expected.

Composition of Atmospheric Deposition in Western North Dakota
Houghton, Robert L. U.S. Geological Survey

Trace-Element Enrichments in Waters Associated with Strip Mining of Lignite in the Fort Union Group of Southwestern North Dakota
Houghton, Robert L. U.S. Geological Survey

Weathering of outcropping lignite and strip mining in the Fort Union Group near Gascoyne in southeastern North Dakota has resulted in enrichment of several trace elements in local ground and surface waters. The 30-Foot Harmon Lignite bed of the Bullion Creek Formation of the Paleocene Fort Union Group (as used by the North Dakota Geological Survey) crops out along an east-trending bench in the Gascoyne area and dips north toward the center of the Williston basin at 30-30 feet per mile. The Gascoyne mine, weathered lignite (Leonardite) along the outcrop and unoxidized lignite at depth are strip mined within an eight square mile area.

In the Gascoyne area, the shallow Harmon Lignite provides water for local domestic and livestock use. The lignite aquifer is recharged by local precipitation and discharges principally through a basal claystone bed to an underlying sandstone aquifer and by lateral flow to intermittent streams within the mine area. As these streams are also used for livestock water, deterioration of water by the lignite aquifer could force ranchers to develop deeper, more expensive, water sources. Along the lignite outcrop line, oxidation of the organic components of lignite results in Fe, Sr, and Se that are readily dissolved by infiltrating waters. Additionally, oxidation of Fe sulfide minerals makes a variety of chalcophile trace metals available for dissolution. Stripping the overburden during mining accelerates the oxidation of reactive Fe sulfides to completion in the poorly consolidated Fort Union strata, increasing the availability of trace metals like Cu, Cd, Zn, and Zn to the phreatic zone as limonite.

Ferrous sulfide solutions are partially saturated with carbonate, Fe is largely removed as siderite or in the phreatic zone as limonite. Other trace metals like Cu, Ni, and Pb are released during precipitating as complex sulfate salts including copiapite, melanterite, and jarosite. Concentrations of these metals in infiltrating waters are controlled by sulfate-salt solubilities, where sulfate salts occur adjacent to relict lignite in the soils. Solubilities are greatly enhanced by preferential adsorption of Ca and Mg. Five-fold trace-metal enrichments are observed in parts of the lignite aquifer downgradient from active mine pits and in surface waters at base flow. Cadmium, Cu, Pb, and Se concentrations exceed recommended domestic water criteria.

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in many parts of the lignite aquifer. Although concentrations of these trace elements currently do not exceed recommended levels for livestock use, expanded mining may alter this condition.

Weathering of Coal Scoria—A Source for Diagenetic Silica Controls?

Houghton, Robert L.
U.S. Geological Survey

Coal scoria, clastic sedimentary rocks baked by the natural incrustation of coal, has long been considered relatively inert in most low-temperature geochemical systems. However, chemical weathering of scoria may be important in the early diagenesis of its surrounding strata.

During underground burning of coal, blocks of sediment overburden may fall into the resultant coal furnace and fuse to a glasslike slag. Thus, concentrations of slag usually underlie major coal seams. Like all glass, this slag is chemically unstable and will hydrate and release silicic acid to the groundwater system, making silica available for other diagenetic processes.

Scoria slag in the Paleocene Fort Union Formation near Gascouyez, North Dakota, is extensively hydrated and associated with minor secondary zeolite. Two such scoria zones are overlain by siliceous sedimentary horizons. One silica-cemented horizon has been described as a silcrete and overlies deeply weathered strata. The second siliceous horizon is comprised of silicified, silica-cemented concretions which have formed at depth, perhaps delineating a paleo-water-table position. The similarity of trace-element ratios in slag and associated silica cements indicates that hydration of fused scoria is the primary source of siliceous fluids responsible for diagenetic silica cementation of overlying Fort Union sediments. Similar silica cementation is absent in the underlying sediments and at the same stratigraphic level distant from scoria zones.

GROUND-WATER BASIC DATA FOR DUNN COUNTY, NORTH DAKOTA

Klausing, R. L.

GEOLICAL SURVEY, BISMARCK, N. D.


Journal Announcement: SWAO972, COOPERATEVLY BY THE U.S. GEOLOGICAL SURVEY AND NORTH DAKOTA STATE WATER MANAGEMENT DISTRICT, THE RESULTS OF THE INVESTIGATION WILL BE PUBLISHED IN THREE SEPARATE PARTS. PART (1) IS AN INTERPRETIVE REPORT DESCRIBING THE GEOLOGY OF THE STUDY AREA; PART (2) IS A COMPILATION OF THE GROUND-WATER BASIC DATA; AND PART (3) IS AN INTERPRETIVE REPORT DESCRIBING THE GROUND-WATER RESOURCES. PART (2) THIS REPORT CONTAINS BASIC DATA FOR 1227 WELLS AND TEST HOLES AND 134 SPRINGS. IT INCLUDES 652 LOSS OF TEST HOLES MED WELS FOR CHEMICAL ANALYSES OF WATER SAMPLES AND WATER-LEVEL MEASUREMENTS.
The aquifers in the glacial deposits is predominantly a sodium bicarbonate or calcium bicarbonate type, and is usually hard to very hard. Wells tapping the Fort Union Group of Paleocene age generally yield from 5 to 75 gpm; however, in places yields as great as 200 gpm may be possible. The water type is predominantly a sodium bicarbonate type. Wells tapping the hill creek and fox hills formations yield from 10 to 50 gpm. The water is predominantly a sodium bicarbonate type. (Knapf-USGS)

Groundwater Resources of McLean County, West-Central North Dakota

Klausing, R. L.
Geological Survey, Washington, D.C.
Available from USGS, Washington, D.C. 20242-price $0.75.
Geological Survey Hydrologic Investigations Atlas HA-475, 1972, 1 sheet, 1 fig, 1 map, 1 tab, 6 ref.

Journal Announcement: SWRAUS23
This one-sheet hydrologic atlas describes the occurrence and movement of groundwater in “Clean County,” N. Dak., including the sources and areas of recharge and discharge, the potential yields of wells tapping the major aquifers, and the chemical quality of the groundwater. Important aquifers occur both in the glacial drift and in the underlying redrock formations. The major glacial drift aquifers generally will yield more than 50 gpm to individual wells and in places will yield more than 1,000 gpm. Three bedrock units—the Fort Union Formation, Hill Creek Formation, and Fox Hills Sandstone—supply water to wells in McLean County. The most productive redrock aquifers consist of sandstone and lignite beds. Wells from the bedrock aquifers is predominantly soft and is a sodium bicarbonate type. Water from the glacial-drift aquifers generally is harder but less saline and of better quality than water from the bedrock aquifers. (Woodard-USGS)

Groundwater Resources of Renville and Ward Counties

Pettyjohn, W. A.; Hutchinson, R. O.
Geological Survey, Bismarck, N. Dak.

Journal Announcement: SWRAUS03
Two major types of aquifers occur in Renville and Ward Counties, North Dakota—those in the semiconsolidated and consolidated bedrock formations and those in the unconsolidated glacial deposits. The Fort Union Group contains the most productive bedrock aquifers. Generally water from the Fort Union is a sodium bicarbonate type or a sodium chloride type. The water is unsuitable for irrigation and in many places is undesirable for domestic use. Deposits of Quaternary age comprise the major aquifers with yields of more than 500 gpm of good quality water. The most productive aquifers are in the valleys of the Souris and Des Lacs rivers. Well yields of more than 500 gpm are available from the Kenmare aquifer and locally from aquifers in the Souris River valley between Minot and Logan, northwest of Minot and between Logan and Minot. Sodium bicarbonate groundwater can be expected. Most of the water in the valley aquifers is suitable for domestic, municipal, and industrial uses. Substantial quantities of groundwater are stored in surficial sand and gravel deposits in ice-marginal channels. In most places the water had a specific conductance that is less than 1,000 micromhos. (Woodard-USGS)

Geology and Ground Water Resources of Renville and Ward Counties, Part 2—Ground Water Basic Data

N Dak Geol Surv Bull 50, 152 p., 1968. 2 fig, 1 plate, 6 tabs.

Journal Announcement: SWRAUS01
This basic-data volume is part 2 of a series. Part 1 describes geology and part 3 describes the groundwater resources of the 2 counties located in North-Central North Dakota. The basic data are useful for predicting geologic and groundwater conditions at a proposed well site. Tables list (1) descriptive data for 1,375 wells and test holes, (2) water-level measurements in 81 wells, (3) logs of 242 test holes and wells, and (4) chemical analyses of 415 water samples. Aquifers in the counties are consolidated bedrock units and glacial deposits.

Plan of study of the hydrology of the Madison Limestone and associated rocks in parts of Montana, Nebraska, North Dakota, South Dakota, and Wyoming.


Ground-water Basic Data for Grant and Sioux Counties, North Dakota

Handich, P. G.
Geological Survey, Bismarck, N. Dak.

Journal Announcement: SWA0902 Chiefly between 1971 and 1974. The data include: (1) geologic and measurements in 77 observation wells; (3) lithologic and geophysical logs of 257 test holes and wells; (4) 15 chemical analyses of groundwater; (5) 15 chemical analyses of water from streams during low flow.
Ground-Water Resources of Grant and Sioux Counties, North Dakota

Randich, P. G.


Journal Announcement: SWRA1311

Ground water in Grant and Sioux Counties is obtainable from aquifers of Late Cretaceous Tertiary, Pleistocene, and Holocene age. The major bedrock aquifers in the counties are the Fox Hills and Hell Creek aquifers of Late Cretaceous age and the Cannonball and Heart River aquifers of Holocene age. Potential yields to individual wells range from about 5 to 150 gallons per minute. The water generally is soft and high in dissolved solids. Aquifers of Pleistocene age--the Shields, Elm Creek, St. James, Beaver Creek, and Battle Creek aquifers--underlie about 50 square miles in Grant and Sioux Counties. Well yields of as much as 1,000 gallons per minute are obtainable in a few places along the central axes of these aquifers. The major dissolved constituents in water from these aquifers are calcium, magnesium, sodium, bicarbonate, and sulfate. Aquifers of Holocene age are located in the alluvial deposits in the Cannonball River, Heart River, and Cedar Creek valleys. Potential well yields generally are less than 50 gallons per minute. (Kosco-USGS)

Groundwater Data for McHenry County, North Dakota

Randich, P. G.


Journal Announcement: SWRA142O

The purpose of the investigation in McHenry County, N. Dak., was to provide detailed geologic and hydrologic information needed for the orderly development of water supplies for municipal, domestic, livestock, irrigation, industrial, and similar uses. Specifically, the objectives were to: (1) determine the location, extent, and nature of the major aquifers; (2) evaluate the occurrence and movement of ground water, including the sources of recharge and discharge; (3) estimate the quantities of water stored in the glacial aquifers; (4) evaluate the chemical quality of the groundwater; and (5) estimate the water use. The data in this report were collected chiefly between 1974 and 1978, and points of collection are shown. The data consist of the following: (1) Geologic and hydrologic records of wells and test holes; (2) water-level measurements in observation wells; (3) lithologic and geophysical logs of test holes and wells; (4) chemical analyses of groundwater; (5) chemical analyses of water from streams during low flow; (6) particle-size distribution graphs; (7) analyses of core samples for heavy-mineral content; and (8) hydraulic parameters and statistical characteristics of grain-size analyses. (USGS)

North Dakota North Dakota

aquifers; (5) evaluate the chemical quality of the groundwater; and (6) estimate the water use. The data in this report were collected chiefly between 1974 and 1978, and points of collection are shown. The data consist of the following: (1) Geologic and hydrologic records of wells and test holes; (2) water-level measurements in observation wells; (3) lithologic and geophysical logs of test holes and wells; (4) chemical analyses of groundwater; (5) chemical analyses of water from streams during low flow; (6) particle-size distribution graphs; (7) analyses of core samples for heavy-mineral content; and (8) hydraulic parameters and statistical characteristics of grain-size analyses. (USGS)

Summary

Appraisals of the Nation's Ground-Water Resources--Sorirs-Red-Rainy Region

Reeder, H. O.


Journal Announcement: SWRA122

A broad-perspective analysis of the ground-water resources and present and possible future water development and management in the Souris-Red-Rainy Region is presented. The region includes the basins of the Souris River within Montana and North Dakota, the Red River of the North in South Dakota, North Dakota, and Minnesota, and the Rainy River within Minnesota. This report is one of a U.S. Geological Survey series that summarizes information on the Nation's ground water for the guidance of planners. New data were not collected for this appraisal, but information that has been utilized. In addition to summarizing the knowledge of ground-water resources of the region, the report points out deficiencies in knowledge. The primary objectives of evaluating information deficiencies is to direct attention to types of studies and information that will lead to fuller understanding and description of ground-water reservoirs for higher-water-year planning and management of the region's management of all water resources. Ground water can assume greater significance in the region's development. (Ward-USGS)

The Geochemistry of the Fox Hills-Hell Creek Aquifer in Southwestern North Dakota and Northwestern South Dakota

Thorstenson, D. C.; Fisher, D. W.; Crofts, M. G.


Water Resources Research, Vol. 11, No 6, p 1747-1748,

The geochemistry of the Fox Hills-Hell Creek Aquifer in Southwestern North Dakota and Northwestern South Dakota. (USGS)
December 1979 | 9 Fig., 5 Tab., 66 Ref., Journal Announcement: SWRA1318

The Upper Cretaceous Fox Hills Formation and the basal part of the overlying Hell Creek Formation constitute an important aquifer in the Fort Union coal region. Throughout most of southwestern North Dakota and northeastern South Dakota the aquifer is at depths ranging from 1,000 to 2,000 feet; except for exposures along the Cedar Creek anticline, water flows in the aquifer from southwest to northeast with flow rates of a few feet per year. The recharge and discharge areas of the aquifer are separated by a north-south trending transition zone in which significant changes in water chemistry occur. Computer modeling and carbon isotope data suggest the following reactions in the recharge area. Carbon dioxide derived from lignitic carbon reacts to dissolve carbonate, exchangeable sodium is exchanged for sodium on clay minerals. The high pH in the aquifer is the result of buffering by carbonate-ion exchange equilibria. These changes can be accounted for by reactions in the aquifer: (1) Sulfate is reduced by lignitic carbon with formation of pyrite; (2) Hydrogen-ion concentration is continuously buffered by the carbonate-ion exchange equilibria. Chemical and hydrologic data suggest that the increase in sodium chloride results from upward movement of small volumes of water into the Fox Hills aquifer from the transition zone eastward. Redox reactions in the aquifer are closely analogous to those observed in pore waters of reducing marine sediments. Reactions approach, but not achieve, true thermodynamic equilibrium. Measurements of redox potential suggest a downslope increase in oxygen content. The measurements are not amenable to quantitative interpretation. (Kosco-USGS)

GEOLGY AND GROUNDWATER RESOURCES OF HETTINGER AND STARK COUNTIES, NORTH DAKOTA

TRAPP, J. W.; CROFT, M. G.

GEOLoGICAL SURVEY, BISMARCK, N. DAK.

NORTH DAKOTA STATE WATER COMMISSION, BISMARCK, COUNTY

GROUNDWATER STUDIES 16. PART I, 1975, 51 P., 14 FIG., 4 PLATES, 4 TABS., 52 REF., Journal Announcement: SWRA0915

THE SEDIMENTARY ROCKS OF PALEOZOIC, MESOZOIC, AND CENOZOIC AGE IN HETTINGER AND STARK COUNTIES, N. DAK., ON THE SOUTH-CENTRAL FLANK OF THE WILLISTON STRUCTURAL BASIN, ARE ABOUT 100 FEET THICK. THEY ARE GENTLY FOLDED INTO NORTH-PLUNGING ANTICLINES AND SYNCLINES. THE FOX HILLS AND BASAL HELL CREEK AQUIFER SYSTEM UNDERLIES THE WHOLE AREA AT DEPTHS GREATER THAN 1,100 FEET. THE WATER IN THIS SYSTEM IS A SODIUM BICARBONATE TYPE WITH CREEK AND LOWER CANONBURL-LUDLOW AQUIFER SYSTEM UNDERLIES ALL OF HETTINGER AND STARK COUNTRIES. THE WATER CONTAINS A SODIUM BICARBONATE TYPE WITH A IN THE BASAL HELL CREEK MEMBER IS GENERALLY A SODIUM NITRATE TYPE WITH A SENTINEL BUTTE AQUIFER SYSTEM UNDERLIES MOST OF STARK COUNTY. THE WATER IS GENERALLY OF A SODIUM SULFATE TYPE. DISSOLVED SOLIDS CONCENTRATION OF THE WATER WAS OBTAINED FROM GROUNDWATER AND SURFACE-WATER SOURCES IN 1966. GROUNDWATER SOURCES CONTRIBUTED ABOUT 40 PERCENT OF THE TOTAL WATER SUPPLY. (WOODARD-USGS)

GROUND WATER BASIC DATA, HETTINGER AND STARK COUNTIES, NORTH DAKOTA

TRAPP, HENRY JR.

GEOLoGICAL SURVEY, BISMARCK, N. DAK., 1971, 455 P., 2 FIG. 1 PLATE, 7 TABS., 19 REF., Journal Announcement: SWRA0416

HYDROLOGIC INVESTIGATIONS WERE MADE IN HETTINGER AND STARK COUNTIES, N. DAK., TO DETERMINE THE QUANTITY AND QUALITY OF GROUNDWATER AVAILABLE FOR MUNICIPAL, DOMESTIC, LIVESTOCK, INDUSTRIAL, AND IRRIGATION USES. THE INFORMATION WAS COLLECTED BETWEEN 1966 AND 1967, AND CONSISTS OF THE FOLLOWING: (1) DATA ON 5,000 WELLS AND TEST HOLES; (2) DATA ON 91 SPRINGS; (3) WATER-LEVEL MEASUREMENTS IN 61 OBSERVATION WELLS; (4) LOGS OF 544 TEST HOLES AND WELLS; (5) CHEMICAL ANALYSES OF 38 WATER SAMPLES; (6) COLOR VALUES OF 351 WATER SAMPLES; AND (7) 25 PARTICLE-SIZE DISTRIBUTION CURVES. THE DATA ARE PRESENTED IN TABLES AND MAPS. (WOOD-USGS)

Striping coal deposits of the Northern Great Plains, Montana, Wyoming, North Dakota, and South Dakota

U.S. Geological Survey, 1976

U.S. Geological Survey Miscellaneous Field Studies Map MF-590

Current Water-Resources Investigations of the U.S. Geological Survey in North Dakota--Fiscal Year 1981


Journal Announcement: SWRA1505

Water-resources studies and investigations in North Dakota made by the U.S. Geological Survey in cooperation with State and Federal agencies are summarized. The investigations include data-collection projects, ground-water studies, regional water-resource studies, aquifer evaluations, energy-related water-resource studies, and special investigations. The special investigations include snow survey research, ground-water quality sampling technique research and hydrologic response changes on a major stream. (USGS)
The water resources division of the U.S. Geological Survey, it is hoped that knowledge of these activities will enable other investigators to more effectively plan and coordinate work of a similar nature, and perhaps in some instances avoid costly and needless duplication. The work done by the water resources division in North Dakota is listed by individual project identification number. Some of the projects are primarily concerned with data collection. Others involve interpretation in addition to data collection. The results of all projects are made available to the public in various forms of publication. (Woodard-USGS)

Water-resources investigations in the Fort Union coal region, North Dakota, 1976-77
Open-File Report, April 1976, 26 p., 11 fig., 17 ref.
Journal Announcement: SWR215

Owing to the current emphasis on energy development, a rather large number of geologic and hydrologic studies either are underway or are proposed by a number of agencies and private companies working in the Fort Union coal region of North Dakota. The purpose of this report is to inform other agencies, private companies, and the public in general of the on-going and recently completed work by the water resources division of the U.S. Geological Survey in the Fort Union coal region. The work done by the water resources division in North Dakota is listed by sequential project identification number. Some of the projects are primarily concerned with data collection. Others involve interpretation in addition to data collection. A summary of each project includes objectives, co-operators, and availability of the report. (Woodard-USGS)

Ground-water data for selected coal areas in western North Dakota
Wald, James D., and Norbeck, Steven W.
U.S. Geological Survey publication 222 pages, 11 illus., 12 tables, 25 text figs.

Ground-water data are provided for the Sand Creek-Hanks, New England-Hanks, Dickinson, and Newman-Gascoyne coal areas of western North Dakota.
The report contains the following: (1) Maps showing the location of wells, springs, and test holes; the location of test holes; where drillers' logs are available; and the location of wells with chemical analyses; and (2) tables showing well, spring, and test hole records: logs; and chemical analyses of water.
The 4.2 square mile Beulah Trench site in the Renners Cove Coalfield of the Williston Basin is characterized by rolling hills, bordered by flat saltwater channels on the east and south. Most of the site is drained by tributaries to ephemeral Antelope Creek. Annual precipitation is about 15 inches plus and evaporation is estimated to be 36 inches annually. The hills are underlain by bedrock. Till and alluvium cover the low lands. Nearly 110 million tons of coal are in beds more than 2.5 feet thick covered by less than 300 feet of overburden. Most of the coal is in the Beulah-Zap bed, part of the Sentinel Butte Member of the Paleocene Fort Union Formation. Small amounts of unconfined and semi-confined water occur in discontinuous sandstone layers above the coal. Small amounts are also found confined in the coal. Dissolved solids ranged from 1,010 to 2,150 milligrams per liter. Larger quantities of more highly mineralized water undoubtedly occur in deeper aquifers. Moderate to large quantities of water are available in the buried valleys on the east and south borders of the site. Mining would dewater the coal and aquifers above. Recharge, of poorer quality, to the buried valley aquifers would be hastened.

Falkirk Coal Lease Application, central North Dakota
BLM, Miles City, Montana
EA, 1976

This document analyzes the impacts of leasing 998.87 acres of Federal coal (19.2 million tons) in 8 scattered tracts (1/4 section or smaller) in McLean County, central North Dakota. Refusal to lease would leave the Federal coal isolated and economically unrecoverable. The tracts are in the prairie pothole region which is underlain by a veneer of glacial deposits. Relief is generally less than 25 feet. Precipitation is about 13 inches per year. Surface drainage is internal and most of the potholes contain brackish to briney water and many are ephemeral. Coal is in two seams totaling 11 feet thick, in the Sentinel Butte Formation at the top of the Upper Cretaceous Fort Union Group. Ground water occurs in the sandstones of the Fort Union Group below the coal, and in the underlying Hell Creek and Fox Hills Formations. Wells yield range up to 75 gallons per minute, and dissolved solids range from 206 to 3,550 milligrams per liter. Wells in buried glacial channels in the vicinity yield as much as 200 gallons per minute of water containing from 277 to 1,360 milligrams per liter dissolved solids. Surface mining of these leases would have little influence on their hydrology.
This record analyzes the impacts of leasing 120 acres of Federal coal to avoid being bypassed by an ongoing mining operation. The site is 8 miles south of Velva and 20 miles southeast of Minot. It is on a gently sloping, 70-feet in one-half mile escarpment between the Missouri Coteau plateau and the drift prairie, at the head of intermittent Spring and Blacktail Creeks. Annual precipitation and lake evaporation are about 12 and 30 inches, respectively. About 1.5 million tons of recoverable coal remain beneath 65 acres in the less than 11-foot thick Coteau bed of the Paleocene Port Union Group Tongue River Formation. The coal is under less than 30 feet of overburden consisting of shale and sandstone layers veneered by glacial drift and lake sediments. The bedrock layers are essentially flat-lying. Small quantities of water are perched in the coal on underlying clay, and contain 2,000 to 33,000 milligrams per liter of dissolved solids. Mining of this coal would have no significant impact on the hydrology of the area.
SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES—OHIO REGION

BLOOM, R. M. JR.
GEOLOGICAL SURVEY, RESTON, VA.
AVAILABLE FROM SUPT. OF DOCUMENTS, GPO, WASHINGTON, D.C.
20402 — $1.75 (PAPER COVER). PROFESSIONAL PAPER 813-A, 1974. 41 P., 22 FIG., 13 TAB., 25 REF.,
JOURNAL ANNOUNCEMENT: SWA1821

GROUNDWATER IN THE OHIO REGION IS A LARGE, IMPORTANT, AND MANAGEABLE RESOURCE THAT SHOULD HAVE A SIGNIFICANT ROLE IN REGIONAL WATER DEVELOPMENT. ON THE BASIS OF A COMPARISON OF GROUNDWATER WITHDRAWALS WITH ESTIMATED GROUNDWATER RECHARGE, THE GROUNDWATER RESOURCES PROBABLY WILL NOT BE USED AT FULL POTENTIAL UNDER EXISTING DEVELOPMENT PLANS. ANNUAL GROUNDWATER USE (1960) IN MUNICIPALITIES AND RURAL RESIDENTS WAS ABOUT 1,000 MILLION GALLONS PER DAY. AVERAGE ANNUAL REGIONAL GROUNDWATER RECHARGE IS ABOUT 35,000 MGD. THEREFORE, BASE-YEAR (1960) MUNICIPAL AND RURAL GROUNDWATER USE IS ONLY ABOUT 3% OF RECHARGE. ANNUAL REGIONWIDE GROUNDWATER USE (1965) BY INDUSTRY ALSO IS ONLY ABOUT 3% OF RECHARGE. TOTAL POTABLE GROUNDWATER AVAILABLE FROM STORAGE IN THE OUTWASH AND ALLUVIAL AQUIFERS IN THE OHIO RIVER VALLEY AND THE SUBRASINS IS ABOUT 23,000 BILLION GALLONS. THIS IS ABOUT FOUR TIMES THE FLOOD-CONTROL STORAGE OF ALL OHIO REGION CORPS OF ENGINEERS RESERVOIRS CONSTRUCTED, UNDER CONSTRUCTION, OR IN ADVANCE PLANNING AS OF JULY 1965, APPROXIMATELY 85,000 BILLION GALLONS OF POTABLE GROUNDWATER IS AVAILABLE FROM STORAGE IN AQUIFERS OTHER THAN THE OUTWASH AND ALLUVIAL AQUIFERS.

Hydrology of Area 7, Eastern Coal Province, Ohio
Engelke, M. J., Jr., Roth, D. K., and others, 1981

Ground-Water Hydrology of Strip-Mine Areas in Eastern Ohio (Conditions During Mining of Two Watersheds in Coshocton and Muskingum Counties)
Helgesen, J. O., Jr., Razem, A., Geological Survey, Columbus, OH, Water Resources Div,
Geological Survey Open-File Report 83-913 (WRI), 1981. 25 P., 14 FIG., 2 TABS, 3 REF.,
JOURNAL ANNOUNCEMENT: SWA1512

Ground-water conditions during coal strip mining in two small watersheds are described as part of an ongoing study of effects of mining on hydrologic systems. Each watershed was underlain by stratified sedimentary rocks containing two perched aquifers above clays which underlaid the major coal seams. Mining involved removing the over-burden rocks, including the
top aquifers, stripping the top coal seam, and recultivating the overburden spoil to the approximate premining shape of the watersheds. Water levels in the top aquifer declined as mining near the watersheds, but destruction of observation wells precluded a record of the decline during mining of the watersheds. Location of the top aquifer was reflected in stream base flow, which was reduced and more highly mineralized after mining. Initial saturated thickness of replaced overburden was less than 1 foot. After mining, initial saturated thickness of replaced overburden was more than 1 foot, beneath the stripped watersheds.

The conditions of mining operation but with temporary closure, allowing ground water to flow, which was reduced and more highly mineralized after mining. Initial saturated thickness of replaced overburden was less than 1 foot. After mining, initial saturated thickness of replaced overburden was more than 1 foot, beneath the stripped watersheds. (USGS)

Surface Water Quality in Ohio's Coal Regions Helsel, Dennis R., and Pfaff, Christine L. U.S. Geological Survey Papers Presented Before the Abandoned Mine Reclamation Symposium Water quality at base flow for 150 streams located within the coal mining areas of eastern Ohio was inventoried during 1975-76 in a two-phase study. Phase one, a reconnaissance to relate water quality to land use, demonstrated significant differences in levels of pH, total alkalinity, total aluminum, specific conductance, and sulfate between unlined watersheds and those containing abandoned coal mines. Reclaimed basins produced waters similar to those from unlined watersheds for pH, total iron, and total aluminum concentrations, whereas specific conductance and sulfate concentrations were significantly reduced in abandoned mine streams. Alkalinity and pH varied not only with type of mining operation but with the underlying geologic formation.

In the second phase of this study, four watersheds were selected from among the first-phase sampling sites. Types of mining represented were abandoned drift mines, abandoned surface mine, temporary surface mine, and reclaimed surface mine. Samples from drainage upstream and downstream from the mine sites were collected to describe any chemical changes within the watersheds resulting from mining activity. The experimental mine site did not significantly affect quality in the main stream channel, whereas water quality was altered in the other three streams because of mining activity.


Hydrologic data are presented for area 3 of the Eastern Coal Province, 4,077 square miles of the lower Allegheny River basin in western Pennsylvania. Seventy-three streams were sampled three times during the 1979 and 1980 water years for specific conductance, hydrogen, alkalinity, dissolved and total iron, dissolved and total manganese, dissolved sulfate, and dissolved solids. Benthic invertebrate populations were determined and benthic material samples were analyzed for metals. Sixteen streams had pH, alkalinity, acidosis, total iron, total manganese, and dissolved sulfate indicative of acid-mine drainage. These streams were most common in the Redbank and Blacklick Creek basins and in the Conemaugh and lower Kiskiminetas River basins. Benthic invertebrates were not found in 11 of 64 streams sampled. An additional 13 streams had low benthic invertebrate diversity indices. Low diversity indices were most common in the southern part of area 3. Low flow, mean flow, peak flow, and flow duration data are presented for gaging stations in area 3. Data for estimating these flow data for ungaged sites are presented and referenced. The functions of, and access to, the National Water Data Exchange, National Water Data Storage and Retrieval Systems, and Office of Water Data Coordination are explained. (USGS)


Water Resources of the Black Hand Sandstone Member of the Cuyahoga Formation and Associated Aquifers of Mississippian Age in Southeastern Ohio Norris, Stanley E., and Mayer, Gregory C. U.S. Geological Survey Open-File Report 82-170, 72 pages. The Black Hand Sandstone Member of the Cuyahoga Formation and associated aquifers of Mississippian age, including the Allensville Conglomerate member of the Logan Formation, were investigated in a 1,500-square-mile area, parts of five counties in southeastern Ohio. The aquifers crop out in western Vinton, western Jackson, and southwestern Fairfield Counties. They dip southeastward about 35 feet per mile, becoming progressively more deeply buried until at Lake Hope, in northeastern Vinton County, the aquifers are the deepest sources of potable ground water in Ohio, occurring at depths locally exceeding 200 feet. These aquifers are the chief sources of water beneath the
coal-bearing rocks of the Pennsylvanian System and are widely used for farm and home requirements. Specific capacities of wells are low exceeding 1 gallon per minute per foot of drawdown only in scattered areas.

At McArthur in Vinton County, the aquifers yield about 300,000 gallons per day for municipal and industrial use, but withdrawal has accompanied by declining ground-water levels during the past 10 years in a 10-square-mile area. Transmissivity determined from wells open to both the Black Hand Sandstone Member and Allisonville Conglomerate Member at McArthur's west municipal well field is about 135 square feet per day.

The ground water is predominately of the sodium bicarbonate or calcium bicarbonate type in the central part of the area and changes, as it moves downslope, to a sodium chloride bicarbonate type. Along the eastern boundaries of Hocking and Vinton Counties the aquifers are below the common depth of wells and are presumed to be potable but contain water too salty for ordinary use. Locally, the aquifers are contaminated by brine from oil and gas wells.

Assessment of Water Quality in Streams Draining Coal-Producing Areas in Ohio


Water quality in the coal-producing areas of eastern Ohio was studied in a two-phase investigation between May 1975 and August 1976. Results of phase one, a reconnaissance of water quality at 150 sites, indicated that acid mine drainage generally occurs where abandoned drift or strip mines were located, whereas areas characterized by reclaimed or active strip mines showed few instances of acid drainage. Phase two was a detailed study of four small basins: One contained abandoned drift mines; the second, abandoned strip mines; the third, reclaimed strip mines; the last, active strip mines. Results of phase two were similar to those of phase one. (USGS)

Hydrology of Area 4, Eastern Coal Province, Pennsylvania, Ohio, and western Pennsylvania. It is part of the upper Ohio River Basin which includes the Beaver, Mahoning, and Shenango Rivers. The area is underlain by rocks of the Pottsville, Allegheny, Conemaugh, Monongahela Groups (or formations), and Dunkard Group. Area 4 has a temperate climate with an annual average rainfall of 38 to 42 inches, most of its area is covered by forest. The soils have a high erosion potential where the vegetation cover is removed. In response to Public Law 95-67, 132 sites were added to the existing surface-water data-collection network in area 4. At these added sites, collected data includes discharge, water quality, sediment, and biology. The data are available from computer storage through the National Water Data Exchange (NWDEX) or the published annual Water Resources Data reports for Ohio, Pennsylvania, and west Virginia. Hydrologic problems related to mining are: (1) Erosion and increased sedimentation, and (2) degradation of water quality. Erosion and sedimentation are associated chiefly with surface mining. Sediment yields increase drastically when vegetation is removed from the highly erosive soils. Degradation of water quality can be caused by acid-mine drainage from underground and surface mining. More than half the acid-mine drainage effluent in area 4 comes from underground mines. The rest seeps from abandoned surface mines. Usually in reclaimed surface mines the overburden is replaced in such a short time after the coal is taken out that oxidation of acid-forming minerals commonly pyrite or marcasite, is not complete or is neutralized by the buffering action of calcareous minerals in the soils. (USGS)


Water resources data for Ohio consist of records of stage, discharge, and water quality of streams; stage, contents; and water quality of lakes and reservoirs; and water levels and water quality of wells. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, Federal, and other governmental agencies in Ohio. (Woodard-USGS)
Rainfall-Runoff Hydrograph and Basin Characteristics Data for Small Streams in Oklahoma

Bergman, O. L.; Huntzinger, T. L.


Available from OFS, USGS Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $42.00, Microfiche $4.00. Geological Survey Open-File Report 81-824, September, 1981, 318 p. 2 Fig. 3 Tab., 4 Ref.

Journal Announcement: SWRA 1509

Rainfall with concordant runoff events recorded at 45 gauges located in drainage basins of less than 30 square miles in Oklahoma are summarized. Selected basin characteristics which relate to storm runoff are described and tabulated for each gage site summarized. A tabulation is included which identifies drainage basins that produce atypical rainfall-runoff distribution as a result of regulation by upstream flood-retention structures. (USGS)


Ground-water records for Eastern Oklahoma, Part 2 - Water-quality records for wells, test holes, and springs

Huntzinger, T. L., 1976

Journal Announcement: SWRA1121

The U.S. Geological Survey has collected data on Oklahoma’s ground-water resources since 1934. This report makes available both published and unpublished water-quality records for approximately 1740 wells, test holes, and springs in 39 counties in eastern Oklahoma. (Woodard-USGS)

Ground-water records for northeastern Oklahoma--Part 1. Records of wells, test holes, and springs

Havens, J. S., and Bergman, D. L., 1976

High-flow frequencies for selected streams in Oklahoma

Huntzinger, T. L., 1978b

Low-flow characteristics of Oklahoma streams

Huntzinger, T. L., 1978c

Maps and description of disturbed and reclaimed surface-mined coal lands in eastern Oklahoma

Johnson, K. S., 1974
Oklahoma Geological Survey Map GR-17, 12 p., 3 maps, scale 1:125,000.

GEOL0GY AND EARTH RESOURCES OF OKLAHOMA

Johnston, K. S., Branson, C. J., Curtis, H. M., Jr., Ham, W. E., Marcher, M. V., Geological Survey, Norman, Okla., Educational Publication 1, 1972, 8 P., 7 MAP, 1 TAB.

Journal Announcement: SWRA0622

THIS ATLAS OF MAPS AND CROSS SECTIONS DESCRIBES GEOLOGY AND EARTH RESOURCES FOR OKLAHOMA. ROCKS OF EVERY GEOLOGIC PERIOD CROP OUT IN OKLAHOMA. ALTHOUGH MOST OF THESE ROCKS ARE OF SEDIMENTARY ORIGIN, CONSOLIDATED FROM SEDIMENTS DEPOSITED DURING THE PALEOZOIC ERA, THE OLDEST ARE PRECAMBRIAN GRANITIC AND RHITOLITHES FORMED 1.05 TO 1.35 MILLION YEARS AGO. AVERAGE ANNUAL PRECIPITATION RANGES FROM ABOUT 16 INCHES IN THE WESTERN PANHANDLE TO AS MUCH AS 56 INCHES IN THE SOUTHEASTERN PART OF THE STATE. MAJOR GROUNDWATER AQUIFERS ARE STREAM DEPOSITS, ALLUVIUM, TERRACE DEPOSITS, AND THE OGALLALA FORMATION. LIMESTONE, SANDSTONE, AND GYPSUM. THESE AQUIFERS ARE ESTIMATED TO CONTAIN MORE THAN 300 MILLION ACRE-FEET OF WATER. THE ENTIRE STATE IS DRAINED BY THE ARKANSAS AND RED RIVERS AND THEIR TRIBUTARIES. EACH YEAR APPROXIMATELY 13 MILLION ACRE-FEET OF WATER FLOWS INTO THE STATE THROUGH THESE STREAMS. 22 MILLION ACRE-FEET IS ADDED BY PRECIPITATION, AND 35 MILLION ACRE-FEET FLOWS OUT. THE MINERAL CONTENT OF GROUNDWATER FROM STREAM DEPOSITS, LIMESTONE, AND SANDSTONE IS TYPICALLY LOW TO MODERATE, AND THE WATER IS SUITABLE FOR MOST PURPOSES. HIGHLY MINERALIZED WATER, UNFIT FOR NEARLY ANY USE, IS PRESENT BENEATH FRESHWATER IN ALL PARTS OF THE STATE. (WOODARD-USGS)

Bibliography of abandoned coal-mine lands in Oklahoma

Oklahoma Geological Survey Special Publication 81-2, 84 p.

Geology and fuel resources of the southern part of the Oklahoma coal field: Part 2. The Lehigh district, coal, Atoka, and Pittsburg Counties

Knechtel, M. W., 1937

Statistical summaries of surface-water-quality data for selected sites in Oklahoma through the 1975 water year


Journal Announcement: SWRA1303

Statistical summaries of surface-water-quality data for 47 streams in Oklahoma have been compiled, to be used for the period of record through the 1975 water year at each site. Data were used to develop regression equations for specific conductance, constituent relationships for calcium, magnesium, sodium, potassium, bicarbonate, sulfate, chloride, silicate, and dissolved solids. Tables include minimum, mean, and maximum values for selected constituents for the period of record through the 1975 water year for individual water years. (Woodard-USGS)

NORTHEASTERN OKLAHOMA

Marcher, M. V., Bingham, R. H., Geological Survey, Oklahoma City, Okla., Oklahoma Geological Survey Map HA-2, 4 SHEETS, 1971, 2 FIG, 5 MAP, 6 TAB, 20 REF.

Journal Announcement: SWRA0622

THIS 4-SHEET ATLAS DESCRIBES THE WATER RESOURCES FOR THE TULSA AREA. SURFACE WATER IS THE MAJOR SOURCE OF WATER USED IN THE TULSA QUADRANGLE. THE TOTAL AMOUNT OF WATER USED IN 1968 IS ESTIMATED AT 22.6 MILLION GALLONS. APPROXIMATELY...
65% of this amount, or about 21.8 billion gallons, was taken from the lakes and rivers of the area; the remaining 3.6 billion gallons was provided by groundwater development. The major use of water was for municipal and industrial purposes, which accounted for about 28 billion gallons. Rural domestic use accounted for the remaining 1.4 billion gallons. The most intensive area of groundwater development is in Ottawa County, where, in 1968, about 1.7 billion gallons was pumped from deep aquifers for municipal and industrial use. Because of the difficulty in obtaining sufficient water of good quality in many parts of the area, 33 rural water districts had been established by the end of 1967. These approximately 15,000 people; all the water was taken from surface-water sources.

RECONNAISSANCE OF THE WATER RESOURCES OF THE FORT SMITH QUADRANGLE, EAST-CENTRAL OKLAHOMA


The geology and water resources of the Fort Smith Quadrangle, Oklahoma, are shown by a 4-sheet hydrologic atlas consisting of a geological map, a groundwater availability map, a groundwater quality map, a map showing distribution of precipitation, hydrographs, tabulated data, and descriptive text. In some parts of the Quadrangle, wells readily yield several hundred gallons of water per minute suitable for most purposes, whereas in other parts, supplies of water sufficient for daily household use are difficult to obtain and much of this water is of poor quality. Differences in well yield and water quality are controlled mainly by the type of rock in which a well is completed. In general, alluvium is the most favorable type of rock for large well yields, followed by terrace deposits in local areas and then, in order of decreasing favorability, weathered chert, limestone, sandstone, and siltstone. With shale the least frequent. In addition to rock type, geologic structure also affects the occurrence of groundwater, particularly in the northeastern part of the area where springs and some of the wells of larger yield apparently obtain water from rocks broken by faulting. Minor streams in the area go dry or nearly dry almost every year. Alluvium yields groundwater of the best quality and shale to poorest. Whereas other rock types yield water with a quality somewhere between, groundwater that has been in contact with coal beds is usually highly mineralized and, in some places, unfit to drink. Coal mining and gas-field development may adversely affect the water quality locally. (KNAPP-USGS)

Statistical summaries of streamflow records, Oklahoma, through 1974

Oklahoma
Floodflows from small drainage areas in Oklahoma: Progress report and data compilation

Thomason, W. O., Jr; Corley, R. K.

Geological Survey, Oklahoma City, OK.


Journal Announcement: SWA-U76

Annual peak discharges and basin and climatic characteristics are summarized for 103 small-stream sites in Oklahoma. The U.S. Geological Survey rainfall-runoff model was calibrated for the small watersheds. The rainfall-runoff model can be used to extend the length of flood records for small watersheds. Records from four small watersheds were extended by the model, and synthetic frequency curves were computed for these sites to show applicability of the model. (KNAPP-USGS)

Techniques for estimating flood discharges for Oklahoma streams

Thomason, W. O., Jr; Corley, R. K.


Available from the National Technical Information Service, Springfield, VA. 22161 as pu-273 402, price codes: AD01 in paper copy, AO1 in microfiche. Water-Resources Investigations 77-54.


Statewide (Oklahoma) regression equations are defined for estimating peak discharges of floods having recurrence intervals ranging from 2 to 500 years. Contributing drainage area, main-channel slope and area, and annual precipitation are the independent variables required for estimating flood discharges for rural streams. For urban streams the percentage of the basin that is impervious and served by storm sewers also is required. The regression equations are applicable for watersheds draining less than 2,500 sq mi that are not significantly affected by regulation. For rural streams, the regression equations are presented in graphical form for easy application. Annual peak discharges, basin and climatic characteristics, log-Pearson Type III statistics, and the flood-frequency relations are presented for 188 gaging stations. (Woodard-USGS)

Coal resources of Oklahoma

Trumbull, J. V., Jr., 1957


Water Resources Data for Oklahoma, published annually since 1975.


Water resources data for Oklahoma consist of records of stage, discharge, and water quality of streams, stage, contents, and water quality data of lakes or reservoirs. The database includes that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Oklahoma. (Kosco-USGS)

Water resources investigations in Oklahoma, 1968

Geological Survey, Washington, D.C.

Geological Survey report of investigations folder, 1 sheet, 1968. 6 fig., 1 map.

Journal Announcement: SWA-U50

Water resources studies and investigations of the U.S. Geological Survey in Oklahoma are summarized. A selected bibliography of material concerning the state is included. A list is given of state and Federal agencies, counties, and cities who cooperate in different parts of the program. The hydrologic data network consists of 160 primary, secondary, and water management streamflow stations; 254 groundwater observation wells; and 35 water quality observing sites. Small state maps show principal sources of groundwater, average annual
Precipitation, Average Annual Runoff, Discharge of the Principal Rivers, and the Chemical Quality of the Rivers. A Map, Scale 35 Ml to the Inch, Shows by Symbols, Numbers, and Colored Outline the Hydrologic Data Network and Investigations in Oklahoma in July 1966. (Woodard-USGS)


This report is a summary of the 1978 program of the U.S. Geological Survey for Oklahoma. It contains listings of all active projects and the current status of each. A list of all published reports related to the water resources of Oklahoma is given. It contains listings of all streamflow gaging stations, water quality stations, and reservoir stations which the Geological Survey operates or publishes through cooperation with other state, local, and federal agencies. Included are discontinued surface water and water quality stations for which the Geological Survey has published records. Stations are listed by type and by cooperating agency and the number of stations funded by each cooperating agency is summarized.

Maps show the locations of various types of stations, the locations of selected ground-water projects and an index of the two-degree sheets in Oklahoma for which hydrologic reconnaissance studies have been made. (Woodard-USGS)


Active Primary-Collection Sites for Hydrologic Data are Shown on a Map of the Greater Pittsburgh Region (Allegheny, Armstrong, Beaver, Butler, Washington, and Westmoreland Counties in southwestern Pennsylvania). The Sources of Data—By Publication or Responsible Agency—are Described. Secondary data collection sites have not been shown on the map, but several agencies involved in this activity have been listed. Hydrologic data are collected at the following numbers of identified sites under the auspices of federal, state, and interstate organizations: precipitation or temperature 39, surface-water stage or discharge 82, surface-water quality 69, and ground-water levels 7. (Woodard-USGS)

Stream Reconnaissance for Nutrients and Other Water-Quality Parameters, Greater Pittsburgh Region, Pennsylvania. Beall, R. M.


Eighty-Five Stream Sites in and Near the Six-County Greater Pittsburgh Region were Sampled in May-June 1971 and Again in Mid-October 1972. Data Are Reported for 89 Data Sites (Including 4 Substitute Sites Sampled in the Second Period). Drainage Areas of the Basins Sampled ranged from 4.1 to 19,500 Square Miles (10.6 to 50,000 Square Kilometers). The Chemical Analyses Include Constituents of Three General Classes: (1) Nutrients, (2) Activity Indicators, and (3) Dominant Anions. Nutrient Concentrations were High Enough to Indicate Potential Problems at About a Quarter of the Sampling Sites, Temperature, Dissolved Oxygen, and pH Values Indicated a
GENERALLY FAVORABLE CAPACITY FOR REGENERATION OR RECOVERY FROM DEGRADATION, ALTHOUGH A NUMBER OF STREAMS EAST OF THE ALLEGHENY AND MONONGAHELA RIVERS ARE MARGINAL OR LACKING IN THAT CAPACITY. REGIONALLY, SULFATE IS THE DOMINANT ION AND WAS OBSERVED IN CONCENTRATIONS OF 40 MILLIGRAMS PER LITRE OR MORE AT 90% OF THE SITES. BICARBONATE EXCEEDED 100 MILLIGRAMS PER LITRE AT 22 SITES. A MODERATE TO HIGH DEGREE OF MINERALIZATION, AS INDICATED BY CONDUCTANCE READINGS OF MORE THAN 500 MICROMHOS PER CENTIMETER AT HALF OF THE SAMPLING SITES, IS A CHARACTERISTIC OF THE REGION'S SURFACE WATERS. (WOODARD-USGS)

GROUNDWATER IN PENNSYLVANIA

Gebehr, A. E.

GEOLOGICAL SURVEY, HARRISBURG, PA.

AVAILABLE FROM BUREAU OF PUBLICATIONS, TENTH AND MARKET STREETS, HARRISBURG, PENN 17125. PENNSYLVANIA GEOLOGIC SURVEY EDUCATIONAL SERIES NO 3, 1970. 42 P, 29 FIG. 1 MAP, 2 TAB, 46 REF.

Journal Announcement: SWRA0411

THE EXISTING KNOWLEDGE OF THE GROUNDWATER RESOURCES OF PENNSYLVANIA IS SUMMARIZED. IT WAS WRITTEN TO PROVIDE INDUSTRIAL AND CIVIL PLANNERS, DEVELOPERS, MANAGERS, AND THE PUBLIC WITH SUFFICIENT INFORMATION ABOUT STATEWIDE WATER RESOURCES TO MAKE INTELLIGENT, FUNDAMENTAL DECISIONS ABOUT THE FUTURE USE, DEVELOPMENT, AND PROTECTION OF THE GROUNDWATER. PENNSYLVANIANS USED ABOUT 6.6 BGD (BILLION GALLONS PER DAY) OF WATER IN 1966, EXCLUDING ELECTRIC POWER PLANT USE. ALTHOUGH ONLY 11% OF THE WATER WAS TAKEN DIRECTLY FROM GROUNDWATER SOURCES, 25 TO 35% OF THE PEOPLE DEPEND ON GROUNDWATER FOR THEIR PERSONAL NEEDS. IN ADDITION, 55% OF WATER COMPANIES OBTAIN ALL THEIR WATER, AND ANOTHER 13% OBTAIN PART OF THEIR WATER FROM GROUNDWATER SOURCES. TWENTY-ONE OF THE 67 PENNSYLVANIA COUNTIES OBTAIN MORE THAN HALF THEIR TOTAL WATER SUPPLIES FROM GROUNDWATER. BOTH REGIONAL AND LOCAL PROBLEMS OF WATER QUALITY EXIST IN PENNSYLVANIA. MANY OF THESE PROBLEMS ARE THE RESULT OF ACTIVITIES UNDERTAKEN IN THE PAST WITHOUT ADEQUATELY PROTECTING WATER RESOURCES. WATERS THAT FLOW FROM COAL MINES AND ContAIN HIGH CONCENTRATIONS OF SULFURIC ACID AND IRON IN SOLUTION ARE THE MAJOR PROBLEM OF WATER QUALITY BOTH IN THE VOLUME OF WATER INVOLVED AND THE TOTAL AREA AFFECTED. SECOND TO ACID MINE WATERS IN AREAL EXTENT, BUT EQUALLY SERIOUS, IS THE POLLUTION OF PENNSYLVANIA'S STREAM AND GROUNDWATERS BY S:\WAGE AND INDUSTRIAL WASTES. ANOTHER TYPE OF GROUNDWATER POLLLUTION IS CAUSED BY CRUDE OIL AND SALINE WATERS MOVING UPWARD INTO FRESH WATER AQUIFERS EITHER THROUGH NATURAL OPENINGS OR THROUGH OIL AND GAS WELLS ABANDONED PRIOR TO THE WELL PLUGGING LAW OF 1951. (WOODARD-USGS)

Stream quality in Appalachia as related to coal-mine drainage, 1965 (Duplicated see Alabama and W. Virginia).

Bieseecker, J. E., and George, J. R., 1966

284
Pennsylvania

U.S. Geological Survey Circular 528, 27 p

WATER RESOURCES OF THE SCHUYLKILL RIVER BASIN
BIESECKER, J. E.; LESCINSKY, J. B.; WOOD, C. R.
GEOLOGICAL SURVEY, HARRISBURG, PA.
PENN DEP FOR WATERS, WATER RESOURCES HUBL NO 3, MAY
1968, 198 P, 74 FIG, 68 TAB, 95 PBF, 1 APPEND
Journal Announcement: SWRA221


Selected Water Resources Data, Clarion River and Red-Bank Creek Basins, Northwestern Pennsylvania--Part 2
Buckwalter, T. F.; DOODGE, C. H.; SCHINER, G. R.
Journal Announcement: SWRA311

This report presents selected basic data collected during a study of the water resources of the Clarion River and Redbank Creek basins in northwestern Pennsylvania. Hydrologic information including data on aquifers, water levels, and yields is presented for 1,550 wells. Records for 51 springs are also given. The report contains 83 chemical analyses of water samples collected from 50 stream sites and 300 analyses of water from 196 wells and 43 springs. Also included are 103 trace-element analyses. Monthly and annual means of ground-water levels for six observation wells are tabulated. Benthic invertebrate data from 136 stream sites are listed. Locations of data-collection sites are shown on 50 page-size reductions of 7.5-minute topographic quadrangle maps. (Kosco-USGS)

Water Resources of the Clarion River and Redbank Creek basins

285

Pennsylvania

Buckwalter, T. F., and others, 1981
U.S. Geological Survey Water-Resources Investigations

Chemical quality of surface waters in Pennsylvania
Durso, C. N., and Anderson, P. W., 1963

ACIDITY CONTROL IN WILD EAGLE CREEK AND WEST BRANCH SUSQUEHANNA RIVER, CLINTON COUNTY, PENNSYLVANIA
FLIPPO, H. N., JR.
GEOLOGICAL SURVEY, HARRISBURG, PA.
GEOLOGICAL SURVEY OPEN-FILE REPORT, FEBRUARY 1971, 28 P, 8 FIG, 2 REF.
Journal Announcement: SWRA505

REGRESSION ANALYSIS OF CHEMICAL AND PHYSICAL DATA COLLECTED ON BEECH CREEK IN CLINTON COUNTY, PENNSYLVANIA IN TWO CURVES THAT RELATE THE CONCENTRATION OF FREE HYDROGEN ION TO THE ELECTRICAL SPECIFIC CONDUCTANCE OF THE WATER. THESE CURVES PROVIDE A MEANS OF ESTIMATING, THROUGH USE OF DATA TELEMETRED FROM A WATER-QUALITY MONITOR ON BEECH CREEK, THE ACID LOAD IN THE STREAM AT ANY TIME. THESE ESTIMATES OF ACID LOADS IN BEECH CREEK ENABLE THE OPERATORS OF FOSTER JOSEPH SAYS DAM ON BALD EAGLE CREEK TO RELEASE SUFFICIENT ALKALINE WATER FROM THE RESERVOIR TO PREVENT FISH KILLS IN LOWER BALD EAGLE CREEK THAT COULD BE CAUSED BY THE ACID FROM BEECH CREEK. THE ACID CONTENT OF THE WEST BRANCH SUSQUEHANNA RIVER UPSTREAM FROM THE CITY OF LOCK HAVEN USUALLY EXCEEDS THE AMOUNT THAT CAN BE NEUTRALIZED BY BALD EAGLE CREEK. HOWEVER, INASMUCH AS THE ALKALINE CONTENT OF BALD EAGLE CREEK EXCEEDS THE AMOUNT REQUIRED TO EFFECTIVELY NEUTRALIZE THE ACIDITY OF BEECH CREEK, SOME WATER MAY BE CONSERVED IN THE RESERVOIR FOR THE PURPOSE OF IMPROVING THE QUALITY OF THE WEST BRANCH WHEN THE RIVER IS USUALLY ACID. (WOODARD-USGS)

Ground-water resources, Allegheny River basin and part of the Lake Erie basin, New York
FRIEMPER, M. H., 1974

SUMMARY GROUND-WATER RESOURCES OF ALLEGHENY COUNTY, PENNSYLVANIA
GALLACHER, J. T.
GEOLOGICAL SURVEY, HARRISBURG, PA.
Sediment Discharge from Highway Construction Near Port Carbon, Pennsylvania

Helm, R. E.


Journal Announcement: SWRA1210

The effects of highway construction on suspended-sediment loads were studied in the upper reaches of the Schuylkill River basin, Schuylkill County, Pennsylvania, from April 1975 to March 1977, and from December 1976 to August 1977, when State Route 209 was relocated through the upper reaches of the basin, a mountainous watershed with a drainage area of 27,178 square miles. About 16,000 tons of suspended-sediment was discharged from the basin during the construction. The highway construction produced about 6,000 tons or 50 percent of the total sediment discharge. Steep slopes, the availability of fine coal washings, and other land use activities in the basin were responsible for most of the remaining sediment discharge. Seventy percent of the total suspended-sediment discharge occurred during eight storms. (Woodard-USGS)

Hydrology of Area 5, Eastern Coal Province, Pennsylvania, Maryland, and West Virginia

Herb, W. J. J. Shaw, L. C. Brown, D. E.


Journal Announcement: SWRA1511

Hydrologic data are presented for area 5 of the Eastern Coal Province, a 7,384-square-mile Monongahela River basin in western Pennsylvania, western Maryland, and eastern West Virginia. One hundred thirty-four streams were sampled about three times during the 1979 and 1980 water years for specific conductance, pH, acidity, alkalinity, dissolved and total iron, dissolved and total manganese, dissolved sulfate and sulfate levels, and benthic invertebrate populations were determined and bottom material samples were analyzed for metals. Sixteen streams had pH, acidity, alkalinity, total iron, total manganese, and benthic invertebrate diversity indices. These streams were most common in the Redbank and Black Creek River basins and in the Conemaugh and lower Kiskiminetas River basins. Sixteen streams had low benthic invertebrate diversity indices. Low diversity indices were most common in the southern part of area 5. Low flow conditions, mean flow, peak flow, and flow duration data are presented for gaging stations in area 5. Techniques for estimating these data for ungauged sites are presented and referenced. The functions of and access to, the National Water Information System, National Water Data Exchange, National Water Data Storage and Retrieval System, and Office of Water Data Coordination are explained. (USGS)

Hydrology of Area 3, Eastern Coal Province, Pennsylvania, and West Virginia

Herb, W. J. J. Shaw, L. C. Brown, D. E.


Journal Announcement: SWRA1511

Hydrologic data are presented for area 3 of the Eastern Coal Province, a 3,077 square mile area of the Allegheny River basin in western Pennsylvania. Seventy-three streams were sampled three times during the 1979 and 1980 water years for specific conductance, pH, acidity, alkalinity, dissolved and total iron, dissolved and total manganese, dissolved sulfate and sulfate levels, and benthic invertebrate populations were determined and bottom material samples were analyzed for metals. Sixteen streams had pH, acidity, alkalinity, total iron, total manganese, and benthic invertebrate diversity indices. These streams were most common in the Redbank and Black Creek River basins and in the Conemaugh and lower Kiskiminetas River basins. Sixteen streams had low benthic invertebrate diversity indices. Low diversity indices were most common in the southern part of area 3. Low flow conditions, mean flow, peak flow, and flow duration data are presented for gaging stations in area 3. Techniques for estimating these data for ungauged sites are presented and referenced. The functions of and access to, the National Water Information System, National Water Data Exchange, National Water Data Storage and Retrieval System, and Office of Water Data Coordination are explained. (USGS)
Ground-water Quality and Data on Wells and Springs in Pennsylvania, Volume 1—Ohio and St. Lawrence River Basins

Koester, H. E.; Miller, D. R.


Journal Announcement: SWRA1414

Volume I of the Groundwater Quality and Data on wells and springs in Pennsylvania presents groundwater quality and physical data on about 1,200 well and spring sites in the Ohio and St. Lawrence River basins. Locations are shown on site-identification maps derived from the hydrologic unit map codes showing the geologic age and aquifer are provided. (USGS)

WATER QUALITY AND DISCHARGE OF STREAMS IN THE LEHIGH RIVER BASIN, PENNSYLVANIA

McCarron, Edward F.; Keighton, Walter B.


Journal Announcement: SWRA306

The Lehigh River is 300 miles long. It is the second largest tributary to the Delaware River. It drains 1,364 sq mi in 4 physiographic provinces. The Lehigh River Basin includes mountainous and forested areas, broad agricultural valleys and tilled farm lands, and urban and industrial development. In the headwaters, the water is of good quality and has low dissolved solids. Downstream, some tributaries receive coal-mine drainage and other drain areas undercut by limestone and acquire alkaline characteristics. The alkaline streams neutralize and dilute the acid mine water where they mix. The dissolved oxygen content of river water, which is high in the upper reaches of the stream, is reduced in the lower reaches because of lower turbulence, higher temperature, and the respiration of organisms. Most of the river water requires only moderate treatment for industrial use and public distribution throughout the Lehigh River valley. At times, however, some segments of the main river and its tributaries transport industrial wastes and acid coal-mine drainage. Since May 1966 an instrument installed by the U.S. Geological Survey at Easton, PA, has conductance, temperature, and dissolved oxygen content. Streamflow and water quality data are tabulated. (Knap-USGS)

SUMMARY GROUND-WATER RESOURCES OF CLARION COUNTY, PENNSYLVANIA

Newport, T. G.


The geologic units in Clarion County, Pa., include the unconsolidated Quaternary deposits; the Pennsylvania Llewellyn and Rotville formations; the Mississippian Mauch Chunk and Pocono groups; and the Cambrian Loyalhanna limestone and marine beds, and Hamilton Group. Ground water occurs largely in the secondary openings and solution channels in the Pennsylvanian rocks. In the alluvial deposits along the Susquehanna River, yields of over 1,000 gpm have been reported from wells. The Llewellyn formation marine beds and Hamilton Group are the poorest of the bedrock aquifers, well yields range from less than 1 to 1,000 gpm. In the other bedrock aquifers, well yields range from 2 to 325 gpm, and most wells produce soft water of good quality. Coal-mine waste collected outside of the mined areas were of acceptable quality. Ground water in the vicinity of the coal mines is generally high in iron and sulfate. There is no known overraft of ground water anywhere in the county, except in the vicinity of active mines, where the table water is being lowered to facilitate mining. The locations of sources of pollution are assuming sanitary landfills and septic tanks to be a major factor. The results of the selection of well sites for discharge from abandoned strip and deep mines is a major source of...
SUMMARY GROUND-WATER RESOURCES OF WASHINGTON COUNTY, PENNSYLVANIA
Journal Announcement: SWAP029.
GROUND-WATER IS AVAILABLE IN WASHINGTON COUNTY, PENNSYLVANIA, FROM ROCKS OF THE PENNSYLVANIAN MONONGAHELA AND CONEMAUGH GROUPS, THE PERMIAN-PENNNSYLVANIAN WASHINGTON FORMATION, THE PENNSYLVANIAN MONONGAHELA AND THE PENNSYLVANIAN POCONO GROUP TO THE ALLUVIUM. THE PENNSYLVANIAN MONONGAHELA AND CONEMAUGH GROUPS ARE WELLS THAT WERE ABANDONED BUT NOT PROPERLY PLUGGED.

SUMMARY GROUND-WATER RESOURCES OF WESTMORELAND COUNTY, PENNSYLVANIA
Journal Announcement: SWAP074.
GROUND-WATER IS AVAILABLE IN WESTMORELAND COUNTY, PENNSYLVANIA, FROM ROCKS RANGING IN AGE FROM THE MISSISSIPPIAN POcono GROUP TO QUATERNARY ALLUVIUM. THE ALLUVIUM OVERLIES BEDROCK IN THE MAJOR STREAM VALLEYS IN THE COUNTY, THE YIELDS OF WELLS IS DRAINED FROM 15 TO 85 FEET IN THE ALLUVIUM RANGE FROM 15 TO 700 GPM AND AVERAGE 250 GPM. OF THE CONSOLIDATED AQUIFERS, THE PENNSYLVANIAN CONEMAUGH AND ALLEGHENY GROUPS OBTAINED YIELDS OF SMALL TO MODERATE SUPPLIES OF WATER. THE POTTSVILLE GROUP HAS YIELDS OF 20 TO 500 GPM, DEPENDING ON WHETHER THE WELLS PENETRATE THE FULL THICKNESS OF THE SANDSTONE. THE MISSISSIPPIAN POCONO GROUP IS DEEPLY BURIED THROUGHOUT MOST OF THE COUNTY, BUT IN ITS OUTCROP AREAS THERE ARE MANY HILLSIDE SPRINGS WHICH YIELD 5 TO 100 GPM. MANY SAMPLES ARE HIGH IN IRON CONTENT. IN THE WESTERN PART OF THE COUNTY, SALTWATER IS A PROBLEM IN A WELL DEEPER THAN 50 TO 100 FEET. THE AMOUNT OF GROUNDWATER USED FOR MOST PURPOSES HAS PROBABLY DECREASED DUE TO IMPROVED PLANT DESIGN AND TO THE USE OF MORE EFFICIENT MANUFACTURING TECHNIQUES. SINCE THERE IS RELATIVELY LITTLE USE OF GROUNDWATER IN THE COUNTY, THERE IS NO KNOWN OVERDRAFT. THE GREATEST WATER PROBLEM IN THE COUNTY IS THE CONTAMINATION OF WATER RESOURCES BY DRAINAGE FROM COAL-MINING OPERATIONS. OTHER SOURCES OF POLLUTION ARE THE NUMEROUS OIL AND GAS WELLS THAT WERE ABANDONED BUT NOT PROPERLY PLUGGED.

SUMMARY GROUND-WATER RESOURCES OF ARMSTRONG COUNTY, PENNSYLVANIA
GROUND-WATER IS AVAILABLE IN ARMSTRONG COUNTY, PENNSYLVANIA, FROM ROCKS RANGING IN AGE FROM THE CAMPBELLIAN-POCONO GROUP TO THE TERTIARY ALLUVIUM. THE ALLUVIUM OVERLIES BEDROCK IN THE MAJOR STREAM VALLEYS IN THE COUNTY, THE YIELDS OF WELLS IS DRAINED FROM 15 TO 85 FEET IN THE ALLUVIUM RANGE FROM 15 TO 700 GPM AND AVERAGE 250 GPM. OF THE CONSOLIDATED AQUIFERS, THE PENNSYLVANIAN CONEMAUGH AND CONEAPUAH GROUPS OBTAINED YIELDS OF SMALL TO MODERATE SUPPLIES OF WATER. THE POTTSVILLE GROUP HAS YIELDS OF 20 TO 500 GPM, DEPENDING ON WHETHER THE WELLS PENETRATE THE FULL THICKNESS OF THE SANDSTONE. THE MISSISSIPPIAN POCONO GROUP IS DEEPLY BURIED THROUGHOUT MOST OF THE COUNTY, BUT IN ITS OUTCROP AREAS THERE ARE MANY HILLSIDE SPRINGS WHICH YIELD 5 TO 100 GPM. MANY SAMPLES ARE HIGH IN IRON CONTENT. IN THE WESTERN PART OF THE COUNTY, SALTWATER IS A PROBLEM IN A WELL DEEPER THAN 50 TO 100 FEET. THE AMOUNT OF GROUNDWATER USED FOR MOST PURPOSES HAS PROBABLY DECREASED DUE TO IMPROVED PLANT DESIGN AND TO THE USE OF MORE EFFICIENT MANUFACTURING TECHNIQUES. SINCE THERE IS RELATIVELY LITTLE USE OF GROUNDWATER IN THE COUNTY, THERE IS NO KNOWN OVERDRAFT. THE GREATEST WATER PROBLEM IN THE COUNTY IS THE CONTAMINATION OF WATER RESOURCES BY DRAINAGE FROM COAL-MINING OPERATIONS. OTHER SOURCES OF POLLUTION ARE THE NUMEROUS OIL AND GAS WELLS THAT WERE ABANDONED BUT NOT PROPERLY PLUGGED.

Journal Announcement: SWRA 724

Groundwater occurs in Armstrong County, Pennsylvania in unconsolidated deposits along the stream valleys, especially the Allegheny River, and in fractures in the bedrock. Yields of wells in the unconsolidated deposits average about 400 GPM and yields as high as 1,100 GPM have been reported. Calculated bedrock hydrologic yield is considerably less than those in the unconsolidated material. The average yield of wells in the bedrock is about 25 GPM, although some wells yield less than 1 GPM and some as much as 150 GPM. The water is generally hard and high in calcium, magnesium, sulfate, and iron. Water from deeply buried rocks is also high in chloride. There is no known overdraft of groundwater, but overdraft is possible in the future. The locations of sources of pollution, such as sanitary landfills and septic tanks, are a major factor in the selection of well sites. The chief water problem is contamination from coal-mining operations and other sources of contamination are the hundreds of oil and gas wells that were abandoned but not properly plugged. The casings have been removed or are severely corroded, allowing saltwater to rise in the boreholes and contaminate shallow freshwater aquifers. (Knapp-USGS)

Courier Announcement:

Journal Announcement: SWRA 724

Groundwater is available in Butler County, Pennsylvania from rocks of the Mississippian Pocono Group, the Pennsylvania Conemaugh, Allegheny, and Pottsville Groups. Water is generally hard and high in calcium, magnesium, sulfate, and iron. Water from deeply buried rocks is also high in chloride. There is no known overdraft of groundwater, but overdraft is possible in the future. The locations of sources of pollution, such as sanitary landfills and septic tanks, are a major factor in the selection of well sites. The chief water problem is contamination from coal-mining operations and other sources of contamination are the hundreds of oil and gas wells that were abandoned but not properly plugged. The casings have been removed or are severely corroded, allowing saltwater to rise in the boreholes and contaminate shallow freshwater aquifers. (Knapp-USGS)

SUMMARY GROUNDWATER RESOURCES OF BUTLER COUNTY, PENNSYLVANIA

POTH, C. W.

GEOLOGICAL SURVEY, HARRISBURG, PA.


Journal Announcement: SWRA 724

Groundwater is available in Butler County, Pennsylvania from rocks of the Mississippian Pocono Group, the Pennsylvania Conemaugh, Allegheny, and Pottsville Groups. Water is generally hard and high in calcium, magnesium, sulfate, and iron. Water from deeply buried rocks is also high in chloride. There is no known overdraft of groundwater, but overdraft is possible in the future. The locations of sources of pollution, such as sanitary landfills and septic tanks, are a major factor in the selection of well sites. The chief water problem is contamination from coal-mining operations and other sources of contamination are the hundreds of oil and gas wells that were abandoned but not properly plugged. The casings have been removed or are severely corroded, allowing saltwater to rise in the boreholes and contaminate shallow freshwater aquifers. (Knapp-USGS)

Effects of Strip Mining the Abandoned Deep Anna S Mine on the Hydrology of Yuba Creek, Tioga County, Pennsylvania

Reddy, L. A.


Available from the National Technical Information Service, Springfield, Va. Publication 72151 as PWH-72-12157, 45 p. 4 fig., 1 plate, 7 tabs. 27 ref.

Journal Announcement: SWRA 724

Daylighting at strip-mining of coal seams previously deep mined operations are being conducted on the Anna S Mine, that underlies about 850 acres that are drained by three major discharges. The number of shafts, drains, and underground areas were 125 and 2. At least 15 acres (15%) had been 850 acres. In addition, 110 acres in the drift basin, about 15 acres (15%) in the Anna S main entry, and about 30 acres (30%) at the Anna S main entry basin.
of the Mitchell 2 discharge changed the most, from 176 milligrams per liter (as CaCO₃) in 1975-76 to 1,190 in 1978-79, an increase of 580%. The acidity of the Hunter Drift discharge increased from 348 milligrams per liter during 1975-76 to 710 milligrams per liter during 1978-79, an increase of 100%. The acidity of Anna S 1 increased about 45%. (USGS)

WATER RESOURCES INVESTIGATIONS IN THE UPPER OHIO RIVER BASIN
ROSSOUW, C. J. J.; COLL, M. D., JR. GEOLOGICAL SURVEY, HARRISBURG, PA.
PENNSYLVANIA DEPARTMENT OF FORESTS AND WATERS TECHNICAL BULLETIN NO. 1, 1970, 1 SHEET, 2 TAB, 1 MAP., Journal Announcement: SWRA402

ACTIVE AREAL PROJECTS IN THE UPPER OHIO RIVER BASIN OPERATED BY THE U.S. GEOLOGICAL SURVEY (WGRL) LARGELY IN COOPERATION WITH OTHER AGENCIES ARE SHOWN ON THESE HYDROLOGIC ATLAS AS FOLLOWS: (A) GROUND-WATER RESOURCES, ALLEGHENY RIVER BASIN AND PART OF THE LAKE ERIE BASIN, NEW YORK; (B) SURFACE-WATER RESOURCES OF THE ALLEGHENY RIVER BASIN AND PART OF THE LAKE ERIE BASIN, NEW YORK; (C) CHEMICAL QUALITY OF STREAMS, ALLEGHENY RIVER BASIN, NEW YORK; (D) GEOLOGY AND GROUND-WATER RESOURCES OF WESTERN CRANFORD COUNTY; (E) GEOLOGY AND GROUND-WATER RESOURCES OF THE SHENANGO AND STONEBORO QUADRANGLES; (F) INVESTIGATION OF PRINCIPAL AQUIFERS IN NORTHEASTERN OHIO; AND (G) ROARING CREEK-GRASSY RUN ACID MINE DRAINAGE INVESTIGATIONS. AREA CONTAINING DATA ON WATER IN THE OHIO RIVER BASIN AND 45 SELECTED REFERENCES ON HYDROLOGY. (WOODARD-USGS)

Hydrology of Area 4, Eastern Coal Province, Pennsylvania, Ohio, and Western Virginia
62 p. 41 Ref., 5 Append., Journal Announcement: SWRA1511

Area 4 (one of the 24 hydrologic areas defining the Eastern Coal Province) is located at the northern end of the Eastern Coal Province in eastern Ohio, northern West Virginia, and western Pennsylvania. It is part of the upper Ohio River basin which includes the Allegheny, Mahoning, and Shenandoah Rivers. The area is underlain by rocks of the Pottsville, Allegheny, Conemaugh, Monongahela Groups (or formations) and Dunkard Group. Area 4 has a temperate climate with an annual average rainfall of 38 to 42 inches, most of its area is covered by forest. The soils have a high erosion potential where the vegetation cover is removed. In response to Public Law 95-87, 132 sites were added to the existing surface-water data-collection network in area 4. At these added sites, collected data includes discharge, water quality, sediment, and biology. The data are available from computer storage through the National Water Data Exchange (NAWDEX) or the

published annual Water Resources Data reports for Ohio, Pennsylvania, and West Virginia. Hydrologic problems related to mining areas: (1) Erosion and increased sedimentation and (2) degradation of water quality. Erosion and sedimentation are associated chiefly with surface mining. Sediment yields increase drastically when vegetation is removed from the highly erosive soils. Degradation of water quality can be caused by acid-mine drainage from underground and surface mining. More than half the acid-mine drainage effluent in area 4 comes from underground mines. The rest comes from abandoned surface mines. Usually in reclaimed surface mines the overburden is replaced in such a short time after the coal is taken out that oxidation of acid-forming minerals, commonly pyrite or marcasite, is not complete or is neutralized by the buffering action of calcareous minerals in the soils. (USGS)

Geology and Groundwater Resources of Western Crawford County, Pennsylvania

This report provides the necessary information on ground water (well water) to estimate with reasonable accuracy the casing requirements, potential yields, and quality of water yielded by wells drilled in western Crawford County, Pa. It should also help to understand why some wells are better than others nearby, even though they have the same depth. The report can be used by well drillers, landowners, and homeowners to help choose sites for maximum yield. The text contains a description of the aquifers (water-yielding rocks), data on well yields and yields of water, information on the quality of the ground water, and is accompanied by geologic maps and a well location map. (WOODARD-USGS)

Geology and Ground-Water Resources of Northern Mercer County, Pennsylvania

The Shenango and Stoneboro 15-minute quadrangles are about 50 miles north of Pittsburgh, Pa. These two quadrangles comprise the following 7.5 minute quadrangles: Greenville west, Greenville East, Sharpsville, Fredonia, Hadley, New Lebanon, Jackson Center, and Sandy Lake. The land surface of the area is a maturely dissected plateau covered almost entirely by glacial deposits of the Kentsville stage. The glacial deposits range in thickness from 50 to as much as 400 feet. The
Bedrock is mapped in detail and consists of rocks of Devonian, Mississippian, and Pennsylvanian age. The rocks of Devonian age are not exposed in the area but are present beneath the glacial deposits in deep bedrock valleys. The Mississippian rocks are found along valley sides and some valley bottoms, and the Pennsylvanian rocks generally underlie the uplands. Maximum yields of bedrock wells seldom exceed 100 gpm (gallons per minute) but a yield of 300 gpm is reported from a well in the lower member of the Shenango Formation. Potable water can be obtained everywhere in the area.

**AN APPRAISAL OF THE GROUND-WATER RESOURCES OF THE UPPER SUSQUEHANNA RIVER BASIN IN PENNSYLVANIA**


Journal Announcement: SWRA0209

The availability, quantity, quality, variability, and cost of development of the groundwater resources in the Upper Susquehanna River Basin in Pennsylvania are described and appraised by geological formations and by areas of the state. Water moves from the ground into most of the streams of the area with a consequent large effect on surface water quantity and quality. In most of the area, development of groundwater supplies is far below the potential maximum development. Tables show estimated specific capacities and yields, well designs, and costs of hypothetical wells in the geologic units of the area. Water chemical analyses from wells in all the geologic units are also tabulated. (Knapp-USGS)

Bituminous coal fields of Pennsylvania. Part II


Quality of Surface Water in the Coal-Mining Areas of Western Maryland and Adjacent Areas of Pennsylvania and West Virginia from April 1979 to June 1980. (duplicated see Maryland.)


Journal Announcement: SWRA1510

Water Resources of Greene County, Pennsylvania-Appalachian Coal Basin.


Journal Announcement: SWRA1423

Acid mine drainage entering the Tioga River above Blossburg, Pa., degrades water quality for most of its length by increasing levels of sulfate, trace elements and specific...
Conductance, and decreasing alkalinity and pH. Mill creek near Tioga and Crooked Creek are alkaline tributaries that help to neutralize acid-mine drainage in the Tioga River Basin. The Cowanesque River is also alkaline, but slightly affected by industrial effluents near Westfield, and has high chloride levels. Suspended sediment levels in the basin are generally low, but high enough to support biological activity. Field measurements indicate that mine drainage has repressed biological activity in the Tioga River. Most of the phytoplankton samples have low diversity indices. Concentrations of many of the water-quality parameter were related to discharge using mean regression techniques. Annual suspended-sediment yields averaged 575 tons per square mile above the downstream limit of the study. Mill creek near Tioga and the Cowanesque River upstream from Nelson were the lowest contributors of suspended sediment (USGS).


Journal Announcement: SWA1006

The impoundments have been proposed for the Tioga study area in Pennsylvania and New York. Two of the reservoirs, Tioga and Hammond lakes, are presently under construction and will be completed in 1977. Cowanesque Lake in the planning stages and will be started in the near future. The Tioga River and its major tributaries were sampled monthly from September 1973 to March 1975. Water quality in the Tioga River is degraded by acid-drainage entering the stream near Blossburg, from both strip- and deep-mined areas. The stream supports few species of aquatic life from Blossburg to its confluence with Crooked Creek, whereas water of tributaries Mill Creek, Crooked Creek, and the Cowanesque River counteract the acidity carried downstream from Blossburg, and the water quality of the Tioga River is gradually improving, supporting a more diversified population of fish and aquatic life. All of the streams in the Tioga River basin carry nutrients sufficient for algae blooms. Dissolved solids range from very high to moderately high throughout the basin. The Tioga River has high concentrations of sulfates and heavy metals, particularly iron and manganese. Dissolved oxygen was usually above 80 percent saturation and never dropped below 7.6 milligrams per liter throughout the basin. Relationships between selected water-quality parameters have been developed for the sampling stations throughout the basin. Downstream trends were also examined. (Wardard-USGS)


PREIMPOUNDMENT WATER QUALITY OF RAYSTOWN BRANCH JUNIATA RIVER AND SIX TRIBUTARY STREAMS, SOUTH-CENTRAL PENNSYLVANIA Williams, D. R.

GEOL O GICAL SURVEY, HARRISBURG, PA.

Available from the National Technical Information Service, Springfield, Va. as ADA-4027-387, $4.00 in paper copy, 53.00 in microfiche. Water-Resources Investigations 76-57, July 1976, 23 P, 5 figs, 5 tabs, 5 ref.

Journal Announcement: SWA1024

The Raystown Branch Juniata River watershed, which is the main water source for Raystown Lake, is a 600-square-mile drainage basin in collected on the Raystown branch and six tributary streams in the basin. Specific conductance values varied inversely with water discharge. The pH values were extremely low only at the Shoup Run site. Dissolved oxygen concentrations observed at all sites indicated a relatively high oxygen saturation level throughout the year. Seasonal variations in nitrate-N and orthophosphate-P levels were measured at the main inflow station, Saxton, Pa. The highest concentrations of nitrate-N and orthophosphate-P occurred in the winter and spring months and the lowest concentrations were measured during the summer and fall. Wateriological data indicated the presence of excessive infows. Soil samples collected at four sites in the impoundment area were predominantly of the Barbour, Philo, and Bashe series. Nutrients are considered to be highly mobile in soils with silt loam and sandy-loam textures. Morphological features of the lake basin and low nutrient levels at the inflows should prevent excessive weed growth around the lake perimeter. (Woodard-USGS)

APPRAISAL OF STREAM SEDIMENTATION IN THE SUSQUEHANNA RIVER BASIN Williams, K., F. J. Reed, L. A.

GEOL O GICAL SURVEY, WASHINGTON, D.C.


Journal Announcement: SWA1512

The Susquehanna River transports about 3.0 million tons of sediment annually (110 tons per square mile), only about 1.6 million tons of sediment enters the head of Chesapeake Bay annually because some sediment is trapped behind the power dams on the lower Susquehanna. Measured annual sediment yields from subbasins in Susquehanna range from 40 to 640 tons per square mile. The highest yields are from parts of the glaciated

(WOODARD-USGS)

Summary Groundwater Resources of Centre County, Pennsylvania

Woods, C. R.


Journal Announcement: SWRA412

The northwest third of Centre County, PA, lies in the Appalachian Plateaus physiographic province. The principal aquifers are the Allegheny Group, Pottsville Group, and Warren Sandstone. The average yield of Allegheny and Pottsville Groups is commonly high in iron. The southeast two-thirds of the county lies in the Appalachian Mountain section of the Valley and Ridge physiographic province. The average yield of nondomestic from the Old Port, Keyser, Tonoloway, Wells Creek, Nittany, and Gatesburg Formations. The water occurs in fractures, solution-enlarged in carbonate rocks. Thus, the noncarbonate rocks are susceptible to overpumping, and the carbonate-rock aquifers are easily contaminated. At least 10 springs have generally have much higher yields than those of other yields. Wells in valleys generally have higher yields than those on hillsides and hilltops. (USGS)

WATER RESOURCES OF LEHIGH COUNTY, PENNSYLVANIA

Wood, C. R.; Flippo, H. N. Jr.; Leskinsky, J. B.; Barker, J. L.

Geological Survey, Harrisburg, PA.


Journal Announcement: SWRA715


GREATER PITTSBURGH REGIONAL STUDIES, REPORTS AND MAPS, APRIL 1976

GEOLGICAL SURVEY, RESTON, VA.

GEOLGICAL SURVEY CATALOG, 1976, 14 P.

Journal Announcement: SWAR76


Sediment load of streams in the region, J. D. Schneider, W. J., and others; Water resources of the Appalachian region, J. D. Schneider, W. J., and others, Water resources of the Appalachian region, Alabama Work, J. W., 1965


303


Available from the National Technical Information Service, Springfield, VA 22151.

Water resources data for Pennsylvania consist of records of discharge and water quality of streams, contents of lakes and reservoirs, and water levels of ground-water wells. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements.


Journal Announcement: SWRA1511

A requirement of Public Law 95-87, the Surface Mining Control and Reclamation Act of 1977, is the understanding of the hydrology in actual and proposed surface-mined areas. Surface-water data for small specific-sites and for larger areas such as adjacent and general areas are needed also to satisfy the hydrologic requirements of the Act. The Act specifies that surface-water modeling techniques may be used to generate the data and information. The purpose of this report is to describe how this can be achieved for smaller watersheds. This report also characterizes 12 'state-of-the-art' strip-mining assessment models that are to be tested with data from the large-extensive studies involving small watersheds in watersheds with specific-site data. Extending the use of modeling techniques to larger watersheds remains relatively untested, and to date the upper limits for application have not been established. The U.S. Geological Survey is currently collecting regional hydrologic data in the major coal provinces of the United States and this data will be used to help satisfy the 'general-area' data requirements of the Act. This program is reviewed and described in this report. (USGS)

Hydrology of Area 20, Eastern Coal Province, Tennessee, Georgia, and Alabama.

Hollyday, E. F., and others, 1982
U.S. Geological Survey Water-Resources Investigations 82-440

Improving estimates of streamflow characteristics in the Cumberland Plateau of Tennessee by using digital land-cover data

from the Landsat satellite

Hollyday, E. F., and Hansen, C. R.
U.S. Geological Survey Open-File Report 82-622

The primary objective is to improve upon the regression equations used to estimate streamflow in areas affected by coal mining in the Cumberland Plateau by using land-cover information derived from digitally processed Landsat data as well as maps. The digital data will update the land-cover data base for the New River basin project "Hydrologic Effects of Coal Mining."

The usefulness of the digital land-cover data base developed from Landsat tapes and available map data will be tested by an experiment designed to compare two sets of regression equations—one containing the most up-to-date but routinely-derived basin characteristics derived from Landsat tapes.


Hollyday, E. F., Sauer, S. P.
Geological Survey, Nashville, Tenn. Water Resources Div., Water-Resources Investigations 76-106 (open-file report), September 1976. 14 p. 13 fig. 1 tab. 3 ref. 30 Ref. 3

Journal Announcement: SWRA1006

Land-cover information is needed to select subbasins within the New River basin, Tennessee, for the study of hydrologic processes and is also needed to transfer study results to other sites affected by coal mining. This study demonstrates that the digital processing of Landsat tapes can produce maps and tables of the areal extent of selected land-cover categories. The relative area of each category within the basin is agriculture, 5 percent; evergreens, 7 percent; bare earth, 10 percent; three categories of hardwoods, 81 percent; and water, rock, and unclassified areas, each less than 1 percent. (Woodard-USGS)

Hydrology of area 16, eastern coal province, Virginia, Tennessee

Hufschmidt, P. W., and others, 1981
U.S. Geological Survey Open-File Report 81-204. (Duplicated see Virginia)

Hydrology of Area 18, Eastern Coal Province, Tennessee

May, V. J.

Journal Announcement: SWRA1511
The Eastern Coal Province is divided into 24 hydrologic reporting areas. This report describes the hydrology of area 18 which is located in the Cumberland River basin in central Tennessee near the southern end of the Province. Hydrologic information and sources presented as text, tables, maps, and other illustrations designed be useful to mine owners and consulting engineers in implementing permit applications that comply with the environmental requirements of the Surface Mining Control and Reclamation Act of 1977. Area 18 encompasses parts of three physiographic regions: from east to west the Cumberland Plateau, Highland Rim, and Central basin. The Plateau is underlain by sandstones and shales, with thin interbedded coal beds of Pennsylvanian age. The Highland Rim and Central Basin are underlain by limestone and dolomite of Mississippian age. Field and laboratory analyses of chemical and physical water-quality parameters of streamflow samples show widespread problems. Some streams, however, in the heavily mined areas have concentrations of sulfate, iron, manganese, and sediment above natural levels, and pH values below natural levels. Mine seepage and direct mine drainage were not sampled. Ground water occurs in and moves through fractures in the sandstones and shales and solution openings in the limestones and dolomites. Depth to water is variable, ranging from about 5 to 70 feet below land surface in the limestones and dolomites and 15 to 40 feet in the coal-bearing rocks. The quality of ground water is generally good, locally in coal-bearing rocks, acidic water and high concentrations of manganese, chloride, and iron have been detected. (USGS)

The Quality of Water Discharging from the New River and Clinch Fork Basins, Tennessee


Water discharging from the heavily mined New River basin is characterized by neutral pH, low dissolved solids (less than 300 milligrams per liter), and high concentrations of suspended sediment. Approximately 590,000 tons of suspended sediment were discharged from the New River basin in 1977, as compared to an estimated 20,000 tons from the relatively unmined Clinch Fork basin. More than 90 percent of the suspended sediment is silt and clay. In association with these fine-grained suspended sediments are sorbed trace metals. In 1977 the New River basin discharged an estimated 17,000 tons of suspended iron while Clinch Fork only discharged an estimated 600 tons.

Suspended-sediment concentration was found to be highly correlated with both suspended and total trace-metal concentrations. This correlation coupled with the nearly neutral pH of water indicates that trace metals are transported primarily in the suspended phase. The most promising indicator of the presence of coal mining was found to be dissolved sulfate. All unmined basins sampled in this study showed dissolved-sulfate concentrations less than 20 milligrams per liter, whereas all mined basins had dissolved-sulfate concentrations in excess of 20 milligrams per liter regardless of basin size or discharge. (USGS)

Appraisal of Hydrologic Information Needed in Anticipation of Lignite Mining in Lauderdale County, Tennessee


Available from the National Technical Information Service, Springfield, VA 22161 as PB-1-239428, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-54, August 1981, 67 px 16 Fig, 8 Tab, 48 Ref., Journal Announcement: SWRA1424

Lignite in western Tennessee occurs as lenses or beds at various stratigraphic horizons in the Coastal Plain sediments of Late Cretaceous and Tertiary age. The occurrence of this lignite has been known for many decades, but not until the energy crisis was it considered an important energy resource. In recent years, several energy companies have conducted extensive exploration programs in western Tennessee and tremendous reserves of lignite have been found. Lauderdale County was selected as one of the counties where strip-mining of lignite will most likely occur. Lignite in this county occurs in the Jackson and Cockfield Formations, undivided, of Tertiary age. The hydrology of the county is known only from regional studies and the collection of some site-specific data. Therefore, in anticipation of the future mining of lignite, a plan is needed for obtaining hydrologic and geologic information to adequately define the hydrologic system before mining begins and to monitor the effects of strip-mining once it is begun. For this planning effort, available hydrologic and geologic data, land use, and associated data were located and compiled. A summary description of the surface and shallow subsurface hydrologic system was prepared; the need for additional baseline hydrologic information was outlined; and plans to monitor the effects of strip-mining were proposed. (USGS)

Benthic populations of thirty-three stream locations draining coal reserves of Tennessee: Tennessee Technological University, Cookeville

Pennington, W., 1980

309

310
Ground water resources in the Cumberland River basin, Kentucky-Tennessee
Rima, D. R., and Vult, D. S., 1980

Hydrology of Area 4, Eastern Coal province, Pennsylvania, Ohio, and West Virginia
Roth, K. V., Engleke, M. J., Jr., and others, 1981

The Cumberland Plateau overthrust and geology of the Crab Orchard Mountains area, Tennessee
Stearns, R. G., 1954
Tennessee Division of Geology Bulletin 60, 47 p.

Water Resources of the Appalachian Region, Pennsylvania to Alabama
Marks, J. W., 1965
In Schneider, W. J., and others
milligrams per liter of dissolved solids, which is shown on the sections, serves as an index of water availability of this quality. (Woodard-USGS)


**SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--TEXAS-GULF REGION**

BAKER, E. T. JR; WALL, J. M.

GEOLOGICAL SURVEY, AUSTIN, TEXAS

AVAILABLE FROM SUPERINTENDENT OF DOCUMENTS, GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C., 20402, $2.45 IN PAPER COPY. PROFESSIONAL PAPER 813-F, 1976, 29 P, 5 FIG, 9 TAB, 29 REF., 100 REF.,

Journal Announcement: SWRA0415

GROUNDWATER IN THE TEXAS-GULF REGION IS A LARGE AND IMPORTANT RESOURCE THAT CAN PROVIDE A MORE SIGNIFICANT PERCENTAGE OF THE TOTAL WATER SUPPLY OF THE REGION. TOTAL WATER REQUIREMENTS WITHIN THE REGION ARE PROJECTED TO RISE SHARPLY FROM 14 MILLION ACRE-FT (17 CUBIC KILOMETERS) IN 1970 TO NEARLY 26 MILLION ACRE-FT (32 CUBIC KILOMETERS) IN 2020. ABOUT HALF OF THE WATER USED IN 1970 WAS GROUNDWATER. AN ESTIMATED TOTAL OF 1.04 BILLION ACRE-FT (1,280 CUBIC KILOMETERS) OF RECOVERABLE WATER CONTAINERS LITTLE THAN 25 FEET IN DEPTH TO 31 FEET OF WATER STORAGE. A SIGNIFICANT AMOUNT IS AVAILABLE SHOULD OCCASIONS PROMPT ITS USE ON A TIME-LIMITED BASIS. (WOODARD-USGS)


Stratigraphic and Hydrogeologic Framework of the Coastal Plain of Texas

Baker, E. T. JR

GEOLOGICAL SURVEY, AUSTIN, TEXAS

Open-file report 77-712, March 1978, 32 p, 15 FIG, 1 TAB, 34 REF.,

Journal Announcement: SWRA1120

The subsurface delineation of hydrogeologic units of Miocene and younger age and stratigraphic units of Paleocene to Holocene age establishes and interrelationship of these units statewide across much of the Coastal Plain of Texas. The 11 dip direction and 1 strike section, which extend from the land surface to 7,000 feet below sea level, provide continuity of correlation from the outcrop to the relatively deep subsurface. Sand containing water with less than 3,000
GROUNDO-WATER RESOURCES OF WOOD COUNTY, TEXAS

MCDOWELL, R. E.

U.S. GEOLOGICAL SURVEY.

TEXAS WATER DEVELOPMENT BOARD REP 79, 84 p. AUG 1968. 19 fig. 11 tab. 35 ref.

Journal Announcement: SWA0040 SOUTHWESTERN TERRITORY (TEXAS) OCTOBER 1968 SEPTEMBER 1969. 22 p. 6 fig. 3 tab. 26 ref.

GROUND-WATER RESOURCES OF GREGG AND UPSHUR COUNTIES, TEXAS

BROOME, MATTHEW E.

GEOLOGICAL SURVEY. AUSTIN, TEX.

REPORT PUBLISHED AND DISTRIBUTED BY TEXAS WATER DEVELOPMENT BOARD, PO BOX 12386, AUSTIN, TX 78711. TEXAS WATER DEVELOPMENT BOARD REPORT 101, OCT 1969. 76 p. 16 fig. 9 tab. 41 ref.

Journal Announcement: SWA0311 SOUTHWESTERN TERRITORY (TEXAS) OCTOBER 1968 SEPTEMBER 1969. 22 p. 6 fig. 3 tab. 26 ref.

GROUND-WATER RESOURCES OF EAST BASTROP COUNTY, TEXAS

FOLLETT, C. R.

GEOLOGICAL SURVEY. AUSTIN, TEX.

REPORT PUBLISHED AND DISTRIBUTED BY TEXAS WATER DEVELOPMENT BOARD, PO BOX 12386, AUSTIN, TX 78711. TEXAS WATER DEVELOPMENT BOARD REPORT 101, OCT 1969. 76 p. 16 fig. 9 tab. 41 ref.

Journal Announcement: SWA0311 SOUTHWESTERN TERRITORY (TEXAS) OCTOBER 1968 SEPTEMBER 1969. 22 p. 6 fig. 3 tab. 26 ref.

GROUND-WATER RESOURCES OF EAST BASTROP COUNTY, TEXAS

FOLLETT, C. R.

GEOLOGICAL SURVEY. AUSTIN, TEX.

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Journal Announcement: SWA0311 SOUTHWESTERN TERRITORY (TEXAS) OCTOBER 1968 SEPTEMBER 1969. 22 p. 6 fig. 3 tab. 26 ref.
THE PRINCIPAL FORMATIONS IN BASTROP COUNTY, TEXAS, THAT YELOW GROUNDWATER CAPABLE OF YIELDING MODERATE TO LARGE QUANTITIES OF WATER TO WELLS ARE, IN ORDER OF DECREASING YIELDS, THE WILCOX GROUP, CARRIZO SAND, QUEEN CITY SAND, AND SPARTA SAND. THE CARRIZO SAND AND THE UNDERLYING WILCOX GROUP ARE CONNECTED HYDROLOGICALLY AND FUNCTION AS A SINGLE AQUIFER. THE USE OF GROUNDWATER IS GRADUALLY INCREASING, BUT THE TOTAL OF 3.7 MG D OR 4,100 ACRE-FOOT PER YEAR USED IN 1966 IS SMALL COMPARED TO THE QUANTITY AVAILABLE, ABOUT 100 MILLION ACRE-FOOT OF FRESH TO SLIGHTLY SALINE WATER IS IN TRANSIENT STORAGE IN THE PRINCIPAL AQUIFERS, BUT ONLY A FRACTION OF THIS WATER IS ECONOMICALLY RECOVERABLE BY KNOWN METHODS AT PRESENT COSTS. THE YIELDS OF WELLS IN BASTROP COUNTY RANGE FROM A FEW GALLONS A MINUTE TO ABOUT 1,800 GPM. YIELDS OF AT LEAST 2,000 GPM ARE POSSIBLE FROM PROPERLY CONSTRUCTED AND SCREENED WELLS IN THE CARRIZO-WILCOX AQUIFER. THE DISSOLVED-SOLIDS CONTENT OF SELECTED WATER SAMPLES RANGED FROM 67 TO 4,020 IRON IS ONE OF THE COUNTY'S CHIEF WATER-QUALITY PROBLEMS AS 74% OF THE WAS MODERATELY TO VERY HARD TO VERY HARD; ABOUT 80% OF THE SAMPLES EXCEEDED 60.

GROUNDWATER RESOURCES OF BRAZOS AND DURABLES COUNTIES, TEXAS. FOLLOW, C. R. GEOLOGICAL SURVEY, AUSTIN, TEX. TEXAS WATER DEVELOPMENT BOARD REPORT 185, JUNE 1974, 194 P.

THE GEOLOGIC FORMATIONS THAT YIELD LARGE QUANTITIES OF WATER TO WELLS IN BRAZOS AND BURLESOS COUNTIES, TEXAS, ARE THE WILCOX GROUP, CARRIZO SAND, QUEEN CITY SAND, SPARTA SAND, TERRACE DEPOSITS, AND FLOOD-PLAIN ALLUVIUM. THE CARRIZO SAND AND THE UNDERLYING WILCOX GROUP ARE IN HYDRAULIC CONTINUITY AND FUNCTION AS A SINGLE AQUIFER. ABOUT 34 MG D OF GROUNDWATER WAS USED FOR ALL PURPOSES IN 1969, OF THIS AMOUNT, 66% WAS USED FOR IRRIGATION, 32% FOR PUBLIC SUPPLY, AND 2% FOR INDUSTRIAL, RURAL DOMESTIC, AND LIVESTOCK NEEDS. USE OF GROUNDWATER FOR PUBLIC SUPPLY INCREASED FROM A TOTAL OF 1.3 MG D IN 1940 TO 11 MG D IN 1969. LARGE QUANTITIES OF GROUNDWATER ARE AVAILABLE FOR DEVELOPMENT, ABOUT 290 MILLION ACRE-FOOT OF FRESH TO SLIGHTLY SALINE WATER IS IN TRANSIENT STORAGE IN THE PRINCIPAL UPLAND AQUIFERS AND FLOOD-PLAIN ALLUVIUM. ABOUT 220 MILLION ACRE-FOOT IS STORED IN THE CARRIZO-WILCOX AQUIFER. THE TOTAL QUANTITY OF WATER AVAILABLE FROM THE PRINCIPAL AQUIFERS WITHOUT DEPLETED SUPPLY IS ABOUT 64,000 ACRE-FOOT PER YEAR OR ABOUT 75% OF THE CARRIZO-WILCOX AQUIFER. QUEEN CITY SAND, AND SPARTA SAND CONTAIN WATER THAT IS GENERALLY SUITABLE FOR PUBLIC SUPPLY, MANY INDUSTRIAL USES, AND IRRIGATION.

HYDROLOGIC DATA WERE COLLECTED AND processented FOR THE 46.1-SQUARE-MILE GREEN CREEK SMALL-WATERSHED STUDY AREA, (BRAZOS RIVER BASIN, TEXAS) BETWEEN 1955 AND 1966. DURING 1954-56, EIGHT FLOOD WATER-RETARDING STRUCTURES WERE CONSTRUCTED IN THE STUDY AREA. THE RETARDING STRUCTURES PARTLY CONTROL RUNOFF FROM 22.3 SQUARE MILES AND HAVE A COMBINED CAPACITY OF 7,466 ACRE-FEET BELOW THE CHESTS OF THE EMERGENCY SPIELWAYS, OF THE 7,466 ACRE-FEET, 1,147 ACRE-FEET IS ALLOCATED TO SEDIMENTATION. IN THE 10-YEAR PERIOD OF STUDY, 37% OF ALL INFLOW (INCLUDING RAINFALL ON Pools) TO THE EIGHT RESERVOIRS WAS CONSUMED BY EVAPORATION AND EVAPOTRANSPIRATION. FOVOREVER, THIS CONSUMPTION RANGED FROM 17% OF INFLOW IN 1957 TO 94% IN 1959, AND WAS GREATER THAN 50% OF ALL INFLOW IN 5 OF THE 10 YEARS STUDIED. CHEMICAL ANALYSES INDICATE THAT DISSOLVED CONSTITUENTS PROBABLY HAVE LITTLE OR NO EFFECT UPON THE FLOODWATER CHARACTERISTICS IN RELATION TO ACCELERATED SEDIMENTATION. (WODARDO-USGS)

ANNUAL COMPII-ATION AND ANALYSIS OF HYDROLOGIC DATA AND MUKEWATER CREEK, COLORADO RIVER BASIN, TEXAS, 1969

HEJL, H. H. JR

GEOLoGICAL SURVEY, AUSTIN, TEXAS. WATER RESOURCES DIV.

WATER RESOURCES DATA REPORT, 1970, 94 P, 2 FIG, 3 TAB.

Journal Announcement: SWRAUS7


ANNUAL COMPII-ATION AND ANALYIIICS OF HYDROLOGIC DATA FOR DEEP CREEK, COLORADO RIVER BASIN, 1XAS, 1X970

HEJL, H. H. JR

GEOLOGICAL SURVEY, AUSTIN, TEXAS. WATER RESOURCES DIV.

WATER RESOURCES DATA REPORT, 1970, 94 P, 2 FIG, 3 TAB.

Journal Announcement: SWRAUS7

ACCOMPANYING DETERIORATION IN QUALITY, GROUNDWATER IN THE RIO
GRANDE BASIN CAN BE DIVIDED INTO TWO QUALITY TYPES:
FRESHWATER WHICH GENERALLY IS NEAR THE SURFACE, AND THE
MORE DEEPLY BURIED WATER. FRESHWATER IS PRESENT IN INSUFFICIENT
QUANTITIES IN MOST OF THE RIO GRANDE BASIN IN COLORADO AND
NEW MEXICO, AND IN PARTS OF WEST TEXAS, THE GREATEST THICKNESS
OF THE FRESHWATER AQUIFERS IS PRESENT IN THE SAN LUIS
STRUCTURAL BASIN OF COLORADO. THROUGHOUT THIS ENTIRE
BASIN THE WATER TABLE GENERALLY IS LESS THAN 12 FEET BELOW THE LAND
SURFACE. THE MIDDLE BASIN AREA IS CHARACTERIZED BY WELL
LITHIFIED PALEOZOIC ROCKS. LIMESTONE IS THE MAJOR LITHOLOGY.

Most of this area freshwater is present in the thin alluvial deposits of the river valleys; in other aquifers the water ranges in quality from slightly saline to brine. The lower basin region is similar to the middle basins, but the rocks generally are mesozoic in age and the groundwater is less highly mineral. Major aquifers in the region are limestone and

...more text...

Hydrologic Data for North Creek Trinity River Basin, Texas, 1979
Kiddwell, C. C.
Available from OFS- USGS box 25425 Fed. Ctr., Denver, CO
Open-File Report 81-823, August 1981, 38 p, 2 fig, 3 tab.
Journal Announcement: SWRA0910

...more text...

This report contains rainfall and runoff data collected during the 1979 water year for the 21.6-square-mile area above the stream-gaging station North Creek near Jacksboro, Texas. Continuous water-stage recording gage was installed at a representative floodwater-retarding structure (site 28-A) on North Creek near Jacksboro. Texas, during the 1979 water year. The data are collected to compute the contents, surface area, inflow, and outflow at the site, and the stream-gaging station on North Creek near Jacksboro continuously records the water level which, with measurements of streamflow, is used to compute the runoff from the study area. Streamflow records at this gage began on Aug. 8, 1956. Detailed rainfall-runoff computations are included for one storm during the 1979 water year at the stream-gaging station. (USGS)

Hydrologic Data for North Creek Trinity River Basin, Texas, 1975
Kiddwell, C. C.
Open-file report 76-724, April 1977, 50 p, 2 fig, 3 tab.
Journal Announcement: SWRA0123

...more text...

This report contains the rainfall, runoff, and storage data collected during the 1979 water year for the

...more text...

Hydrologic Data for North Creek Trinity River Basin, Texas, 1978
Kiddwell, C. C.
Open-file report 76-724, April 1977, 50 p, 2 fig, 3 tab.
Journal Announcement: SWRA0123

...more text...
Kidwell, C. C.
Geological Survey, Austin, TX, Water Resources Div.
Journal Announcement: SWR1415

This report contains rainfall and runoff data collected during the 1978 water year for the 21.6-square mile area above the stream-gaging station North Creek near Jacksboro, Texas. A continuous water-stage recording gage was installed at one representative floodwater-retarding structure (site 28-A) on Oct. 5, 1972. The data are collected to compute the contents, surface area, inflow and outflow at this site. The stream-gaging station on North Creek near Jacksboro continuously records the water level which, with measurements of streamflow, is used to compute the runoff from the study area. Streamflow records at this gage began on Aug. 8, 1976. Detailed rainfall-runoff computations are included for two storm periods during the 1978 water year at the stream-gaging station. (USGS)

Hydrologic Data for North Creek, Trinity River Basin, Texas, 1976
Kidwell, C. C.
Geological Survey, Austin, TX, Water Resources Div.
Journal Announcement: SWR1216

This report contains rainfall and runoff data collected during the 1976 water year for a 21.6-square mile area above the stream-gaging station on North Creek near Jacksboro, Texas. A continuous water-stage recording gage was installed at one representative floodwater-retarding structure (site 28-A) on Oct. 5, 1972. The data are used to compute the contents, surface area, inflow and outflow at this site. The stream-gaging station on North Creek near Jacksboro continuously records the water level which, with measurements of streamflow, is used to compute the runoff from the study area. Streamflow records at this gage began on Aug. 8, 1976. Detailed rainfall-runoff computations, including hydrographs and mass curves, are included for two storm periods during the 1976 water year at the stream-gaging station. (Woodard-USGS)

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE SULFUR RIVER AND CYPRESS CREEK BASINS, TEXAS
LEIFESTE, DONALD K.
GEOLoGICAL SURVEY, AUSTIN, TEX.
TEX. WATER DEVELOPMENT BOARD REPORT 87, DEC 1968, 32 p., 13 fig., 6 tab, 29 ref.
Journal Announcement: SWR1211

The Sulphur River and Cypress Creek Basins are free of serious water-quality problems. Continued municipal and industrial growth will increase the waste-disposal burdens of the streams, and planned impoundments will cause a reduction in the streamflow which now aids in waste assimilation. As a result of the growth, the basins are developing water resources and the probable changes in water quality will necessitate studies of the resulting problems. The Sulphur River and Cypress Creek basins are adjacent basins in the northeastern corner of Texas. The combined drainage area in Texas is 6,370 sq mi., both basins are completely within the West Gulf Coastal Plain Section of the Coastal Plain Physiographic Province. The climate of the study area is subhumid to humid. The average annual precipitation ranges from 42 in. in the west to 48 in. in the east and averages about 45 in. about one-fourth of the precipitation appears in the streams as runoff. Surface water in the Sulphur River and Cypress Creek Basins is generally of good chemical quality and is suitable for most municipal, industrial and agricultural purposes. The kinds and quantities of minerals dissolved in surface waters of the basins are related principally to the geology of the runoff area and to rainfall and streamflow characteristics, but are also affected by industrial activities. The water in streams is usually low in concentration of dissolved materials. Water from the cretaceous and Tertiary...

A natural runoff from most of the 40,000 sq mi COLORADO RIVER BASIN IS OF GOOD CHEMICAL QUALITY AND SUITABLE FOR MOST USES. MINERAL QUALITY OF THE WATER IS RELATED TO GEOLOGY, RAINFALL, AND STREAMFLOW EXCEPT BELOW LAKE J. B. THOMAS WHERE INFLOW FROM OIL-FIELD BRINES IMPAIR THE QUALITY. MOST OF THE TRIBUTARY INFLOWS HAVE LESS THAN 250 PPM DISSOLVED SOLIDS, BUT WATER IN THE MAIN STEM DOWNSTREAM FROM THE AREA OF SALINE INFLOW IS GENERALLY ABOVE 250 PPM. THE WATER RANGES FROM MODERATELY HARD TO VERY HARD, AND CHLORIDE CONCENTRATIONS RANGE FROM LESS THAN 50 PPM TO SEVERAL THOUSAND PPM. CHLORIDE IS HIGHEST IN THE UPPER REACHES WHERE BRINES REACH THE STREAMS. MAJOR WATER-SUPPLY RESERVOIRS ALL HAVE WATER OF ACCEPTABLE QUALITY FOR MOST USES. THE QUALITY OF WATER THAT WILL BE STORED IN ROBERT LEE RESERVOIR, NOW SALINE WATER. SMALL-SCALE MAPS SHOW THE RANGE IN PRECIPITATION AND RUNOFF; LOCATIONS OF RESERVOIRS, OIL FIELDS, GAGING STATIONS, AND CHEMICAL-QUALITY SAMPLING SITES; AND GEOLOGY. IMPORTANT TABLES GIVE THE SOURCE, SIGNIFICANCE, AND INDUSTRIAL TOLERANCES FOR VARIOUS MINERAL CONSTITUENTS; AN INDEX TO SURFACE-WATER RECORDS; SUMMARY OF CHEMICAL QUALITY ANALYSES AT DAILY STATIONS; AND CHEMICAL ANALYSES OF WATER FROM OTHER STATIONS.

Progress Report on Geology of the Edwards Aquifer, San Antonio Area, Texas, and Preliminary Interpretation of Borehole Geophysical and Laboratory Data on Carbone Rock, Maclay, R. W.; Smelly, T. A.
Journal Announcement: SWA1011
The Edwards aquifer, which is one of the most productive aquifers in the southwestern military installations and 17 communities in South Texas, San Antonio, which has a population of about 750,000, obtains its entire water supply from the Edwards. The primary purpose of this progress report is to describe the geology and porosity of the rocks of the Edwards aquifer in the San Antonio area and to present preliminary interpretations of borehole geophysical and laboratory data. The data were obtained from geophysical and geologic studies of nine cored test holes, from laboratory analyses of samples of aquifer materials, and from recent stratigraphic studies by Rose (1972). The aquifer is areally divided into a fresh-water zone and a saline zone at the "bad-water" line. The bad-water line forms the southern boundary of the fresh-water zone.
and its position is determined by the Rock characteristics and water chemistry. Rainfall-runoff data in the fresh-water one differ markedly from those of the saline zone. The high permeability of the aquifer within the fresh-water zone results from open fractures and selectively dissolved facies. (Woodard-USGS)

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR GREEN CREEK, BRAZOS RIVER BASIN, TEXAS—1969
MASSEY, B. C.
GEOLOGICAL SURVEY, AUSTIN, TEX.
GEOLOGICAL SURVEY DATA REPORT, 1970, 44 P., 2 FIG., 3 TAB., JOURNAL ANNOUNCEMENT: SWRA016

This report, which is the tenth in a series of basic-data reports published annually for the Green Creek study area, contains the rainfall-runoff, and storage data collected during the 1969 water year (Oct. 1968 - Sept. 1969) from the stream-gaging station Green Creek near Alexander, Texas. The locations of the floodwater-retarding structures and hydrologic instruments in the area are shown. The weighted-mean rainfall was 31.07 inches, or 98 percent of the 1931-60 long-term mean annual rainfall of 31.67 inches in Dublin, Texas. The mean daily discharge at the stream-gaging station Green Creek near Alexander was 12.7 CFS compared with the 11-year (1958-69) average of 6.14 CFS. Three storm periods were selected for detailed analysis and computation. These computations include detailed time breakdown of rainfall and discharge, hydrographs, and mass curves. The storms selected occurred on April 12, 1969, and July 27, 1969. A summary of rainfall-runoff data for these storms is tabulated. Computations along the hydrographs and mass curves for the storms are shown in the compilation and analysis of data. (Woodard-USGS)

Application of a Rainfall-Runoff Model in Estimating Flood Peaks for Selected Small Natural Drainage Basins in Texas
Massey, B. C.; Schroeder, L. E.
Green-file report 77-792, December 1977, 23 P., 2 FIG., 4 TAB., 13 REF., JOURNAL ANNOUNCEMENT: SWRA1114

A parametric rainfall-runoff simulation model was used to synthesize long-term records of annual peak discharges for small natural drainage basins in Texas. Optimum model-parameter values were determined for each of the 40 basins studied by using short-term rainfall, evaporation, and discharge data. The calibrated model was used in conjunction with long-term records of rainfall and evaporation to synthesize a record of annual peaks for each site. Because the frequency curve of the simulated peaks had flatter slopes than those of the observed peaks, the synthetic frequency curves were adjusted for the loss of variance inherent in the modeling process. (Woodard-USGS)

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE RIO GRANDE BASIN, TEXAS
MENDIETA, H. F.
GEOLOGICAL SURVEY, AUSTIN, TEX.
TEXAS WATER DEVELOPMENT BOARD REPORT 180, MARCH 1974, 109 P., 10 FIG., 17 TAB., 69 REF., JOURNAL ANNOUNCEMENT: SWRA0716

The kinds and quantities of minerals dissolved in surface waters of the Rio Grande basin are related principally to the geology of the area and return flow from irrigation. During periods when the flow consists principally of seepage from the lowermost deposits and return flow from irrigation, water in the upper reach of the Rio Grande usually is slightly saline and very hard. Water in the upper reach of the Pecos River and most of its tributaries traverses the Tertiary deposits is slightly to moderately saline. Much of the middle reach of the Rio Grande basin is underlain by rocks of Cretaceous age. Water in streams that traverse these deposits usually is fresh and hard. Inflo5m from the Rio Conchos and other tributaries and from springs more than compensates for the saline inflow from the Pecos River and results in a decrease in dissolved constituents in the middle reach of the Rio Grande. Water in the international Falcon Reservoir on the lower Rio Grande is used for municipal supply, industry, and irrigation, return flow from irrigation causes an increase in dissolved constituents downstream from the reservoir. The concentrations of dissolved solids and sulfate in the Rio Grande upstream from the Rio Conchos usually exceed the limits recommended by the U.S. Public Health Service for drinking water. Water in the Pecos River and some of its tributaries is undesirable for domestic or industrial use because the water usually contains excessive concentrations of dissolved solids, sulfate, and chloride. Water in most of the other streams usually is suitable for domestic supply and many industrial uses. The sodium hazard of water in the Rio Grande usually ranges from very low to moderate. That of the Pecos River usually is very high. The salinity hazard of water in the Rio Grande and Pecos River usually is high or very high. (Knapp-USGS)

TRAVEL TIME FOR SOLUTES, UPPER SABINE RIVER BASIN, TEXAS
APRIL 16-30, 1972
MILLS, W. G.
GEOLOGICAL SURVEY, WASHINGTON, D.C.
GEOLOGICAL SURVEY OPEN-FILE REPORT 1972, 2 SHEETS, 2 FIG., 2 TAB., 2 REF., JOURNAL ANNOUNCEMENT: SWRA0610
THE U.S. GEOLOGICAL SURVEY, IN COOPERATION WITH THE SABINE
MINERALIZATION OF QUALITY PROFILES OF LROUND WATER OF IMPORTANCE EVAPORATION AND CHEMICAL ANALYSIS OF PRECIPITATION.

WATER STUDY OF HUBBARD CREEK RESERVOIR (TEXAS)


Journal Announcement: SWRA0197-1

GEOHYDROLOGIC SIGNIFICANCE OF LITHOFACIES OF THE COCKFIELD FORMATION OF LOUISIANA AND MISSISSIPPI AND OF THE YEGUA FORMATION OF TEXAS

PARKER, J. N.
GEOLoGICAL SURVEY, WASHINGTON, D. C.
AVAILABLE FROM SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.
20402 - 56.25 (INCLUDING PLATES IN SEPARATE CASE).
GEOLoGICAL SURVEY PROFESSIONAL PAPER 569-B. 14 P., 2 FIG., 8 PLTS. 1 TAB. 163 REF. (PLATES UNDER SEPAHATE COVER).
Journal Announcement: SWRA013
WATER IN AND NEAR OUTCROPS CONTAINS APPRECIABLE AMOUNTS OF CALCIUM AND MAGNESIUM. DIFFERENCES IN LITHOLOGIC DISTRIBUTION AND OF ALTITUDE OF THE PIEZOMETRIC SURFACES ARE VIVIDLY REFLECTED IN THE REGIONAL DISTRIBUTION OF THE DISSOLVED-SOLIDS CONTENT OF WATERS. (KNAPP-USGS)

GEOHYDROLOGIC SIGNIFICANCE OF LITHOFACIES OF THE CARRIZO SAND OF ARKANSAS, LOUISIANA, AND TEXAS AND THE MERIDIAN SAND OF MISSISSIPPI

PAYNE, J. N.
GEOLICAL SURVEY, BATON ROUGE, LA.
AVAILABLE FROM SJMT OF DOCUMENTS, GPO WASH., D.C., 20402 - PRICE $11.00. GEOLOGICAL SURVEY PROFESSIONAL PAPER 569-D, 1975, 11 P, 2 FIG, 9 PLATES, 1 TAB, 50 REF.
Journal Announcement: SWRA0915

HYDROLOGIC SIGNIFICANCE OF LITHOFACIES OF THE CANE RIVER FORMATION OR EQUIVALENTS OF ARKANSAS, LOUISIANA, AND TEXAS

PAYNE, J. N.
GEOLICAL SURVEY, WASHINGTON, D.C.
AVAILABLE FROM GPO, WASHINGTON, D.C., 20402 - PRICE $10.90. GEOLOGICAL SURVEY PROFESSIONAL PAPER 564-C, 1972, 17 P, 4 FIG, 16 PLATE (BOUND SEPARATELY), 1 TAB, 50 REF.
Journal Announcement: SWRA0518

RECONNAISSANCE OF THE OXYGEN BALANCE AND THE VARIATION OF SELECTED NUTRIENTS IN THE SAN ANTONIO RIVER DURING LOW FLOW
Rawson, J.; Goss, R. L.; Rathbone, I. G.
GEOLOGICAL SURVEY, AUSTIN, TEX.
TOM WATER DEVELOPMENT BOARD REPORT 142, FEBRUARY 1972, 11 P, 2 FIG, 2 TAB, 1 REF.
Journal Announcement: SWRA0518
A WATER-QUALITY RECONNAISSANCE OF THE SAN ANTONIO RIVER IN TEXAS WAS MADE TO OBTAIN THE PROGRESS OF WASTE ASSIMILATION, TO DELINEATE THE CRITICAL RACI OF THE RIVER (THE REACH IN WHICH THE MINIMUM DISSOLVED-OXYGEN CONCENTRATION OCCURS), AND TO DETERMINE THE CONCENTRATIONS OF SELECTED NUTRIENTS IN THE RIVER DURING THE LOW FLOW PERIOD JUNE 16-19, 1969. WATER-QUALITY AND DISCHARGE DATA WERE OBTAINED AT SEVEN SITES IN THE 136.5-MILE REACH OF THE RIVER BETWEEN FARM ROAD 1518 NEAR ELMENDORF AND THE EL MENDORF RANCH, A MEAN DISCHARGE RANGE FROM 128 CFS NEAR ELMENDORF CONSISTED OF TREATED SEWAGE EFFLUENT. THE QUANTITY OF TREATED EFFLUENT RELEASED INTO THE SAN ANTONIO RIVER ABOUT 18 MILES UPSTREAM FROM THE SITE NEAR ELMENDORF RAN FROM 46 TO 156 CFS AND AVERAGED ABOUT 100 CFS. THE TIME-WEIGHTED CONCENTRATION OF DISSOLVED OXYGEN AND THE DISSOLVED-OXYGEN DEFICIENCY DURING THE PERIOD FROM 1200 HOURS ON JUNE 17 TO 1400 HOURS ON JUNE 19 SHOW THAT THE CRITICAL PART OF THE REACH EXTENDED FROM SITE 1 (MILE 205.0) TO SITE 2 (MILE 175.5). THE DISSOLVED-OXYGEN CONTENT OF WATER IN THIS 27.5-MILE REACH EFFECTS OF THE RATE OF RELEASES FROM SAM RAYBURN RESERVOIR ON THE AERATION CAPACITY OF THE ANGELINA RIVER, EASTERN TEXAS
Rawson, J.; Goss, R. L.; Rathbone, I. G.
GEOLOGICAL SURVEY, AUSTIN, TX. WATER RESOURCES DIV.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A094 503, Price codes: AO3 in paper
A three-phase study was conducted during July and August 1970 to determine the effects of varying release rates through the power outlet works at Sam Rayburn Dam on aeration capacity of a 14-mile reach of the Angelina River below Sam Rayburn Dam. The dominant factors that affected the aeration capacity during the study time were time of travel and the dissolved-oxygen deficit of the releases. Aeration was low throughout the study but increased in response to increases in the dissolved-oxygen deficit and the duration of time that the releases were exposed to the atmosphere (time of travel). The average concentration of dissolved oxygen sustained by release of 8,600 cubic feet per second per hour from the outlet at a site near the power outlet to 4.8 milligrams per liter at a site 14 miles downstream; the time of travel averaged about 8 hours. The average concentration of dissolved oxygen in flow sustained by releases of 2,200 cubic feet per second increased from 5.2 to 5.5 milligrams per liter; the time of travel averaged about 20 hours. (USGS)

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE SAN ANTONIO RIVER BASIN, TEXAS

RAWSON, JACk

GEOLoGICAL SURVEY, AUSTIN, TEX.

TEXAS WATER DEVELOPMENT BOARD REPORT 105, JANUARY 1970, 13 P, 4 FIG, 2 TAB, 5 REF., SWRA0516

TEMPERATURE-PROFILE MEASUREMENTS WERE MADE AT 61 CROSS SECTIONS ON 7 MAJOR STREAMS IN TEXAS. NO CROSS-SECTIONAL VARIATIONS OF TEMPERATURE WERE NOTED. DIRECT MEASUREMENTS, ONLY 34 MEASUREMENTS SHOWED A TEMPERATURE DIFFERENCE OF MORE THAN 0.5 DEG C WITHIN A CROSS SECTION; THE MAXIMUM DIFFERENCE EXCEEDED 2 DEG C. THEREFORE, POINT-TEMPERATURE RECORDS REPORTED BY THE U.S. GEOLOGICAL SURVEY IN TEXAS ARE USUALLY REPRESENTATIVE OF THE AVERAGE TEMPERATURE OF WATER WITHIN THE STREAM CROSS SECTION. AIR TEMPERATURE IS A REASONABLE INDEX OF THE TEMPERATURE OF THE MAJOR STREAMS IN THE STATE—PROVIDED THAT TEMPERATURE IS NOT AFFECTED BY SUCH ARTIFICIAL INFLUENCES AS ADDITION OF TREATED WASTES OR PRESENCE OF IMPOUNDMENTS. AT 8 SITES WHERE ARTIFICIAL INFLUENCE WAS NOT SIGNIFICANT, THE MEAN MONTHLY WATER TEMPERATURES, AS COMPUTED FROM ONCE-DAILY OBSERVATIONS, Seldom differed from corresponding mean monthly air temperatures by more than 2 DEG C AND OFTEN LETTER THAN 1 DEG C. THE TEMPERATURES OF TEXAS STREAMS VARY WIDELY FROM MONTH TO MONTH. THE SPREAD BETWEEN OBSERVED MONTHLY MAXIMUM AND MINIMUM TEMPERATURE AVERAGES 3-6 DEG C. (KNAPP-USGS)

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR CALABERAS CREEK, SAN ANTONIO RIVER BASIN, TEXAS, 1970

REDY, D. R.

GEOLoGICAL SURVEY, AUSTIN, TEX. WATER RESOURCES DIV.

GEOLoGICAL SURVEY DATA REPORT, NOVEMBER 1971, 63 P, 2 FIG, 3 TAB, SWRA0510

RAINFALL, RUNOFF, AND STORAGE DATA COLLECTED DURING THE 1970 WATER YEAR ARE PRESENTED FOR THE 77.2-SQUARE-MILE AREA ABOVE THE SANDY-GEORGIA G tilATION STATION, 12 MILES NEAR ELMENDORF. THERE ARE 7 FLOODWATER-RETARDING STRUCTURES IN THE WATERSHED. THESE STRUCTURES HAVE A CAPACITY FOR TEMPORARY STORAGE OF 8,840 ACRE-FOOTS OF FLOOD RUNOFF FROM THE 77.2-SQUARE-MILE STUDY AREA. THE MEAN RAINFALL IN THE STUDY AREA FOR THE 1970 WATER YEAR WAS 29.64 INCHES. THE AVERAGE MONTHLY RAINFALL TOTALS HANDED FROM 0.42 INCH IN JUNE TO 7.74 INCH IN MAY. YEARLY MEAN DISCHARGE AT THE STREAM-GAGING STATION, CALABERAS CREEK NEAR ELMENDORF, WAS 0.59 CFS. THIS IS WITHIN LIMITS RECOMMENDED BY THE U.S. PUBLIC HEALTH SERVICE FOR DOMESTIC USE. THE WATERS ALSO ARE SUITABLE FOR MOST IRRIGATION USES; HOWEVER, THE WATER THROUGHOUT MUCH OF THE BASIN IS MODERATELY HARD OR VERY HARD AND WILL REQUIRE SOFTENING FOR MOST INDUSTRIAL USES. (KNAPP-USGS)
DIFFERENCES IN QUANTITY AND CHEMICAL QUALITY OF LOW FLOW IN CIBOLO CREEK, TEXAS, MARCH 4-8, 1968.

RICE, WILLIAM E.; KUNZE, HARVEY L.

GEOLOGICAL SURVEY, AUSTIN, TEX.

TEXAS WATER DEVELOPMENT BOARD REPORT 112, APRIL 1970, 16 P., 3 FIG, 3 TAB, 4 REF.

Journal Announcement: SWRAUS30

GROUNDWATER RESOURCES OF WASHINGTON COUNTY, TEXAS.

SANDEEN, W. M.

GEOLOGICAL SURVEY, AUSTIN, TEX.

TEXAS WATER DEVELOPMENT BOARD, AUSTIN, REPORT 162, NOVEMBER 1972, 105 P., 21 FIG, 9 TAB, 52 REF.

Journal Announcement: SWRAUS14

LARGE QUANTITIES OF UNDEVELOPED FRESH WATER, EXTENDING TO DEPTHS OF 1,200 FEET BELOW SEA LEVEL OCCUR IN THE CATAHULA SANDSTONE IN THE VICINITY OF THE AQUIFER. IN STREAM-GAGING STATION AT MILE 89.6, DOWNSTREAM TO A POINT 2.5 MILES UPSTREAM FROM THE MOUTH ARE EVAPOTRANSPIRATION WAS AT A MINIMUM, DISCHARGE INCREASED IN A DOWNSTREAM DIRECTION FROM NO FLOW AT ABOUT MILE 88 TO 67.4 CFS AT MILE 2.5. DISSOLVED-SOLIDS CONCENTRATIONS ALSO INCREASED IN A DOWNSTREAM DIRECTION THROUGHOUT THE REACH.

KNOTT, G. W.

GEOLOGICAL SURVEY, AUSTIN, TEX.

TEXAS WATER DEVELOPMENT BOARD REPORT 112, APRIL 1970, 16 P., 3 FIG, 3 TAB, 4 REF.

Journal Announcement: SWRAUS30

LARGE QUANTITIES OF UNDEVELOPED FRESH WATER, EXTENDING TO DEPTHS OF 1,200 FEET BELOW SEA LEVEL OCCUR IN THE CATAHULA SANDSTONE IN THE VICINITY OF THE AQUIFER. IN STREAM-GAGING STATION AT MILE 89.6, DOWNSTREAM TO A POINT 2.5 MILES UPSTREAM FROM THE MOUTH ARE EVAPOTRANSPIRATION WAS AT A MINIMUM, DISCHARGE INCREASED IN A DOWNSTREAM DIRECTION FROM NO FLOW AT ABOUT MILE 88 TO 67.4 CFS AT MILE 2.5. DISSOLVED-SOLIDS CONCENTRATIONS ALSO INCREASED IN A DOWNSTREAM DIRECTION THROUGHOUT THE REACH.
The Rio Grande is an interstate and international stream which begins in high mountains of Colorado, flows across New Mexico, and forms the boundary between Texas and Mexico. Annual precipitation on the region is about 86 million acre-feet; however, all but 4 million acre-feet is returned to the atmosphere by evapotranspiration. The groundwater reservoirs contain an aggregate of 5,800 million acre-feet of fresh and slightly saline water in storage, which could be withdrawn through wells. In contrast, the surface reservoirs have a combined storage capacity of only 18 million acre-feet. Withdrawal of groundwater in 1970 was 2.7 million acre-feet, of which 88% was used for irrigation. The region appears to offer several possibilities for utilizing underground space for purposes other than the withdrawal of water such as waste disposal, artificial recharge, water-quality control, and development of geothermal energy.

Groundwater resources of Rains and Van Zandt counties, Texas. White, O. E., Geological Survey, Austin, Tex.

Texas water development board report 169, April 1973. 81 p., 26 figs, 6 tabs, 35 refs.

Journal announcement: Swra0519

Rains and Van Zandt Counties in Northeast Texas have abundant water resources and comparatively little water demand. The water is derived from the heavy precipitation (about 43 inches annually) which fills the numerous lakes and reservoirs and recharges the freshwater aquifers. One of the aquifers in the area, the Carrizo-Wilcox, has been appreciably developed. During 1969, this aquifer supplied a reported 1,500 acre-feet of water for municipal supply, industrial use, and rural water systems in the two counties. The Carrizo-Wilcox aquifer contains an estimated 50 million acre-feet of fresh water in storage. About 10% of this amount, or 5 million acre-feet, is available to wells. In addition to the water in storage, the Carrizo-Wilcox aquifer annually receives an estimated 5,000 acre-feet of effective recharge from precipitation. Yields of wells tapping the Carrizo-Wilcox aquifer range from less than 5 to as much as 800 gpm. Most of the municipal and industrial wells are equipped to pump at rates of 100 to 250 gpm. A second aquifer, the Queen City Sand, in southeastern Van Zandt County, which is currently tapped solely for rural domestic and livestock supply, is probably capable of yielding as much as 150 gpm of fresh water to properly constructed wells.

Groundwater data for the Salt Basin, Eagle flat, Red Light Draw, Green River Valley, and Presidio Boslon in westernmost
The proposed action is to lease 6,600 acres for surface coal mining in Bastrop County, southeast-central Texas. Underlying the area are 80-100 million tons of surface minable coal in the Calvert Bluff Formation of the Wilcox Group. The area is drained by intermittent McLaughlin and Dogwood Creeks, tributary to Big Sandy Creek adjacent on the northwest. The Calvert Bluff Formation overlies the Simsboro Formation, also Wilcox Group, and underlies the Carrizo Formation, both being significant aquifers. Highwall seepage from lensatic sandstones in the Calvert Bluff Formation is estimated to be about 160 gallons per minute (worst case). Dewatering of the underlying Simsboro Formation by wells at 10,600 gallons per minute (also worst case) would be required for hydrostatic pressure relief. Discharge of this water into Big Sandy Creek would increase base flow by 23 times, and median flow 4.5 times. Erosion of the streambed would be significant during mining, but the creek would gradually return to premining conditions. Dewatering would cause a drawdown of 81 feet at the nearest well, 2 miles down gradient, and increase its pumping lift.
RECONNAISSANCE OF THE GROUNDWATER RESOURCES OF THE UPPER FREMONT RIVER VALLEY, WAYNE COUNTY, UTAH

Bjorklund, L. J.

GEODETIC SURVEY, LOGAN, UTAH

COPIES OF REPORT AVAILABLE AT UTAH DEPT. OF NATURAL RESOURCES, DIV. OF WATER RIGHTS, 442 STATE CAPITOL, SALT LAKE CITY, UTAH. TECHNICAL PUBLICATION NO. 22, 1969. 54 P. 11 FIG. 6 TAB. 21 REF.

JOURNAL ANNOUNCEMENT: SWRA0313

THE UPPER FREMONT RIVER VALLEY, A DEPRESSION CAUSED BY FAULTING, ALTERED BY EROSION, AND PARTIALLY FILLED BY ALLUVIUM ERODED FROM SURROUNDING HIGHLANDS, INCLUDES ABOUT 40 SQUARE MILES IN SOUTH-CENTRAL UTAH. THE DRAINAGE BASIN WHICH CONTRIBUTES WATER TO THE VALLEY INCLUDES ABOUT 700 SQUARE MILES. WATER MAINLY TO THE VALLEY FROM SEVERAL HIGH PLATEAUS, SEDIMENTARY ROCKS OF TRIASSIC, JURASSIC, TERTIARY, AND QUATERNARY AGE AND VOLCANIC ROCKS OF TERTIARY AGE ARE EXPOSED IN THE AREA. THE TERTIARY VOLCANIC ROCKS YIELD WATER TO SEVERAL LARGE SPRINGS AND FLOWING WELLS. THIS UNIT IS THE PRINCIPAL SOURCE OF GROUNDWATER IN THE VALLEY. THE VALLEY FILL OF QUATERNARY AGE, WHICH IS MORE THAN 500 FEET THICK IN PLACES, IS ALSO AN IMPORTANT SOURCE, YIELDING WATER TO MANY WELLS. THE AVERAGE ANNUAL INFLOW TO THE VALLEY VIA THE FREMONT RIVER DURING 1950-57 WAS 29,120 ACRE-FEET AND THE AVERAGE ANNUAL OUTFLOW DURING 1909-57 WAS 64,840 ACRE-FEET. ABOUT 80,000 ACRE-FEET OF WATER IS DISCHARGED BY SPRINGS AND SEEPS IN THE VALLEY DURING MOST YEARS. APPROXIMATELY 3,500 ACRE- FEET OF WATER IS DISCHARGED FROM FLOWING WELLS AND ABOUT 700 ACRE- FEET OF WATER FROM WELLS DURING A YEAR. IRRIGATION IS THE PRINCIPAL USE OF BOTH SURFACE AND GROUNDWATER IN THE VALLEY. GROUNDWATER IS USED ALSO FOR THE PUBLIC SUPPLIES OF FREMONT, LOA, LYMAN, AND BICKNELL, FOR DOMESTIC AND STOCK USE, AND FOR FISH CULTURE. THE GROUNDWATER IN THE VALLEY IS SUITABLE FOR MOST USES. (KNAPP-USGS)

SALT-LOAD COMPUTATIONS--COLORADO RIVER; CAMEO, COLORADO TO CISEO, UTAH: PART 2. BASIC DATA. (DUPLICATED SEE COLORADO).

Drennan, R. J.; Grozier, R. U.

GEODETIC SURVEY, DENVER, COLO.

OPEN-FILE REPORT, 1976. 222 P. 54 FIG. 12 TAB.

JOURNAL ANNOUNCEMENT: SWRA0919

SALT-LOAD COMPUTATIONS--COLORADO RIVER: CAMEO, COLORADO TO CISCO, UTAH: PART 1. DATA SUMMARY. (DUPLICATED SEE COLORADO).

Drennan, R. J.; Grozier, R. U.

GEODETIC SURVEY, DENVER, COLO.

OPEN-FILE REPORT, 1976. 15 P. 3 FIG. 6 TAB.

Hydrologic and Climatologic Data, Southeastern Uinta Basin, Utah, and Colorado: Water Year 1978

Conroy, L. S.


JOURNAL ANNOUNCEMENT: SWRA1414

This report contains data collected in the vicinity of the oil-shale area in the southeastern Uinta Basin, Utah and Colorado, from Oct. 1, 1977, to Sept. 30, 1978. The data presented in tables include monthly precipitation, depth-duration of rainfall, snow depth and water content, air temperature, daily streamflow records, water-quality data from continuous-recording gaging sites, water-quality data from wells and springs, and water levels, temperature, and specific conductance for selected wells. (USGS)

Climatologic and Hydrologic Data, Southeastern Uinta Basin, Utah and Colorado: Water Years 1975 and 1976

Conroy, L. S.; Fields, F. K.


Utah Basic Data Release No. 29, 1977. 244 P. 5 FIG. 10 TAB.

JOURNAL ANNOUNCEMENT: SWRA1117

Climatologic and hydrologic data were collected as a part of an investigation of the southeastern Uinta Basin, Utah and Colorado, by the U.S. Geological Survey. The data apply mainly to water years 1975 and 1976, which includes the period from October 1974 through September 1976. Included also are some earlier records from groundwater basins. The data, presented in tables, include monthly precipitation, snow depth, monthly pan evaporation, soil moisture, daily streamflow records, water-quality data from continuous-recording gaging sites, discharge and water-quality data at partial-record streamflow gaging sites, and discharge, temperature, and water-quality data for wells and springs, and water levels in selected wells. (Woodard-USGS)

Ground-water conditions in the upper Virgin River and Kanab Creek basins of southeastern Utah with emphasis on the Navajo Sandstone, Cordova, R. M., 1980


The Navajo Sandstone of Triassic (?) and Jurassic age, the most important bedrock aquifer in the area, was estimated to contain 250 million acre-ft of recoverable water. Aquifers occur in geologic units other than the Navajo including coal-bearing rocks of Cretaceous age. It was concluded that water enters the
Ground-Water Conditions in the Upper Virgin River and Kanab Creek Basins, Utah, with Emphasis on the Navajo Sandstone

The upper Virgin River and Kanab Creek basins area in southern-central Utah includes about 1,300 square miles in the upper Virgin River basin and about 650 square miles in the upper Kanab Creek basin. The sparsely populated area contains a large coal reserve. Water occurs in both the unconsolidated and consolidated rocks. Principal aquifers in the unconsolidated rocks include older stream-channel deposits, lower parts of alluvial fans, and stream-valley alluvium. The most important consolidated-rock aquifer is the Navajo Sandstone of Triassic and Jurassic age. Other consolidated-rock aquifers of note include the San Juan Member of the Chinle Formation of Triassic age, sandstone strata of Cretaceous age, and the wasatch Formation of Tertiary age. Groundwater recharge is derived chiefly from precipitation on the area. Discharge is estimated at about 30,000 acre-feet per year. Discharge occurs chiefly as seepage to lower stream reaches and evapotranspiration. Natural discharge is estimated to be about 5,000 acre-feet per year as underflow into Arizona. In 1967, at least 3,300 acre-feet was withdrawn by wells. Chemical characteristics of ground water vary considerably with geologic source. Water in the Navajo Sandstone and wasatch formation is generally saline, containing 1,000 to 3,000 milligrams per liter of dissolved solids in most places. (USGS)

Ground-Water Conditions in Utah, Spring of 1968
Huntington and Cottonwood Creeks, central Utah.
Danielson, T. W., Villard, M. C., and Fuller, M. M., 1980b

The hydrologic system in this important coal-resource area of
the Wasatch Plateau is described. Data were collected from about
140 springs that issue from several water-bearing zones in rocks
of Cretaceous and/or Tertiary age. Most springs that discharged
more than about 50 gal/min were associated with faulting. During
1979, water entered underground coal mines mainly through joints,
fauls, and holes in mine roofs. Discharge from mines ranged
from zero to about 1,100 gal/min.

Large differences in surface runoff in the study area are
described. Chemical quality of surface water, as well as quality
of water from springs and mines, is described. Possible effects of underground coal mining and associated mine
dewatering on the hydrologic system are evaluated. It was
concluded that discharge-recession curves for springs showed
promise as a method of detecting changes in the ground-water
system caused by mining.

Hydrology of coal-resource areas in the southern Wasatch
Plateau, central Utah.
Danielson, T. W., and Sylva, D. A., 1982
U.S. Geological Survey Water-Resources Investigations Open-File
Report 82-400V.

Summary Appraisals of the Nation's Ground-Water
Resources—Lower Colorado Region
Available from U.S. Geological Survey, Washing
ton, D.C. 20250.

Journal Announcement: SWA1318

Much of the water used in the semiarid lower Colorado River
region is ground water, and pumping is in excess of
replenishment. In the southwest depth to water generally is
about 200 to 500 feet below the land surface. Irrigation
and public-supply wells generally yield 500 to 1,500 gallons per
minute, and about 1 billion acre-feet of ground water
potentially is recoverable from storage. In the northeast water
levels generally are more than 500 feet below the land surface.
Most wells yield between 10 and 500 gallons per minute, and
150 million acre-feet or possibly more could be recovered. Annual
storage depletion, almost entirely in the southwest, is about
2.4 to 3.2 million acre-feet. Almost 6 million acre-feet is
pumped annually, mostly for crops. Subsidence, earth cracks,
increasing pumping costs, and water quality limit potential
groundwater development. However, some gains can be made
through changes and greater efficiencies of use and by reducing
evapotranspiration. Prior use and economics determine water use
in Arizona—the largest part of the region. All States except
Arizona have laws that allow control and allocation of
ground water by the State. (Kosco-USGS)

Some engineering geologic factors controlling coal mine
subsidence in Utah and Colorado.
Dunrud, C. R., 1976

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1975
Eychaner, J. H., Geological Survey, Salt Lake City, Utah.
Utah Division of Water Resources, Salt Lake City,
Cooperative Investigations Report No. 14, 1975, 26 p., 37 fig., 2
tab., 13 ref.

Journal Announcement: SWA10281

This report is the twelfth in a series of annual reports
that describe groundwater conditions in Utah. The report includes
individual discussions of the most important areas of groundwater
withdrawal in the State for the calendar year 1974. Water-level
fluctuations, however, are described for the period spring 1974
to spring 1975. The estimated total withdrawal from wells in
1974 was about 879,000 acre-ft which was about 165,000 acre-ft
more than in 1973 and 195,000 acre-ft greater than the
average annual withdrawal for the period 1964-73. Both the
levels were higher in 1973 and the increase in the 10-year average
were due primarily to changes in withdrawals for
irrigation. Estimated total withdrawals for irrigation in 1974
were about 611,000 acre-ft, which was about 273 more than the
480,000 acre-ft withdrawn in 1973. Changes in groundwater
levels from spring 1974 to spring 1975 reflected the decreased
availability of surface water and increased groundwater withdrawals. Water levels fell in most major
groundwater basins in the State, Pavant Valley, in central
Utah, was the only major groundwater basin in which water
levels were higher in March 1975 than in March 1974.
(Woodard-USGS)

Ground-Water Conditions in Utah, Spring of 1978
Utah Division of Water Resources, Salt Lake City, Div. of Water Resources,

Journal Announcement: SWA1122

This is the fifteenth in a series of annual reports
that describe ground-water conditions in Utah. The estimated
total withdrawal of water from wells in Utah in 1977 was
about 947,000 acre-feet which was about 86,000 acre-feet more
than in 1976 and 210,000 acre-feet greater than the average
annual withdrawal for the period 1967-76. Both the increases


Availability and quality of water are assessed. It was concluded that the Navajo Sandstone was the most probable source of large quantities of water. It was estimated that the Navajo contained about 50 x 10^6 acre-ft of ground water per square mile and that each year 26 x 10^6 to 30 x 10^6 acre-ft could be withdrawn from the Navajo in the study area with properly spaced wells. Sources of smaller quantities of water are also identified. Records of wells and springs and chemical analyses of water are listed in tables.


A generalized hydrologic description of this undeveloped coal-resource area is presented. Preliminary data indicated that most reaches of tributaries to Cottonwood and Ferron Creeks on North Horn Mountain were ephemeral and that the dissolved-solids concentrations in surface water averaged less than 500 mg/L. Estimates of peak discharge (100-year flood) were made for several of the ephemeral streams. It was concluded that most ground water in North Horn Mountain probably was stored in perched aquifers underlying the coal. Numerous springs and seeps issued from the perched aquifers, but the spring water usually were consumed by evapotranspiration short distances from the sources. It was also concluded that a regional aquifer exists in the Star Point Sandstone below the coal and sometimes in the coal-bearing Blackhawk Formation, both of Cretaceous age. Dissolved-solids concentrations of ground water ranged from less than 500 to about 1,000 mg/L. Potential impacts of coal development on the water resources are evaluated.
about 56,000 acre-feet--about 31,000 acre-feet or more than in 1978 and 25,000 acre-feet more than the average annual withdrawal during 1969-78. The increase in withdrawal from the amount reported for 1978 was due primarily to increases in withdrawal for public supply. Total withdrawal for public supply in 1979 was 162,000 acre-feet, which is 33,000 acre-feet more than reported for 1978. Withdrawal for irrigation was 56,000 acre-feet, an increase of 34,000 acre-feet. The quantities closely related to local climatic conditions. Precipitation in 1979 was below average in most of Utah (ratio of water withdrawn from wells is near Oceanic and Atmospheric Administration, 1980), of the 33 stations for which graphs of cumulative departure from average annual precipitation are included in this report, 27 had below-average precipitation in 1979. This contributed most significantly to increased withdrawals from wells. The below-average precipitation in most parts of the State during 1979 resulted in local reduction in ground-water recharge as well as increased withdrawals from wells. This in turn resulted in a general decline of ground-water levels in many parts of the State from spring of 1979 to spring of 1980. Notable exceptions where rises occurred were in areas where local above-average runoff contributed greatly to the recharge of the ground-water reservoir. The total number of wells drilled during 1979, as indicated by well-drillers' reports filed with the Utah Division of Water Rights, was about 35 percent less than reported for 1978. The number of those wells 6 inches or more in diameter drilled for public supply irrigation, and industrial use was about 28 percent less than reported for 1978. (USGS)

Ground-water conditions in Utah, Spring of 1982

Hydrologic Evaluation of Ashley Valley, Northern Uinta Basin Area, Utah
Hood, J. W.


Journal Announcement: SWRA1023

The upper Duchesne River valley was studied during 1971-74 as part of an investigation of the northern Uinta Basin area, Utah and Colorado. This report describes the relation of ground water to surface water in the upper Duchesne River valley, estimates the quantity of ground water that moves to the Duchesne River, and evaluates the probable effect of increased ground-water withdrawals on the stream regimen. The primary source of water is precipitation on the highlands adjacent to and north of the area and on the valley itself. Discharge is mainly by flow in the Duchesne River. Adjacent to and within the valley, ground water and surface water are intimately related. Others (1982) can interchange at small rates due to both natural and manmade conditions. The valley fill, which is composed mainly of outwash and related glacial debris, constitutes the main ground-water reservoir in the valley. The ground water in the fill is unconfined. The volume of ground water stored in the fill, and theoretically available by gravity drainage, is a minimum of 40,000 acre-feet; this volume fluctuates by a maximum of 10 percent annually. The discharge from wells and springs used for domestic, stock, public, and irrigation purposes in 1974 was about 2 cubic feet per second. Most ground water, except in parts of the Uinta formation, is part of the surface water sampled in the study area; was fresh. (Woodard-USGS)

Bedrock Aquifers in the Lower Dirty Devil River Basin Area, Utah, with Special Emphasis on the Navajo Sandstone
Hood, J. W., Danielson, T. W.


BIBLIOGRAPHY OF U.S. GEOLOGICAL SURVEY WATER-RESOURCES REPORTS FOR UTAH

LAPRAY, B. A. GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH. UTAH DEPARTMENT OF NATURAL RESOURCES, SALT LAKE CITY, INFORMATION BULLETIN NO 23, 1975. 58 P. 4 TAB.

QUALITY OF GROUND WATER IN THE LOWER COLORADO RIVER REGION, ARIZONA, NEVADA, NEW MEXICO, AND UTAH

KISTLER, L. W. GEOLOGICAL SURVEY, WASHINGTON, D. C. FOR SALE BY USGS, WASHINGTON, D. C. 20247, PRICE $1,00 PER SET, HYDROLOGIC INVESTIGATIONS ATLAS WA-478, 2 SHEETS, 1975. 3 FIG. 2 MAP. 17 REF.

DATA ARE PRESENTED ON THE AREAL AND VERTICAL
Hydrologic studies of the U.S. Geological Survey in major coal-resource areas of Utah through 1980
Lines, G. C., 1981

Hydrologic Monitoring in the Coal Fields of Central Utah, August 1978-September 1979
Lines, G. C. and Plants, G. G.
30 Figs, 1 Plate, 13 Tab, 17 Ref.
Journal Announcements: SWRA422

Surface-water quantity and quality were monitored at 12 gaging stations down-stream from mine and lease areas in the Wasatch Plateau, Book Cliffs, and Emery coal fields in central Utah. Measurements of base flow were made at 52 other sites in the region. The report describes the hydrologic setting of this important coal region and summarizes the surface-water data collected at the monitoring sites from August 1978 through September 1979. Coal mining and lease activities in each of the monitored basins are also described. Where possible, hydrologic impacts of coal mining are evaluated. Impacts include increases in streamflow and degradation of surface-water quality due to water discharged from underground mines. Other impacts include removal of water from ground-water storage changes in the natural ground-water flow system and possibly the diminution of spring flows. Adequacy of the monitoring network to detect hydrologic changes due to mining is described in order to fully assess and quantify the impacts. Comprehensive studies and monitoring of the ground-water system and water produced in mines are needed.

Hydrology of the Ferron sandstone aquifer and effects of proposed surface-coal mining in Castle Valley, Utah, with a section on stratigraphy by F. A. Byer and a section on Leaching of overburden by R. M. Fuller

Availability and chemical quality of water in the Ferron Sandstone member of the Morris Shale of Cretaceous age are evaluated. To aid in estimating drilling depths to reach and fully penetrate the aquifer, structure-contour and thickness maps for the Ferron are included. Records of wells and springs and chemical analyses of water from the Ferron are listed in tables. The impacts of a proposed surface-coal mine in the Emery area on the water resources are evaluated. Techniques used in the evaluation included a three-dimensional digital-computer model of the Ferron sandstone aquifer (Morrissey and others, 1980) and laboratory experiments that simulated leaching of overburden.

MAJOR THERMAL SPRINGS OF UTAH
MUNDORFF, J. C.
GEOL O GICAL SURVEY, SALT LAKE CITY, UTAH.
AVAILABLE FROM UTAH GEOLOGICAL AND MINERALOGICAL SURVEY, 103 UTAH GEOLOGICAL SURVEY BLDG., UNIV. OF UTAH, SALT LAKE CITY, 84112 - PRICE $3.00.

Fig 2 Plate, 3 Tab, 74 Ref.

Journal Announcements: SWRA442

As part of a study of the springs of Utah, reconnaissance data were obtained on the thermal, chemical, and geologic characteristics of the major thermal springs of Utah. Temperatures of the thermal springs studied ranged from 68 deg to 189 deg F. Nearly all thermal springs in Utah are in or near fault zones. Very few of these springs issue from volcanic rocks. Sprites open thermal springs are close to or near areas of late tertiary or quaternary volcanic rocks. Dissolved-solids contents of the springs range from as low as 214 ppm for a spring having a temperature of 60 deg F to as high as about 45,000 ppm for a spring having a temperature of 132 deg F. Most springs are sodium chloride in type, and all springs that contain more than 3,000 ppm of dissolved solids are of the sodium chloride type. Only two springs in the state, Roosevelt and Abraham hot springs, are in potentially valuable geothermal areas. Some thermal springs have large discharges, low dissolved-solids contents, and fairly low temperatures; these springs are valuable as water supplies for irrigation and stock use. An undesirable effect of the thermal springs is that they add significant amounts of water having high dissolved-solids contents to some streams and lakes.

NORTH THERMAL SPRINGS OF UTAH
MUNDORFF, J. C.
GEOL O GICAL SURVEY, SALT LAKE CITY, UTAH.
AVAILABLE FROM UTAH GEOLOGICAL AND MINERALOGICAL SURVEY, 103 UTAH GEOLOGICAL SURVEY BLDG., SLC 84112, $4.00.

Fig 2 Plate, 2 Tab, 24 Ref.

Journal Announcements: SWRA505

Data are presented for about 4,500 nontermal springs that discharge in the state of Utah. Most major springs having discharge of several cubic feet per second or more are in or near mountain ranges or plateaus where precipitation is much greater than in other parts of the state. The largest instantaneous discharge observed was 314 CFS at Mammoth Spring in southwestern Utah. Discharges exceeding 200 CFS were observed at SNA Creek Spring in extreme northern Utah and discharges of 200 CFS were reported for Big Brush Creek Spring in northeastern Utah. Maximum discharges of other springs...
RANGE FROM 25 TO 60 CFS. MAXIMUM DISCHARGES GENERALLY ARE DURING THE PERIOD OR WITHIN A FEW WEEKS AFTER THE MAIN PERIOD OF SNOWMELT, WHICH IS USUALLY FROM LATE APRIL TO THE MIDDLE OF JUNE. THE LARGEST SPRINGS GENERALLY DISCHARGE FROM OR VERY NEAR CARBONATE ROCKS IN WHICH SOLUTION CHANNELS AND FRACTURES ARE NUMEROUS OR FROM AREAS OF POROUS OR FRACTURED VOLCANIC ROCKS. MOST NONTHERMAL SPRINGS IN UTAH PROBABLY ARE VARIABLE SPRINGS—that is, their variability of discharge exceeds 100 percent. MOST OF THE MAJOR SPRINGS DISCHARGE WATER THAT CONTAINS LESS THAN 500 PPM OF DISSOLVED SOLIDS, AND MOST OF THE WATER IS OF THE CALCIUM BICARBONATE TYPE. WATER FROM SPRINGS IS USED FOR DOMESTIC, MUNICIPAL, IRRIGATION, LIVESTOCK, MINING, AND INDUSTRIAL PURPOSES. (WOODARD-USGS)

Reconnaissance of Chemical Quality of Surface Water and Fluvial Sediment in the Dirty Devil River Basin, Utah
Mundorff, J. C.
Utah Department of Natural Resources, Technical Publication No 65, 1979. 132 p, 4 figs, 3 plates, 7 tabs. 21 ref.

Journal Announcement: SWRA1404
This water-quality reconnaissance in the Dirty Devil River basin, Utah, covers an area of about 4,500 square miles. Data were obtained by the U.S. Geological Survey one or more times at 104 sites during the period from July 1975 to September 1976. The most pronounced characteristics of water in streams in the Dirty Devil River basin occurs in a 15-mile reach of Muddy Creek between the major diversions 10 miles north of Emery and the point at which Highway 1-70 crosses Muddy Creek. Dissolved-solids concentrations at the diversions are generally less than 300 milligrams per liter and at the lower end of the reach are commonly less than 2,000 milligrams per liter. The Dirty Devil River, which is formed by the confluence of Muddy Creek and the Fremont River, has no perennial tributaries. Except during short periods of the thunderstorm runoff in tributaries, the flow is simply a composite of flow from Muddy Creek and the Fremont River. A few data on total coliform, fecal coliform, and fecal streptococci bacteria suggest a general absence of major zoological pollution in the basin. Sediment discharge from the upper 1,000 square miles of the Fremont River basin and from the upper 400 square miles of Muddy Creek Basin is a very small part of sediment discharge of the Dirty Devil River basin. The area of the drainage area of the Dirty Devil River probably contributes most of the sediment that is discharged by the streams during a very small part of the time each year. (USGS)

RECONNAISANCE OF CHEMICAL QUALITY OF SURFACE WATER AND FLUVIAL SEDIMENT IN THE PRICE RIVER BASIN, UTAH
Mundorff, J. C.
GEOL O GICAL SURVEY, SALT LAKE CITY, UTAH.

U.S. DEPARTMENT OF NATURAL RESOURCES, SALT LAKE CITY, TECHNICAL PUBLICATION NO 591, 1972. 55 p, 13 figs, 3 plates, 5 tabs. 22 ref.

Journal Announcement: SWRA0617
The Price River Basin is mainly in Carbon and Emery Counties in East-Central Utah and the total drainage area is about 1,900 square miles. Normal annual precipitation (1951-60) is more than 30 inches in headwater areas and is less than 8 inches in the downstream part of the basin. Surface rocks in the basin range in age from Jurassic to Quaternary. But the rocks having predominant influence on water quality are marine shales of Cretaceous age. The general chemical characteristics of the main stem of the Price River as determined by a reconnaissance during 1969-70 changed markedly between the headwaters and the mouth. The dissolved solids content on the Price River, a rough estimate of the suspended sediment discharge at Woodside was at least 1,400,000 tons during the 1970 water year. (WOODARD-USGS)

Reconnaissance of Water Quality in the Duchesne River Basin and Some Adjacent Drainage Areas, Utah
Mundorff, J. C.
Utah Department of Natural Resources, Salt Lake City, Technical Publication No 55, 1977. 47 p, 9 figs, 5 plates, 2 tabs. 17 ref.

Journal Announcement: SWRA1102
A water-quality reconnaissance in the Duchesne River basin and some adjacent drainage areas covered an area of about 4,400 square miles. Data were obtained for more times at 108 sites during March 1973 to September 1974 and at 49 other sites during earlier years. Dissolved-solids concentrations are generally less than 200 milligrams per liter in the upper and western part of the basin and increase markedly in the southeastern part of the basin. The increase results predominantly from diversions of large amounts of water having low dissolved-solids concentrations from upstream parts of the basin and the return to or entry into the stream of smaller amounts of water having much higher dissolved-solids concentrations. Additional diversions of water from the upper part of the basin will cause an increase in weighted average dissolved-solids concentrations in downstream reaches of the river. Tributaries to the Duchesne and Strawberry Rivers in the southern part of the basin have high boron concentrations. Concentrations as high as 36,200 milligrams per liter were observed in one tributary from a thunderstorm in the southeastern part of the area. Sediment concentrations greater than 100,000 milligrams per liter could be expected during periods of intense thunderstorm runoff in many of the southern tributaries. (WOODARD-USGS)
Reconnaissance of the quality of surface water in the San Rafael River basin, Utah

Mundorf, J. C. and Thompson, K. A., 1980

U.S. Geological Survey Open-File Report 80-574, 54 p. (to be duplicated as a Utah Department of Natural Resources Technical Publication); 4 fig., 14 tables.

Water in mountain streams in the study area during 1977-78 nearly always contained less than 500 mg/L of dissolved solids. The chemical quality of surface water deteriorated downstream from the mountains where the streams crossed a belt of land 10 to 15 miles wide where the gypsum-bearing Mancos Shale crops out. This same area contained nearly all the intensive irrigation in the San Rafael River basin. Numerous chemical analyses of surface water from sites throughout the basin are listed in tables.

Selected Biological Characteristics of Streams in the Southeastern Uinta Basin, Utah and Colorado

Watenbarger, H. C. and Fuller, R. H.


Journal Announcement: SWRA 1512

Biological sampling was carried out during 1976-78 in five streams in the southeastern Uinta Basin, Utah and Colorado, in order to provide baseline water-quality data for an area of potential oil- and gas development. The biological activity in the streams sampled generally is limited by physical factors more than by chemical constituents and plant nutrients. Characteristics of streamflow, such as high turbidity, fluctuating water levels, and moderate to high salinity, limit production of flora and fauna biomass. Samples were collected for the determination of bacterial and periphyton concentrations and benthi-c-invertebrate communities. Bacterial concentrations were generally small, with some peaks of contamination primarily from livestock and wildlife. Members of the order Chlorophyta (green algae) were the major periphytic algae present in three of the streams sampled. Glitter Creek was dominated by members of the order Cyanophyta (blue-green algae), and pennate diatoms were the predominant algae in Willow Creek. The benthic-invertebrate communities generally reflect a nonpolluted environment. Shannon-Weiner diversity indices ranged from 1.14 to 3.08. (USGS)

Developing a State Water Plan, Ground-Water Conditions in Utah, Spring of 1979

Price, D.


Utah Division of Water Resources Cooperative Investigations Report No. 18, 1979, 68 p., 37 figs., 3 tabs., 3 refs.

Journal Announcement: SWRA 1301

The estimated total withdrawal of water from wells in Utah in 1978 was about 829,000 acre-feet, which was about 118,000 acre-feet less than in 1977 and 62,000 acre-feet greater than the average annual withdrawal for the period 1968-77. The decrease from 1977 was due primarily to decreases in withdrawals for irrigation. Precipitation in 1978 was above average in most of Utah. This made more surface water available, reducing dependence on ground water for irrigation. Relatively small ground-water declines were recorded in some of the more heavily developed areas. The above-average precipitation combined with increased runoff and reduced ground-water withdrawals, however, resulted in significant rises of ground-water levels in many parts of the State. (Woodard-USGS)

Map Showing General Availability of Ground Water in the Kaiparowits Coal-Basin Area, Utah

Price, D.


Journal Announcement: SWRA 1210

This is one of a series of maps that describe the geology and related natural resources of the Kaiparowits coal-basin area, Utah. The map is based partly on records of water wells, springs, and coal and petroleum exploration holes, partly on unpublished reports of field evaluations of prospective stock-water well sites by personnel of the U.S. Geological Survey, and partly on a 6-day field reconnaissance by the writer. Rocks ranging in age from Permian to Holocene are exposed in the Kaiparowits coal-basin area. They consist chiefly of sedimentary rocks—mostly interbedded sandstone, siltstone, shale, conglomerate, and limestones, with a thickness of thousands of feet. The minimum expected yields of individual wells shown on the map assume that the wells are at least 6 inches in diameter; fully penetrate the aquifer(s) without casing, perforated casing, or well screens opposite the aquifers; and are equipped with optimal pumping equipment. The yields shown are those that could be sustained indefinitely by pumping. The ranges of expected depth to ground water shown on the map are based on measured and reported depths of water in wells. Yields of most springs range from less than 1 to about 20 gallons per minute; but several springs discharge more than 100 gallons per minute. Much of the ground water (including springflow) may be too saline to drink. (Woodard-USGS)

Map Showing General Chemical Quality of Ground Water in the Richfield Quadrangle, Utah

Price, D.


Journal Announcement: SWRA 1302
This is one of a series of maps that describe the geology and related natural resources of the Richfield Quadrangle, Utah. Known shows known and inferred ranges of dissolved-solids concentrations in the ground water. Concentrations generally range from 100 to 1,000 milligrams per liter throughout most of the area, with a few areas having less than 100 milligrams per liter locally in some higher mountain areas and more than 10,000 milligrams per liter locally beneath the Sevier Desert and Sevier Lake bed. Several mineralized thermal springs discharge in the map area. They include Thermo Roosevelt, Josephine, Red Hill, Monroe Meadow, and Hatton Hot Springs. Dissolved-solids concentrations of those springs range from about 1,500 to about 8,000 milligrams per liter. (U.S. Geological Survey)

**Map Showing General Chemical Quality of Groundwater in the Salina Quadrangle, Utah**

Price: 0.25


Journal Announcement: SWRA1509

**Map Showing Principal Drainage Basins, Principal Runoff-Producing Areas, and Selected Streamflow Data in the Kaiparowits Coal-Basin Area, Utah**

Price: 0.25


Journal Announcement: SWRA1304

This is one of several maps in the U.S. Geological Survey Miscellaneous Investigations Map Series that describe the geology and related natural resources of the Kaiparowits coal-basin area, Utah. About 96 percent of the area drains to the Colorado River, mostly through the Escalante River and Wahweap, Warm, and Last Chance Creeks. The remaining 4 percent drains to the Great Basin through the Sevier River. The Escalante River and several of its headwater tributaries are perennial streams, but most others in the area are intermittent ephemeral streams. Estimated average annual runoff in the area ranges from less than 1 inch in most places to more than 10 inches in the headwater area of the Escalante River. Most of the runoff, which occurs during late spring and early summer, results from melting of snow and seasonal rains. Summer and fall flooding is common throughout the area. Peak flood flows of more than 5,000 cubic feet per second have been recorded from drainage areas of less than 100 square miles, and a peak floodflow of more than 15,000 cubic feet per second has been recorded on the Paria River. (Woodard-USGS)

**Map Showing Selected Surface-Water Data for the Alton-Kolob Coal-Fields Area**

Price: 0.25


**Map Showing Selected Surface-Water Data for the Manti 30 X 60-Minute Quadrangle, Utah**

Price: 0.25


**Map Showing Selected Surface-Water Data for the Neph N 30 X 60-Minute Quadrangle, Utah**
SELECTED HYDROLOGIC DATA IN THE UPPER COLORADO RIVER BASIN

Price, Don 1982
U.S. Geological Survey Miscellaneous Investigations Map 1-1512

Map showing selected surface-water data for the Price 30 x 60-minute quadrangle, Utah

Price, Don 1982
U.S. Geological Survey Miscellaneous Investigations 1-1513

Map showing selected surface-water data for the Huntington 30 x 60-minute quadrangle, Utah

Price, Don 1982
U.S. Geological Survey Miscellaneous Investigations Map 1-1514

SELECTED HYDROLOGIC DATA IN THE UPPER COLORADO RIVER BASIN ARE DESCRIBED IN A 2-SHEET HYDROLOGICAL ATLAS. THE MAPS IN THIS ATLAS ARE HIGHLY GENERALIZED, AND ARE INTENDED TO PROVIDE ONLY A GENERAL UNDERSTANDING OF THE GEOLOGY, GROUNDWATER CONDITIONS, AND CHEMICAL QUALITY OF WATER IN THE BASIN AS A WHOLE. ROCKS RANGING IN AGE FROM PRECAMBRIAN TO HOLOCENE ARE EXPOSED IN THE UPPER COLORADO RIVER BASIN. THE ROCKS HAVE BEEN GROUPED INTO FIVE BASIC GEHYDROLOGIC UNITS ON THE BASIS OF AGE AND GENERAL LITHOLOGIC CHARACTERS. ALLUVIUM IN GEHYDROLOGIC UNIT 1 AND VOLCANIC ROCKS IN GEHYDROLOGIC UNIT 2 CONTAIN AQUIFERS THAT HAVE THE HIGHEST HYDRAULIC CONDUCTIVITIES, YIELDS TO INDIVIDUAL WELLS AND SPRINGS GENERALLY ARE SMALL IN MOST PARTS OF THE BASIN, PROPERLY LOCATED AND CONSTRUCTED WELLS IN THE THINNER (100 FT OR MORE) ALLUVIAL DEPOSITS YIELD 500 TO MORE THAN 1,000 GPM, AND SOME OF THE MOST PRODUCTIVE WELLS IN THE ENTIRE BASIN TAP BOTH ALLUVIUM AND VOLCANIC ROCKS IN THE UPPER FREMONT RIVER VALLEY, WHERE SEVERAL WELLS YIELD MORE THAN 1,000 GPM. ONLY ABOUT 5 PERCENT OF THE MAXIMUM ESTIMATED VOLUME OF GROUNDWATER STORED IN THE BASIN IS IN UNCONSOLIDATED DEPOSITS THAT HAVE HIGH HYDRAULIC CONDUCTIVITIES. ABOUT 85 PERCENT OF THE MAXIMUM ESTIMATED VOLUME OF STORED WATER OCCURS IN THE ROCKS OF GEHYDROLOGIC UNITS 3-5, AND MUCH OF THAT WATER IS MODERATELY TO HIGHLY PINKERALIZED. HYDROGRAPHS OF WELLS INDICATE THAT THERE HAVE BEEN NO SIGNIFICANT DEPLETIONS OF STORAGE IN THE BASIN OWING TO GROUNDWATER DEVELOPMENT. (KAPP-USGS)

HYDROLOGIC RECONNAISSANCE OF THE SOUTHERN UINTA BASIN, UTAH AND COLORADO

Price, D. J.; Miller, L. L.

GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH. UTAH DEPARTMENT OF NATURAL RESOURCES, SALT LAKE CITY. TECHNICAL PUBLICATION 50-69, 1975, 66 p, 11 FIG, 3 PLATE, 15 TAB, 38 REF.

Journal Announcement: SWRAU821

Geological Survey, Washington, D.C.

ABSTRACT


Hydrologic Evaluation of the Alton Reclamation-Study Site, Alton Coal Field, Utah

Sandberg, G. W.


Geological Survey open-file report 79-346, 1979, 53 p, 5 fig, 8 plat, 1 ref.

Journal Announcement: SWRAU1224

An investigation was conducted from July 1974 to September 1977 to define general hydrologic conditions at a reclamation-study site in the Alton coalfield near Kanab, Utah. The average annual streamflow through the area was less than 500 acre-feet, and the water carried little sediment except during floods which result from intense local storms. Most of the surface water seeps into the ground or is diverted for irrigation downstream from the study area. Ground-water data were insufficient to define the potentiometric surface in most of the area. The water level in each of the three observation wells is above the coal layer in the immediate area of the well. A larger network of wells is needed to define the potentiometric surface throughout the area and to show its relation to surface water and the location of the coal layers. Hydrologic data should be collected continuously to establish a hydrologic base before mining begins and data collection should be continued through the periods of mining and reclamation. (Woodard-USGS)
GROUND-WATER CONDITIONS IN UTAH: SPRING OF 1970
SUMSION, C. T., GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH.
Utah Division of Water Resources Cooperative Investigations Report No. 10, 1972, 73 p., 7 Fig., 2 Tab., 8 Ref.
Journal Announcements: SWRA523

The estimated withdrawal of water from wells in Utah in 1971 was 710,000 acre-feet, or about 30,000 acre-feet more than for 1970. In 1971, precipitation in the north-central division was 3.85 inches above normal and 0.29 inch above normal in the south-central division. These two divisions include most of the major areas of groundwater development in the state. The southeast division suffered a deficiency of 0.3D inch during 1971. From February-March 1971 to February-March 1972, groundwater levels generally declined in southwestern Utah because more groundwater was withdrawn for irrigation, and rose in northern Utah where more surface water was available for irrigation. Conditions in the central part of the state were variable, and no consistent pattern of water-level change is evident. Groundwater development and changes in groundwater conditions in the major areas of groundwater development are summarized. (Woddard-USGS)

Selected Coal-Related Ground-Water Data, Wasatch Plateau-Book Cliffs Area, Utah
Journal Announcements: SWRA517

The Wasatch Plateau-Book Cliffs area in east-central Utah consists of about 8,000 square miles within the upper Colorado River drainage system. Coal production in the area is expected to increase from 8 million tons annually within the next 10 years. Most sources of water supply will be subjected to possible contamination and increased demands by coal-related municipal and industrial growth in the area. The report presents a compilation of coal-related ground-water data from many unpublished sources for the use of local and regional water planners and users. The report includes generalized stratigraphic sections and hydrologic characteristics of rocks in the wasatch Plateau-Book Cliffs area, records of selected test holes and water wells, logs of selected test holes and water wells, levels in selected wells, records of selected springs, records of ground-water discharge from selected mines, and chemical analyses of water from selected test holes, water wells, springs, and mines. (Kosco-USGS)

GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH.
Journal Announcements: SWRA401

This report contains information on groundwater withdrawals, water-level changes, and related changes in precipitation and streamflow in Utah. It also contains supplementary data that are related to groundwater use in some areas. Less than 2% of the wells in Utah obtain water from consolidated rocks. The consolidated rocks that yield the most water are lava flows, limestone, and sandstone, more than 98% of the wells in Utah draw water from unconsolidated rocks. Most wells that tap parts filled with debris from the adjacent mountains. The estimated total withdrawal of water from wells in Utah during 1969 was about 670,000 acre-feet, about 40,000 acre-feet more than in 1968. Precipitation during most of the growing season was less than normal in parts of the state where the largest withdrawals are for irrigation, so irrigation withdrawals increased in these areas. Although all types of generally rose throughout the state from March 1969 to March 1970 as a result of above-normal precipitation. Groundwater development and changes in groundwater conditions in the major areas of groundwater development are summarized. (Knapp-USGS)

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN SELECTED COAL-ENERGY AREAS OF UTAH
DowDell, K. M., GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH.
Open-File Report, 1976, 81 p., 1 Tab., 2 Fig., 5 Ref.
Journal Announcements: SWRA517

Planned coal development in Utah in the next decade includes thermal-electric and coal gasification plants and slurry pipelines with estimated water requirements that may exceed 200,000 acre-feet (246,6 cubic hectometres) annually. The U.S. GEOLOGICAL SURVEY PRESENTLY MAINTAINS A MINIMAL MONITORING PROGRAM ON STREAMS AND WELLS IN THE COALFIELDS. THE CHEMICAL-QUALITY DATA ARE OBTAINED AND 14 AT WHICH SEDIMENT DATA ARE OBTAINED. THE GROUNDWATER MONITORING PROGRAM COVERS 170 WELLS FOR WATER-LEVEL MONITORING AND 16 WELLS AT WHICH SAMPLES ARE OBTAINED FOR CHEMICAL ANALYSIS. FIVE AREAL WATER-RESOURCES STUDIES ARE BEING MADE IN THE VICINITY OF UTAH COALFIELDS. THE PRINCIPAL STUDY WHERE COAL MINING IS MOST ACTIVE IS IN THE WASTACH PLATEAU-BOOK CLIFFS AREA. THIS IS A 2-YEAR HYDROLOGIC RECONNAISSANCE DESIGNED TO PROVIDE AN ASSESSMENT OF THE CURRENT HYDROLOGY, WHICH WILL 40% IN THE SOLUTION TO SOME OF THE POTENTIAL PROBLEMS THAT MAY OCCUR AS A RESULT OF COAL-ENERGY DEVELOPMENT. (Woddard-USGS)
Hydrologic Reconnaissance of the Wasatch Plateau-Book Cliffs Coal-Fields Area, Utah


Data obtained during a hydrologic reconnaissance in 1975-77 in the Wasatch Plateau-Book Cliffs coal area of Utah were correlated with existing long-term data. Maps were prepared showing average precipitation, average streamflow, stream temperature, ground- and surface-water quality, sediment yield, and geology. Recommendations were made for suggested approaches for continued monitoring in the coal areas. During the 1931-75 water years, the minimum discharges for the five major streams that drain the area ranged from about 100 to 150 acre-feet per year, and the maximum discharge ranged from about 59,000 to 315,000 acre-feet per year. Correlations indicate that 3 years of low-flow records at stream sites in the Wasatch Plateau would allow the development of relationships with long-term sites that can be used to estimate future low-flow records within a standard error of about 20 percent. Most-water-quality degradation in streams occurs along the flanks of the Wasatch Plateau and Book Cliffs. In the uplands, dissolved-solids concentrations generally ranged from less than 100 to 500 in the Wasatch Plateau and Book Cliffs, with this range the maximum. The Blackhawk Formation, which is the principal coal-bearing formation, produces water in many of the mines. The dissolved-solids concentration in water discharging from springs varies from 0 to 100.

Selected hydrologic data, Price River Basin, Utah, Water Years 1979 and 1980


Selected Hydrologic Data, 1931-77, Wasatch Plateau-Book Cliffs Coal-Fields Area, Utah


The Wasatch Plateau-Book Cliffs coal-fields area in east-central Utah includes a significant part of the State's coal resources and is currently (1977) the most active coal-mining area in the State. Data gathered by the U.S. Geological Survey are presented as part of a hydrologic reconnaissance in cooperation with the U.S. Bureau of Land Management during the period July 1975-September 1977 as well as selected data for the period 1951-75. Also included are selected data collected by private, State, and other Federal agencies. Types of data include water-level records, logs of selected wells, discharge of springs, wells, and mines, and estimated streamflow, chemical analyses of water from springs, wells, mines, and streams, and laboratory analyses of discharged samples. The report is intended to make data available to those assessing the water resources that may be affected by coal-mining activities in the Wasatch Plateau-Book Cliffs coal-field area. (Woodard-USGS)


GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH

UTAH DEPARTMENT OF NATURAL RESOURCES INFORMATION BULLETIN NO. 26, 1972, 53 P., 4 TAB.

Journal Announcement: SWRA1512

This bibliography contains a complete listing to December 31, 1971, of reports relating to the water resources of Utah prepared by personnel of the U.S. Geological Survey. Related subjects include geology, hydrology, and chemical quality of the water. The reports were for the most part prepared by personnel assigned to the Water Resources Division, Utah District, in cooperation with State and local agencies. The bibliography is divided into four major parts: (1) publications of the Geological Survey; (2) publications by agencies of the State of Utah; (3) other publications—reports prepared by survey personnel, but published by other agencies or by professional organizations in their journals; and (4) open-file reports of the Geological Survey. (Woodard-USGS)

Water Resources Data for Utah. Published annually since 1975.


Water resources data for Utah consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality in wells and springs.

Additional water data were collected at various sites not part of the systematic data collection program, and are published as miscellaneous measures. These data represent the part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Utah. (Woodard-USGS)
This Statement analyzes the impacts of surface mining 212 million tons of Dakota Formation coal, followed by underground mining 100 million tons over a period of 40 years. The coal would be slurried and pipelined 73 miles to the proposed Warner Valley power plant in Utah, and 183 miles to the proposed Harry Allen power plant in Nevada. The slurry would require about 8,300 acre-feet per year of water from the Navajo Sandstone, some 600 to 800 feet below the coal. The coal crops out on the eastern escarpment and southern tip of the southward sloping, elongate Paunsugunt Plateau. The rocks dip gently northward. The coal-bearing Dakota Formation is overlain by the 650- to 740-foot-thick, relatively impermeable Tropic Shale, and is separated from the Navajo Sandstone below by as much as 800 feet of relatively impervious rocks including the Carmel Formation. The area drains by through-flowing Kanab Creek and Johnson Canyon Wash and their steep ephemeral tributaries extending into the escarpments. Most of the base flow of Kanab Creek is diverted for irrigation above the site. Alluvial wells provide irrigation and stock water along Kanab Creek as it crosses the site, and along Johnson Canyon Wash downstream from the site. All drains carry thunderstorm-induced heavy sediment loads. Small amounts of mineralized (up to several thousand milligrams per liter dissolved solids) water occurs perched in rocks above the Tropic Shale and issue as springs and seeps on valley sides. Alluvial valley floors undoubtedly exist in places along the major valleys but their existence must be verified. The Navajo Sandstone, as much as 2,000 feet thick, produces hundreds of gallons per minute of water containing less than 400 milligrams per liter dissolved solids to wells. Storage in the aquifer has been estimated to be from 19,000 to 200,000 acre-feet per square mile. Although contended by one investigator who believes significant Navajo recharge occurs vertically through the Tropic Shale, most recharge probably takes place at the outcrop. If so, effects of pumping for slurry would displace down dip, and would not extend to the outcrop area where the aquifer provides base flow to streams. Computer simulations of proposed Navajo pumping probably have produced the range of realistic results because of the variety of aquifer parameter values assumed by three independent investigators. Replacement water for the 20 springs removed by mining could be provided by the proponent. Owing to the existence of poor quality shallow ground water, disrupted aquifer water may not degrade receiving streams.

The Alton site, 3.6 square miles of the much larger Alton Coal Field, contains about 27 million tons of identified coal within 200 feet of land surface which could be surface mined. The main coal bed, 16 feet thick, is in the upper part of the Dakota (sandstone) Formation. It crops out near bottoms of steep-sided valleys, and in the north, as much as 200 feet below the south-sloping mesa tops. The mesas are dissected by gullies draining ephemerally to the comparatively wide, flat valley of Skutumpah Creek and to the narrow, steep-sided valley of Thompson Creek. Both creeks are perennial, but flashy. The area is highly faulted, displacing both coal and aquifers. Little water occurs in the relatively impermeable Tropic Shale at the surface above the Dakota. In some places, small quantities are in the fractured coal beds, and in one place, in the Dakota more than 100 feet above the coal. Less than a mile away water is 130 feet below the coal. Dissolved solids in four test holes ranged from 641 to 2,210 milligrams per liter, sulfate being the chief constituent in the more highly mineralized waters. Mining will encounter less water than needed for operations. Special protection and restoration practices will be required to prevent further deterioration of water quality and to avoid increasing existing high erosion and sedimentation.

Reclaimability Analysis of the Emery Coal Field, Emery County, Utah
BLM, Denver, Colorado
EMRZA Report No. 16-79

Most of the 3.5-square-mile Emery study site about 5 miles south of Emery in the Emery Coal Field occupies a gently north-westward sloping, slightly rolling, partially dissected mesa. Relief is about 1,000 (7?) feet. The rugged east-facing escarpment in the northern part of the site drains into south-flowing Muddy Creek (lower part perennial). The southern part drains down the mesa to Quitchupah Creek. Annual precipitation is about 7.5 inches. An undetermined amount of strippable coal in the upper Perron Sandstone Member of the Mancos shale formation underlies less than 100 feet of overburden in about 40 acres in the extreme south and 30 acres in the extreme north. Small amounts of water may occur intermittently in and above the coal. Larger amounts occur in deeper aquifers.
This document evaluates the impacts of an 860-megawatt coal-fired electric generating plant in Castle Valley, 20 miles north-northeast of Emery, central Utah. The plant would use 84 million tons of coal in 35 years from the existing Wilberg underground mine in Grimes Wash 13 miles northwest. The generator site required draining shallow, poor quality (9,000 milligrams per liter dissolved solids) ground water at a rate of 80,000 gallons per day into Rock Canyon Creek. About 10 million tons of ash and sludge would cover 160 acres an average of 15 to 25 feet thick in an area of shallow water table. About 7,000 acre-feet per year of water would be consumed by purchase of de creed water rights from Millecree Reservoir on Ferron Creek 11 miles south-west of the plant. Coal is in the Hiawatha and Bear Canyon seams of the Upper Cretaceous Mesaverde Group Blackhawk Formation, which crop out about 1,000 feet below the top of a south-pointing finger of the Wasatch Plateau (East Mountain). The coal is overlain by the Price River, North Horn, and Flagstaff Formations. These sedimentary strata dip about 5 degrees to the west. Consumption of 7,000 acre-feet of water annually would reduce dissolved solids content of the Colorado River system by nearly 8,000 tons (0.3 to 0.6 milligrams per liter), and reduce flow at Lee's Ferry by 2,000 acre-feet (0.15 percent of total flow) per year. Subsidence following mining, if it occurs, could affect springs and reduce flow in Roan Canyon, Deer Creek and Grimes Wash, and would raise or lower water levels in Snow and Flag Lakes.

Emery Power Plant, Utah
BLM, Richfield, Utah
FES, 1976

This document evaluates the impacts of adding 800 megawatt generating capacity to the Emery Power Plant in Castle Valley, 20 miles north-northeast of Emery, central Utah. The plant would require 70 million additional tons of coal over 35 years from the existing Wilberg and Church mines and 14,000 acre-feet of water annually. The water would come from existing or proposed reservoirs on Ferrin and Cottonwood Creeks, both tributary to the San Rafael, Green, and Colorado Rivers. Annual precipitation is 8.19 inches. About 10 million tons of ash and sludge would be deposited on 160 acres near the plant site. The coal is in the Hiawatha and Bear Canyon seams of the Upper Cretaceous Mesaverde Group Blackhawk Formation. They crop out about 1000 feet below the top of a south-pointing finger of the Wasatch Plateau (East Mountain). The coal is overlain by the Price River, North Horn and Flagstaff Formations. These sedimentary strata dip about 5 degrees to the west. Water consumption would eliminate 3,415 irrigated acres, reduce San Rafael River flow by 7,700 acre feet per year (10%), and reduce annual flow at Lee's Ferry, Colorado River, by 3,850 acre-feet (0.03%). Mine subsidence, if it occurs, could affect aquifers above the mines, and springs and surface waters.

Rehabilitation Potential for the Henry Mountain Coal Field, Southeastern Utah
BLM, Denver, Colorado
EMRIA Report No. 15-78

The 8-square-mile Henry Mountain Coal Field study site is an irregular 6- by 2-mile strip extending across Wildcat Mesa on the west and Sweetwater Creek, Pete Steele Bench, Dugout Creek, and Apple Brush Flat on the east. Relief is about 600 feet. Dry washes draining to creeks extend into the mesa and piedmont escarpments. Precipitation is 8 to 9 inches, evaporation 64.8 inches and evapotranspiration 21 to 27 inches annually. Several thin coal beds occur in the Emery Sandstone tongue of the Hancos Shale Formation. Maximum coal thickness in one of eight core holes, is 5 feet. Very little water occurs in the coal and overburden. Water for revegetation might come from water harvesting, 5,000-foot well(s) in the Navajo Sandstone Formation (uncertain yield and quality) or purchase, or any combination.

Intermountain Power Project
BLM, Richfield, Utah
FES, 1979

The operation of the plant would consume 50,000 acre-feet of water annually. The use of water from the Fremont River would decrease the downstream flow by 57 percent and increase the salinity of the Colorado River, and could require the retirement of 7,200 to 7,800 acres of irrigated farmland. The natural flow of 24 springs and seeps and four wells could be stopped for over 50 years beyond the life of the project.

Kaiparowits Project, southern Utah
BLM, Cedar City, Utah
FES, 1976

This statement evaluates impacts of a proposed 3,000 megawatt coal-fired electric generating plant, four underground coal mines, a limestone quarry, all in central southern Utah, and transmission lines extending to southern
California. The plant is on a narrow, southern canyon-bound extension (Fourmile Bench) of the Kaiparowits Plateau. The mine entries are inclined into the John Henry Member of the Cretaceous Straight Cliffs Formation. The minable leased coal, in four principal beds, ranges from 100 feet beneath canyon floors to 900 feet below the bench surface. The proposed mine straddles the Smokey Mountain anticline. The underlying Dakota Sandstone dips several degrees northeast and southwest. The 47,768-acre lease includes more than 1.8 billion tons of coal in beds more than 4 feet thick. Twelve million tons will be mined and 9 million tons will be for use in the power plant. The plant and mine entrance areas are drained by ephemeral tributaries to Lake Powell (Colorado River). Annual precipitation is 10 inches at the plant site and 7 inches at the mine entrances, about 6 to 10 miles southeast and 500 feet lower than the plant site. The main ground water body begins about 1,000 feet below the plateau surface and 100 feet beneath the canyon bottoms. Small quantities of fresh to slightly saline water occur sporadically, perched in the coal and in lenticular sandstones above and below the coal, and issue as springs in the canyon sides. The power plant would consume 47,000 acre-feet per year, and the mine 3,000 acre-feet per year of water, both from Lake Powell, comprising 3.8 percent of Utah's allotment. The "new town" would need 9,690 acre-feet per year from the underlying Upper Triassic (? Navajo Sandstone, possibly tributary (bank storage) to Lake Powell. This consumption would increase salinity in Lake Powell by about 2 milligrams per liter. Mining could cause subsidence of 10 to 14 feet over 63 square miles and disrupt perched aquifers now yielding 160 acre-feet per year and comprising 0.33 percent of the impact area.

Uinta - Southwestern Utah Regional Coal
BLM, Salt Lake City, Utah
FEIS, Undated (1981)

This statement analyzes impacts of leasing 275.7 million tons of recoverable coal in 8 tracts in the Wasatch Plateau and Emery Coal Fields on the Wasatch Plateau and in 4 tracts in the Kaiparowits Coal Field on the Kaiparowits Plateau. The Wasatch Plateau coal, 187.8 million tons, is in the lower third of the Cretaceous Blackhawk Formation, and in the Ferron Sandstone Member of the Mancos Shale Formation. All but 50 million tons would be mined underground. The Kaiparowits coal, 19.5 million tons in the John Henry Member of the Cretaceous Straight Cliffs Formation would be mined underground. Precipitation on the Wasatch Plateau ranges from 6 to 25 inches per year, and on the Kaiparowits from 8 to 12 inches per year. Only one tract has a throughflowing stream, the sometimes dry perennial Muddy Creek. Small amounts of water occur perched above and in the coal layers, ranging from fresh to slightly saline. The Ferron Sandstone provides as much as 50 gallons per minute to wells in parts of the Wasatch Plateau. The Navajo Sandstone can sustain as much as 1,000 gallons per minute to wells beneath the Kaiparowits Plateau away from its outcrop area. Mining would have no effect on the

regional groundwater system; impacts would be limited to mine areas. Surface-mined areas would have higher recharge and storage. Underground mining would diminish or alter points of spring discharge. Total mine drainage of less than 500 acre-feet per year would not seriously affect water quality.

Uinta-Southwest Utah Regional Coal, Round Two
BLM, Salt Lake City, Utah
FEIS, 1983

This document describes the expected impacts of leasing 1,907 billion tons of Federal coal in 25 tracts in central and southern Utah and 2 in west-central Colorado. Of the 82,289.37 acres of overlying surface, only 687 acres (0.008 percent) would be surface mined (in the Emery and Alton coal fields). The Utah leases are in the Book Cliffs, Wasatch Plateau, Emery and Alton Coal Fields. Both Colorado leases are in the Paonia-Somerset coal field. By the year 2,000, 7,500 acre-feet of water (7,000 for community use) would be required annually. In the Book Cliffs and Wasatch Plateau coal fields the coal is in the Cretaceous Blackhawk Formation. In the Emery field, the coal is in the Ferron Sandstone, lower in the Cretaceous section. The coal-bearing zone in the Alton coal field is the Dakota Sandstone. The Colorado coal is in the Cretaceous Mesaverde Formation.
EROS REGIONAL-SCALE OVERVIEW LINKING LAND USE AND ENVIRONMENTAL PROCESSES IN CARETS
ALEXANDER R. M.
GEOLoGY SURVEY, WASHINGTON, D.C. GEOGRAPHIC APPLICATIONS PROGRAM

THE SYMPOSIUM ON SIGNIFICANT RESULTS OBTAINED FROM THE EARTH RESOURCES TECHNOLOGY SATELLITE-1 VOL I-TECHNICAL PRESENTATIONS, SECT B: GUARDIAN SPACE FLIGHT CENTER, NEW CARROLLTON, MD., MARCH 5-9, 1975: NATIONAL AERONAUTICS AND SPACE ADMIN REPT. NASA SP-327, P 931-937, 1975, 3 FIG, 1 TAB,

Journal Announcement: SWRAU713
A MOSAIC OF EROS IMAGES OF THE CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE WAS USED TO PARTITION THE REGION INTO ZONES ON THE BASIS OF SIMILARITY OF TONES AND TEXTURES VISIBLE AT A REGIONAL-SCALE OVERVIEW. THE RESULTING PATTERNS WERE COMPARED WITH EXISTING SMALL-SCALE MAPS OF THE REGION REPRESENTING RELIEF, LAND SURFACE FORMS, GEOLOGY, SOILS, VEGETATION, FOREST TYPES, AND LAND USE. THE EROS-DERIVED ZONES MOST CLOSELY RESEMBLE THE PATTERNS ON THE SMALL-SCALE LAND USE MAP, SUGGESTING THAT LAND USE IS AN Indicator OR RESULTANT SURFACE EXPRESSION OF SEVERAL INTERACTING ENVIRONMENTAL PROCESSES. THESE RESULTS LEND SUPPORT TO A MODEL OF INTERDISCIPLINARY REGIONAL ANALYSIS IN WHICH DATA ON LAND USE AND LAND USE CHANGE BECAME THE BASIC DATA ENTRY INTO A REGIONAL INFORMATION SYSTEM TO (KNAPP-UGS)

Stream quality in Appalachia as related to coal-mine drainage 1965
U.S. Geological Survey Circular 526, 27 P.
A stream-quality reconnaissance at 318 locations in May 1955 offered the first opportunity for a contemporaneous regional collection and appraisal of water-quality data in Appalachia. The results provide a means of regional comparison of the influence of coal-mine drainage on stream quality at approximately medium streamflow. The results disclose that the chemical quality of the water at nearly 200 sites did not meet recommended drinking water standards. At many of these sites, inferior quality was caused by excessive concentrations of solutes commonly associated with coal-mine waters.

Water-quality damage from mine drainage is particularly severe in the more heavily mined northern one-third of the region where high sulfate contents, free mineral acidity, and low pH are typical of most affected streams. A deficiency in natural stream alkalinity in this part of the coal region contributed greatly to the massive effect of mine drainage upon stream quality. However, data collected from streams affected by mine drainage along the west edge of this part of the coal field suggest extensive neutralization of mine waters. In southern Appalachian coal-mine drainage had less influence on stream quality than in northern Appalachia. Fewer streams in this area were influenced by mine drainage and the magnitude of stream damage for affected streams was less than in northern Appalachia. (Author's abstract)

TECHNIQUES FOR QUALITY-OF-WATER INTERPRETATIONS FROM CALIBRATED GEOPHYSICAL LOGS, ATLANTIC COASTAL AREA
BAHN DONALD L.
GEOLoGY SURVEY, NOFOLK, VA. WATER RESOURCES DIV.
GROUNDTWATER, VOL 14 NO 4 P 25-38 JULY-AUGUST 1971, 14 P, 6 FIG, 1 TAB, 4 REF

Journal Announcement: SWRAU21
IN THE FALL AND WINTER OF 1967-68, A 2587-FOOT TEST WELL WAS DRILLED AT MODEST'S HURDLES FILTER PLANT, NORFOLK, VIRGINIA, THE WELL PENETRATED ROCKS OF POST-MIOCENE AGE, LATE EOCENE, AND YOUNGER AGES. EMPIRICAL WATER QUALITY DATA WERE USED FOR CALCULATION OF GROUNDWATER QUALITY FROM CALIBRATED GEOPHYSICAL LOGS. CHEMICAL ANALYSES OF WATER SAMPLES FROM SEVEN SEPARATE ZONES AT DEPTHS BETWEEN 850 FEET TO 2500 FEET BELOW SEA LEVEL INDICATE THAT THE WATER TYPE CHANGES FROM A PREDOMINANTLY SODIUM NITRATE WATER ABOVE 1700 FEET TO A SODIUM CHLORIDE WATER IN THE DEEPER ZONES USING CALIBRATED GEOPHYSICAL LOGS. AN APPROXIMATION OF THE DISSOLVED SOLIDS AND CHLORIDE CONTENT MAY BE CALCULATED. IN THE TIDEWATER AREA, THE SATURATED RESISTIVITY(RESISTIVITY) READING OF THE ELECTRIC LOG IS LESS THAN 65 OHMMETERS THE TOTAL SOLIDS AND CHLORIDE CONTENT OF THE WATER ARE PROBABLY IN EXCESS OF PUBLIC HEALTH STANDARDS FOR POTABLE WATER. AN EMPIRICAL METHOD OF CALCULATING THE QUALITY OF WATER FROM ELECTRIC LOGS IS PRESENTED. (KNAPP-UGS)

GROUNDTWATER RESOURCES OF THE EASTERN SHORE OF VIRGINIA AND THE JAMES, YORK, AND RAPPAHANNOCK RIVER BASINS OF VIRGINIA, EAST OF THE FALL LINE
DEMECHANICAL, GEORGE D.
U.S. GEOLOGICAL SURVEY
U.S. GEOLOGICAL SURVEY, ATLAS HA-284, 2 SHEETS, 1968

Journal Announcement: SW46B05
INFORMATION FROM A VARIETY OF PUBLISHED AND UNPUBLISHED SOURCES IS COMPILED, AND BROAD INTERPRETATIONS OF EXISTING INFORMATION ARE MADE. THE COASTAL PLAIN IS UNDERLAIN BY UNCONSOLIDATED CHETACEOUS AND YOUNGER SEDIMENTS WHICH DIP SOUTHEAST 20 TO 60 FT PER MILE IN A GRADUALLY THICKENING WEST. YIELDS OF WELS RANGE FROM A FEW GPM TO SEVERAL HUNDRED GPM. MOST OF THE DEVELOPED GROUNDTWATER IS FROM ARTESSIAN Aquifers.

373
374
study of groundwater availability and quality in the county of James City. The coastal-plain sediments, parts of which underlie the county, are the largest source of groundwater in Virginia. Four aquifers form the complex aquifer system, hydraulic characteristics vary from aquifer to aquifer and from place to place. The Cretaceous aquifer furnishes nearly all the water for industrial and municipal needs. Movement of water in the Cretaceous aquifer is toward cones of depression formed by pumping centers at Williamsburg and Dow Baischke Co. All aquifers contain water that generally meets State standards for drinking water. Water in the Cretaceous aquifer is of the sodium chloride bicarbonate type. As depth of aquifer increases, the concentrations of dissolved solids and chloride also increase. The saline water (more than 250 milligrams per liter) occupies the deeper parts of the confined aquifers. The amount of water stored in the coastal sediments is estimated to be 650,000 million gallons. An amount of water in storage adequate to accommodate the expected daily demand of 9,8 million gallons per day in year 2000 is feasible provided pumpage is distributed over the county. (USGS)

Acid mine drainage (AMD) and its impact on a small Virginia stream
Hoehn, R. C., and Stas, P. M., 1977
Water Resources Bull. 13(4), 653-660

Hydrology of area 16, eastern coal province, Virginia, Tennessee, 1981
Munson, R. N., and others

The coal provinces of the country are divided into hydrologic reporting units. Hydrologic data for Virginia and Kentucky are presented as tables, maps, and other illustrations designed to be useful to mine owners, operators, and consulting engineers in planning and implementing surface-mine operations that comply with the environmental requirements of the "Surface Mining Control and Reclamation Act of 1977."

Hydrogeology of the Observation Well Site at the U.S. Geological Survey National Center, Reston, Virginia
Larsen, D. L., and others
Open-file report 79-146, 1978, 15 p. 4 fig. 6 tab. 8 ref.

Journal Announcement: SWA11720

The U.S. Geological Survey's National Center is on a 105-acre tract straddling rocks of two distinct types. These are pelitic cherts of late Precambrian or early Paleozoic age; and sandstones, shale, siltstones, conglomerates, and shale of
of Triassic age. Two observation wells and two core holes were drilled on the part of the property underlain by Triassic sedimentary rocks. The wells were drilled to monitor water levels, for equipment testing and to determine the hydraulic properties of the Triassic rocks. Geophysical logs were run and lithologic logs prepared from drill cuttings and cores. An aquifer test was conducted and indicated that the water comes from two thin zones, presumably bedding plane partings. The flowmeter surveys, core samples, and geophysical logs suggest that the Triassic sandstone is a fractured-rock aquifer. A water sample taken at the close of the aquifer test was low in dissolved solids, soft, and of excellent quality.

(woodard-USGS)

Technique for estimating magnitude and frequency of floods in Virginia

Miller, E. M., 1978

Map Showing Drainage Basins and Location of Streamflow-Measuring Sites in Fairfax County, Virginia

Open-file report 77-271, 1977, 1 sheet, 2 ref.,

Journal Announcement: SWA1106

A drainage basin map of Fairfax County shows basins for which continuous flow records were obtained or more. Areas of minor streams draining directly into the Potomac River and Occoquan Creek are tabulated. The locations of flow and partial-record (peak-flow and low-flow) flow sites are shown. The use of topographic and climatic characteristics of drainage basins to transfer flow data from gauged areas to ungauged areas is discussed. (woodard-USGS)

Water Resources of the Appalachian Region: Pennsylvania to Alabama, 1965

Acid streams in the Appalachian region are identified and discussed, and the amount of acidity as H2SO4 discharged annually into several streams is tabulated.

Virginia streamflow data program analysis
Nuckles, E. H., 1970
Also presented is a compilation of the available hydrologic data and a description of related studies expected to provide information and data useful to the ongoing work. The data compilation includes: hourly precipitation for selected days and annual maximum daily precipitation for nine sites; annual maximum streamflow rates and stages for three stream-gaging sites; hourly gageheight and discharge rates for selected storms at four stream-gaging sites; flood profiles; flood-frequency relations; and other streamflow information.

GROUND-WATER RESOURCES OF ACCOMACK AND NORTHAMPTON COUNTIES, VIRGINIA
SINNOTT, ALLEN E. CHASE, G.R. TIBBITS, JR.
U.S. GEOLOGICAL SURVEY.
VIRGINIA DEP OF CONSERV AND ECON DEVELOP, DIV OF MINERAL RESOURCES.
Journal Announcement: SWRL-201
GROUNDWATER RESOURCES OF ACCOMACK AND NORTHAMPTON COUNTIES, IN THE VIRGINIA PART OF THE DELMARVA PENINSULA, WERE STUDIED BY THE USGS AND THE VIRGINIA DIVISION OF MINERAL RESOURCES. MEAN ANNUAL TEMPERATURE IS 58 DEG AND THE PRECIPITATION IS 45 IN. THIN SURFICIAL PLEISTOCENE SANDS AND CLAY ARE UNDERLAI BY MIocene DEPOSITS WHICH SUPPLY MOST OF THE WATER FOR MUNICIPAL AND INDUSTRIAL USES. CHEMICAL CHARACTER OF THE DEEPER WATER SUGGESTS HYDRAULIC CONNECTION WITH THE ARTEIAN AQUIFERS EAST OF CHESAPEAKE BAY. DOMESTIC WATER IS MAINLY FROM WELLS IN THE PLEISTOCENE DEPOSITS. LARGER WELLS ARE MAINLY IN Miocene AQUIFERS: ONE NEAR EXMORE YIELDED 766 GPM WITH 57 FT OF DRAWDOWN; AND ONE AT CAPE CHARLES YIELDS 645 GPM. THE WATER IS GOOD, MODERATELY HARD, AND USUALLY LOW IN IRON AND FLUORIDE. DEEP Miocene WELLS YIELD WATER HIGH IN CARBONATE AND FAIRLY HIGH IN CHLORIDE. WITHDRAWAL IS NOT EXCESSIVE ANYWHERE AND THE SUPPLY IS ADEQUATE FOR FORESEEABLE NEEDS. WELL DESCRIPTIONS, AQUIFERS, WATER LEVELS, YIELDS, AND CHEMICAL ANALYSIS ARE TABBULATED. MAPS ARE CROSS SECTIONS AND A STRATIGRAPHIC COLUMN SHOW LOCATION, GEOLOGY, AND STRATIGRAPHY. (KNAPP-USGS)

Geohydrologic Reconnaissance of the Upper Potomac River basin Trainers: Frank W. and Watkins, F. R., Jr., 1975

Mineral Resources of the Appalachian Region

Water Resources Data for Virginia, published annually since 1975,

Available from the National Technical Information Service, Springfield, VA 22161

Water resources data for Virginia consist of records of stage, discharge, and water quality of streams; stage-contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Virginia. (USGS)

WATER RESOURCES INVESTIGATIONS IN VIRGINIA, 1969
GEOLoGICAL SURVEY, WASHINGTON, D.C.
GEOLoGICAL SURVEY REPORT OF INVESTIGATIONS FOLDER, 1 SHEET, 1969.

Journal Announcement: SWRAUS21
The water resources studies and investigations of the U.S. GEOLOGICAL SURVEY IN VIRGINIA ARE SUMMARIZED. A SELECTED LỊBROGRAPH OF MATERIAL CONCERNING THE STATE IS INCLUDED. A LIST IS GIVEN OF STATE AND FEDERAL AGENCIES, COUNTIES, AND CITIES WHO COOPERATE IN DIFFERENT PARTS OF THE PROGRAM. THE HYDROLOGIC DATA NETWORK CONSISTS OF 177 PRIMARY, SECONDARY, AND WATER MANAGEMENT STREAMFLOW STATIONS; 64 GROUNDWATER OBSERVATION WELLS; AND 21 WATER QUALITY OBSERVING SITES. SMALL STATE MAPS SHOW PRINCIPAL SOURCES OF GROUNDWATER, DISCHARGE OF THE PRINCIPAL RIVERS, AVERAGE ANNUAL PRECIPITATION, AND AVERAGE ANNUAL RUNOFF. A MAP, SCALE 1:25 MI TO THE INCH, SHOWS BY SYMBOLS, NUMBERS, AND COLORED OUTLINE THE HYDROLOGIC DATA NETWORK AND INVESTIGATIONS IN VIRGINIA IN JULY 1969. (WOODARD-USGS)

Ground-water resources of the Appalachian region
Prior, Granville, G., 1960

Hydrology Data for the Guyandotte River Basin, West Virginia. Bader, John S., Chisholm, James L., Downs, Sanford C., and Bragg, Robert L.

Bader, J. S.
U.S. Geological Survey Atlas, 1 Sheet, 6 Illus., 5 Tables, 16 Ref.

Water Resources of the Coal River Basin, West Virginia.
Bader, J. S., Chisholm, J. L., Downs, S. C., and Morris, F. D., 1976

Stream Quality in Appalachia as Related to Coal-Mine Drainage, 1965. (Duplicated see Alabama and Pennsylvania)
Biesecker, J. E., and George, J. R.

Effects of deep and surface coal mining on the hydrologic environment of selected stream basins in southern West Virginia.

Geology and Economic Resources of the Ohio River Valley in West Virginia.
Carlston, Charles W., and Graeff, George D., Jr.
U.S. Geological Survey

Stress and Recovery of Aquatic Organisms as Related to Highway Construction Along Turtle Creek, Boone County, West Virginia.
Chisholm, J. L.; Downs, S. C.
During and after construction of Appalachian Corridor G, a divided four-lane highway in West Virginia, five benthic invertebrate samples were collected at each of four sites on Turtle Creek, and, for comparative purposes, three samples were collected at each of two sites on Lick Creek, an adjacent undammed stream. Diversity index, generic counts, and total count initially indicated severe depletion or destruction of the benthos of Turtle Creek, but, within 1 year after highway construction was completed, the benthic community of Turtle Creek was similar to that of Lick Creek. The greatest degradation occurred near the headwaters of Turtle Creek because of erratic movement of sediment resulting from high streamflow velocity. Diversity indices ranged from 0 to 3.41 near the headwaters in the original channel, but only from 0.96 to 2.42 farther downstream in a freshly cut channel. The final samples from Turtle Creek, which were similar to those taken from Lick Creek at the same time, had generic counts of 10 at the most upstream site and 16 near the mouth. A total of 147 organisms was found near the headwaters, whereas a total of 668 was found near the mouth of the stream. The total number of organisms collected at each site was proportional to the drainage area upstream from the site. As a result of tributary inflow from unaltered drainage areas and organisms drift, rapid repopulation and stabilization of the benthic community occurred. Channel relocation, bank recontouring, and reseeding also accelerated the recovery of the benthic community. (Woodard-SGS)


Surface mining of coal in the United States increased from 406 million tons in 1970 to almost 400 million tons from 1978 to 1979. In the coal-rich 1,560-square-mile Tug Fork basin located in Kentucky, Virginia, and West Virginia, there has been a 2,500 percent increase since 1950 in areas affected by surface-mining activities.

This study used a rainfall-runoff model to determine if land-use changes associated with surface mining in the Tug Fork basin have affected basin streamflow characteristics. The model was calibrated and verified for two periods, one representing 1980 land-use and one representing 1950 land-use. Two 29-year synthetic daily streamflow time series representing the two land-use conditions were generated. Statistical tests performed on the two time series at 15 points in the basin showed no difference at the 0.01 percent confidence level at any of the locations.

In addition, analyses were made to determine if future increases in surface-mining activities might affect basin streamflow. One analysis showed that increasing mining in an upland watershed by as much as 200 percent had little effect on streamflow in the intermediate area and no effect on streamflow at downstream locations along the Tug Fork. Even for a scenario where all areas disturbed by mining were assumed totally totally, the modeling process demonstrated that the increase in mean-annual 1-day high flows (for recurrence intervals of 2, 5, 10, 25, 50, 100, and 200 years) was less than 4 percent at the basin outlet.


CONSERVATION MEASURES, THE ABSENCE OF APPRECIABLE
SEDIMENT-PRODUCING CONSTRUCTION ACTIVITIES, AND A REDUCTION
OF THE AMOUNTS OF RAINFALL AND RUNOFF DURING THE SECOND, 4-YEAR
PERIOD. PARTICLE-SIZE DISTRIBUTION OF THE SUSPENDED SEDIMENT
DISCHARGED FROM THE WATERSHED REMAINED UNCHANGED DURING THE TWO
4-YEAR PERIODS. ALTHOUGH SAND AND SOME SILT WERE DEPOSITED
IN UPSTREAM RESERVOIRS, SANDS AND OTHER SEDIMENTS WERE
ENTRAINED IN THE FLOW BELOW THE RESERVOIRS. (WOODARD-USGS)

RECORDS OF WELLS, SPRINGS, AND TEST BORINGS; CHEMICAL ANALYSES
OF WATER, SEDIMENT ANALYSES, STANDARD STREAMFLOW DATA
SUMMARIES, AND SELECTED DRILLERS' LOGS FROM THE LITTLE KANAWHA
RIVER BASIN IN WEST VIRGINIA

FRIEL, E. A.; BAIN, G. L.
GEOLOGICAL SURVEY CHARLESTON, W. VA. WATER RESOURCES DIV.
GEOLOGICAL SURVEY BASIC DATA REPORT NO 2, 1971, 76 P, 4 FIG, 12 TAB.

Journal Announcement: WRAUD50

BASIC DATA ARE PRESENTED FOR THE WATER RESOURCES (SURFACE
WATER AND GROUNDWATER) OF THE LITTLE KANAWHA RIVER BASIN IN WEST
VIRGINIA. MOST OF THE BASIC DATA WERE OBTAINED DURING THE
PERIOD 1966-1969. INCLUDED ARE SUMMARIES OF WATER-BEARING
PROPERTIES OF THE PRINCIPAL ROCK UNITS UNDERLAYING THE
LITTLE KANAWHA BASIN, LABORATORY AND FIELD CHEMICAL ANALYSES OF
SURFACE-WATER SAMPLES, INSTANTANEOUS SUSPENDED SEDIMENT
ANALYSES AT STREAM-GAGING STATIONS, STREAMFLOW RECORDS OF DAILY
DISCHARGE FOR EACH STATION, AND WELL DRILLERS' LOGS. (WOODARD-USGS)

RECORDS OF WELLS, SPRINGS, AND STREAMS IN THE POTOMAC RIVER
BASIN, WEST VIRGINIA

FRIEL, E. A.; HOBBA, W. A., JR; CHISHOLM, J. L.
GEOLOGICAL SURVEY MORGANTOWN, W. VA. WATER RESOURCES DIV.
WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY, (MORGANTOWN)
BASIC DATA REPORT NO 3, 1975, 96 P, 3 FIG, 10 TAB.

Journal Announcement: WRAUD95

THIS BASIC DATA REPORT WAS COMPILLED FROM WATER-RESOURCES
STUDIES OF THE POTOMAC RIVER BASIN IN WEST VIRGINIA. MOST OF THE
BASIC DATA WERE OBTAINED DURING THE PERIOD 1968-1971. THE
STUDY IS A PART OF THE CONTINUING INVESTIGATION OF THE WATER
RESOURCES OF THE RIVER BASINS OF WEST VIRGINIA BY THE U. S.
GEOLOGICAL SURVEY, CONDUCTED IN COOPERATION WITH THE WEST
VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY AND THE WEST VIRGINIA
DEPARTMENT OF NATURAL RESOURCES, DIVISION OF WATER RESOURCES.
OTHER INCLUDED DATA ARE FROM THE FILES OF THE U. S. GEOLOGICAL
SURVEY OR FROM PREVIOUSLY PUBLISHED REPORTS. THE 10 TABLES OF
DATA INCLUDE: (1) RECORDS OF WELLS AND SPRINGS, (2) CHEMICAL
ANALYSES OF GROUNDWATER, (3) CHEMICAL ANALYSES OF SURFACE
WATER, (4) FIELD CHEMICAL ANALYSES OF SURFACE WATER AT
STREAM-GAGING STATIONS, (5) LOW-FLOW MEASUREMENTS AT FLOW
MEASUREMENT STATIONS, (6) DAILY SPECIFIC CONDUCTANCE AND DISCHARGE OF MILLIONS RUN AT CAPON

W. Virginia W. Virginia
BRIDGE, (7) PESTICIDE ANALYSES OF GROUNDWATER, (8) STANDARD
SUMMARIES OF STREAMFLOW DATA, (9) DISCHARGE MEASUREMENTS
AT PARTIAL-RECORD AND MISCELLANEOUS 'ST', AND (10) SELECTED
DRILLERS' LOGS. (WOODARD-USGS)

Water Resources of the Monongahela River Basin West Virginia
FRIEL, E. A.; WILMOTH, B. M.; WARD, P. E.; WALK, J. W.
U.S. Geological Survey

Hydrology of Area 5, Eastern Coal Province, Pennsylvania,
Maryland, and West Virginia, (duplicated see Pennsylvania).
HERBS, W. J.; SHAW, L. C.; UPTON, D. E.
Geological Survey Open-File Report 81-538 (WR1), September
1981, 92 p, 60 FIG, 22 TAB, 57 REF, Appendix.

Journal Announcement: SWRA1411

Investigation of Trends in Flooding in the Tug Fork Basin of
Kentucky, Virginia, and West Virginia
HIRSCH, R. M.; SCOTT, A. G.; WYANT, T.
Available from Supp. of Documents, GPO, Washington, DC
FIG, 16 TAB, 58 REF, 5 APPEND.

Journal Announcement: SWRA1601

Statistical analysis indicates that the average size of annual
flood peaks of the Tug Fork (West Virginia and Kentucky) has been increasing. However, additional statistical
analysis indicates that flood levels exceeded typically once or twice a year in the period 1947-1979 are any
more likely to be exceeded now than in 1947. Possible trends in stream-channel size are also investigated at
three locations. No discernible trends in channel size are noted. Further statistical analysis of the trend in the
size of annual flood peaks shows that much of the annual variation is related to local rainfall and to the
'natural' hydrologic response in a relatively undisturbed subbasin. However, some statistical indication of trend
prevails after accounting for these natural factors, though it is of borderline statistical significance. This suggests the need
for further study in the basin that may relate flood magnitudes to both rainfall and to land use. (USGS)

Coal mines as a source of water for public supply in Upshur
County, West Virginia. HOBBA, W. A., JR., 1983

Ground-Water Hydrology of the Little Kanawha River Basin, West
Virginia
HOBBA, W. A., JR.

Effects of Underground Mining and Mine Collapse on the Hydrology of Selected Basins in West Virginia


The effects of underground mining and mine collapse on areal hydrology were determined at one site where the mined bed of coal lies below major streams. Subsidence cracks observed at land surface generally parallel predominant joint sets in the rocks. The mining and subsidence cracks increase hydraulic conductivity and interconnection of water-bearing rock units, which in turn cause increased infiltration of precipitation and surface water, decreased evapotranspiration, and higher base flows in near-surface streams. Water levels in observation wells in mined areas fluctuate as much as 100 feet annually. Both gaining and losing streams are found in mined areas. Mine pumping and drainage can cause diversion of water underground from one basin to another. Areal and single-well aquifer tests indicated that near-surface rocks have higher transmissivity in a mine-subside basin that in unmined basins. Increased infiltration and circulation through shallow subsurface rocks increases dissolved mineral loads in streams, as do treated and untreated contributions from mine pumping and drainage. Abandoned and flooded underground mines make good reservoirs because of their increased transmissivity and storage. Subsidence cracks were not detectable by thermal imagery, but springs and seeps were detectable.

Water Resources of the Potomac River Basin, West Virginia


This report presents basic information and interpretations regarding the occurrence, availability, and quality of the water resources of the Potomac River basin in West Virginia. The basin includes an area of 3,446 square miles or about 15% of the State. The present population is 125,500. Considerable future increases in population, with increases in recreational and industrial expansion, are anticipated. Thus, the water resources are essential in proper planning for development. Virtually all water in the basin is derived from precipitation. Annual baseflow in the basin is 38 inches per year. Of this amount 25 inches is returned to the atmosphere by evapotranspiration, 18 inches becomes ground-water recharge, and 5 inches becomes direct overland runoff. Average annual streamflow is 0.9 cubic feet per second per square mile. The carbonate rocks of Berkeley and Jefferson Counties are the best aquifers and may yield more than 600 gallons per minute to individual wells tapping cavernous zones. The shale rocks of the central part are generally the poorest aquifers. The chemical quality of both surface water and ground water is very poor to excellent, depending on location. (Woodard-USGS)

Abandoned Coal Mines in West Virginia as Sources of Water Supplies.


During 1973-1975, the U.S. Geological Survey collected hydrologic data to describe the character of the ground- and surface-water resources of the Coal River basin in southern West Virginia. Streamflow and chemical, physical, and biological data were collected at about 150 stream sites. Descriptive data were collected at about 2000 wells sites and water samples were collected from nearly 400 of them were analyzed for chemical and physical properties. The chemical composition of surface water at the time of low flow and moderate flow was determined for about 115 small streams. (Woodard-USGS)

Hydrologic Modeling in Selected Small Watersheds in the Coal River Basin of West Virginia.


The hydrologic model was developed for the Potomac River Basin in West Virginia. The model was developed to evaluate the effects of changes in land use and water use on the water resources of the basin. The model was developed using a computer program called the Watershed Model (Watershed Model Group, 1980). The model was calibrated using data from the Potomac River and its tributaries. The model was verified using data from the Potomac River and its tributaries. The model was used to evaluate the effects of changes in land use and water use on the water resources of the basin. The model was used to evaluate the effects of changes in land use and water use on the water resources of the basin. The model was used to evaluate the effects of changes in land use and water use on the water resources of the basin.
Eastern Coal Province is located at the northern end of the Eastern Coal Province in eastern Ohio, northern West Virginia, and western Pennsylvania. It is part of the upper Ohio River basin, which includes the Beaver, Mahoning, and Shenango Rivers. The area is underlain by rocks of the Pottsville, Allegheny, and Conemaugh Groups (upper formations) and the Dunkard Group. Area 4 has a temperate climate with an annual average rainfall of 38 to 42 inches, most of its area is covered by forest. The soils have a high erosion potential where the vegetation cover is removed. In response to Public Law 95-87, 132 sites were added to the existing surface-water data-collection network in area 4. At these added sites, collected data includes discharge, water-quality, sediment, and biology. The data are available through computer storage through the National Water Data Exchange (NAWDEX) or the Water Resources Data System database for Ohio, Pennsylvania, and West Virginia. Hydrologic problems related to mining are: (1) Erosion and increased sedimentation, and (2) degradation of water quality. Erosion and sedimentation are associated chiefly with surface mining. Sediment yields increase drastically when vegetation is removed from the highly erosive soils. Degradation of water quality can be caused by acid-mine drainage from underground and surface mining. More than half the acid-mine drainage effluent in area 4 comes from underground mines. The rest seeps from abandoned surface mines. Usually in reclaimed surface mines the overburden is replaced in such a short time after the coal is taken out that the acid-forming minerals, commonly pyrite or marcasite, is not complete or is neutralized by the buffering action of calcareous minerals in the soils.

FLOOD ON BUFFALO CREEK FROM SAUNDERS TO MAN, WEST VIRGINIA

RUNCIN, G. S., GEOLOGICAL SURVEY, RESTON, VA.

FOR SALE BY US GEO. SURVEY, RESTON, VA 22092 - PRICE $1.50 PER SET, HYDROLOGIC INVESTIGATION ATLAS HA-547, 1974, 2 SHEETS, 13 FIG. 4 TAB., 2 REF.

Journal Announcement: SWRA817

ON FEBRUARY 26, 1972, AT APPROXIMATELY 8 A.M., A COAL MINE REFUSE CASCADE PASSED MIDDLE FORK, A TRIBUTARY TO BUFFALO CREEK, WEST VIRGINIA. THIS 1-SHEET HYDROLOGIC ATLAS REPORT DOCUMENTS THE HYDROLOGIC EVENTS ASSOCIATED WITH THE BUFFALO CREEK DISASTER AS AN AID IN PLANNING REMEDIAL MEASURES TO REDUCE POTENTIAL FLOOD HAZARDS FROM SIMILAR DAMS AND IMPROVEMENTS. THIS MOST DESTRUCTIVE FLOOD IN WEST VIRGINIA'S HISTORY SWEEP THROUGH 15.5 MILES OF THE BUFFALO CREEK VALLEY AT AN AVERAGE SPEED OF 7 FEET PER SECOND (15 MILES PER HOUR) AND REACHED THE TOWN OF MAN AT THE MOUTH OF BUFFALO CREEK AROUND 11 A.M. THE TRAVEL TIME FOR THE 15.5 MILES WAS ABOUT 3 HOURS. DURING THE 3-HOUR TRAVEL TIME DOWN THE VALLEY AT LEAST 178 LIVES WERE LOST, 500 HOMES WERE DESTROYED, 4,000 PEOPLE WERE LEFT HOMELESS, PROPERTY DAMAGE EXCEEDED $50 MILLION AND HIGHWAY DAMAGE EXCEEDED $15 MILLION. (KNAPP-USGS)

W. Virginia

West Virginia Department of Highways Research Project 16 “Runoff Studies on Small Drainage Areas” (Technique for Estimating Magnitude and Frequency of Floods in West Virginia)

Runners: U.S. Geological Survey

Applicable: U.S. Geological Survey

A technique is presented for estimating the magnitude and frequency of floods on unregulated, virtually natural streams in West Virginia. Multiple-regression techniques were used to develop relations between dependent variables, flood peaks, and independent variables, drainage areas. Data collected at 170 stream-gaging sites were used in the analyses. Analyses of all residuals errors indicated that the best estimate of flood peaks could be made by dividing the state into three regions. Peak discharges can be estimated for drainage areas from about 0.3 square mile up to 2000 square miles. Graphs are provided to estimate the flood peak having recurrence intervals of 2, 5, 25, 50, 100, and 500 years and drainage areas between 1 and 1000 square miles. For drainage areas less than 1 and greater than 1000 square miles, peak flows can be estimated using equations listed on each graph.

Ground-Water Hydrology of the Upper New River Basin, West Virginia


This atlas report describes the ground-water resources of the upper New River basin in West Virginia based on three earlier reports on the hydrology of the same basin. The basin drains 2,370 square miles in southeastern West Virginia and extends from the northernmost western edge of Pocahontas County to the southwestern edge of Mercer County. Precipitation is the principal source of ground-water recharge, averaging close to 40 inches basinwide and ranging from more than 40 inches in the southwestern part to less than 30 inches in the southeastern part. The yield of wells ranges from 0.5 to 500 gallons per minute and varies with topographic location, geologic structure, and geologic unit. Hilltop wells and a few hillside wells may fail to supply enough water for domestic use. Wells in valleys generally yield the greatest amounts of water. The chemical quality of the ground-water ranges widely, but it is generally good for most uses. In places, it is subject to problems resulting from excessive concentrations of hardness, iron, and manganese.

Quality of Surface Water in the Coal-Mining Areas of Western Maryland and Adjacent Areas of Pennsylvania and West Virginia from April 1979 to June 1980 (duplicated see Maryland).

Staubitz, W. W., Geological Survey, Towson, MD. Water Resources Div.

W. Virginia

The upper Potomac River basin, in the central Appalachian region in Pennsylvania, Maryland, Virginia, and West Virginia, is a humid temperate region of diverse fractured rocks. Three geohydrologic terranes, which underlie large parts of the basin, are described in terms of their aquifer characteristics and of the magnitude and duration of their base runoff: (1) Fractured rock having a thin regolith; (2) fractured rock having a thick regolith; and (3) carbonate rock, crystalline rock in the mountainous part of the Blue Ridge province and shales with tight sandstone in the folded Appalachians are covered with thin regolith. Water is stored in and moves through fairly unmodified fractures. Average transmissivity (T) is estimated to be 150 SQ FEET PER DAY, and average storage coefficient (S) is 0.005. Crystalline and sedimentary rocks in the Piedmont province and in the lowland part of the Blue Ridge province form a complex of wide occurrence. Adjusted average values for aquifer characteristics at 100 SQ FEET PER DAY, and S, 0.01, carbonate rock, in which fractures have been ignored, are selectively by solution, especially near streams, has estimated average aquifer characteristics of 500 SQ FEET PER DAY, and S, 0.03-0.04. This rock is the most effective in the basin in terms of water supply and base runoff.

Mineralized groundwater, and the high nitrate content of groundwater in some areas would probably have little adverse affect on the use of groundwater for low-flow augmentation. (WOODARD-USGS)

GROUND-WATER HYDROLOGY OF THE MONAGHEMA RIVER BASIN IN WEST VIRGINIA

WARD, PORTER; WILMOTH, GENTOW M.; U.S. GEOLICAL SURVEY.

West Virginia Geol and Econ Surv., River Basin Bull 1, 34 P., 1968. 22 FIG, 6 TAB, 38 Refs., Journal Announcement: SWRA1510

AQUATIC SUPPLIES OF GROUNDWATER ARE AVAILABLE IN THE MONAGHEMA BASIN TO MEET PRESENT AND FUTURE REQUIREMENTS. THE BEST SOURCES ARE WELLS IN BEDROCK, PARTICULARLY IN SANDSTONE. THE MOST FAVORABLE AREAS ARE UNDERLAIN BY ROCKS OF THE POTTSVILLE GROUP, ALLEGHENY GROUP, GREENBRIER LIMESTONE, AND THE POTTSTOWN GROUP. YIELDS OF 50-500 GPM ARE COMMON IN MOST AREAS. THE DUNKARD GROUP YIELDS ONLY ABOUT 2 GPM. DEVELOPMENT OF WATER SUPPLIES IN ITS OUTFLOW AREA IS DIFFICULT, REQUIRING INTENSIVE INVESTIGATION AND TEST DRILLING. ALLUVIUM IS TOO THIN AND AREALLY RESTRICTED FOR LARGE GROUNDWATER DEVELOPMENT. WATER QUALITY IS GENERALLY GOOD, WITH HIGH IRON, HARDNESS, AND HYDROGEN SULFIDE CONCENTRATION IN A FEW PLACES. SOME SALTY WATER IS FOUND BELOW 100-300 FT IN THE WESTERN PART OF THE BASIN. SOME OILFIELD, MUNICIPAL, AND INDUSTRIAL WATER USE FOR WATER QUALITY ARE SHOWN IN THE WESTERN PART OF THE BASIN. SOME OILFIELD, MUNICIPAL, AND CHEMICAL POLLUTION OCCURS IN A FEW AREAS. COAL-MINE ACID POLLUTION HAS A SMALL EFFECT IN SOME POPULATED AREAS IT IS A DIFFICULT PROBLEM. DESCRIPTIONS OF GEOLOGIC UNITS AND THEIR WATER-BEARING PROPERTIES ARE TABULATED. GEOLOGY, WATER POTENTIAL, AND WATER QUALITY ARE SHOWN BY HAPS. (KNAPP-USGS)

Techniques for estimating streamflow characteristics in the eastern and interior coal provinces


WATER RESOURCES DATA FOR WEST VIRGINIA, WATER YEAR 1980, Appendix - Coal Areas


Water resources data for the 1980 water year for coal regions of West Virginia consist of discharge and water-quality records collected during two sampling periods at 369 sites. Also included are sediment data from 26 sites. Data were collected as a part of the statewide Coal Hydrology Project. (USGS)

WATER RESOURCES DATA FOR WEST VIRGINIA, WATER YEAR 1979, Appendix - Coal Areas

Water resources data for the 1979 water year for coal regions of West Virginia consist of records of discharge and water quality of streams, wells, mines, and abandoned Mine shafts; and water levels in wells and abandoned Mine shafts. Section one consists of data obtained for the statewide Coal Hydrology Monitoring Project and includes discharge and water-quality data collected during two sampling periods at 361 sites. Section two consists of data obtained for the Mining Effects Research Project in five small basins in southwestern West Virginia during the period February 1976 to January 1980 and includes records of water quality for 53 stream sampling sites, 52 well sampling sites, 31 mine-discharge sampling sites, and 2 mine-shaft sampling sites; and water levels in 6 wells and 2 Mine shafts. (USGS)

Water Resources Data for West Virginia, published annually since 1975
Available from the National Technical Information Service, Springfield, VA 22161.

Water resources data for West Virginia consist of records of stage, discharge, and water quality of streams and springs; stage and contents of lakes and reservoirs; and water levels in wells. These data represent part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in West Virginia. (USGS)

Ground-Water Levels in Wyoming, 1974
Ballance, Wilbur C., and Freudenthal, Pamela B.
Unnumbered Open-File Report, 1975

Ground-water levels are measured periodically throughout Wyoming in an observation-well network by the U.S. Geological Survey in cooperation with the Wyoming State Engineer and the city of Cheyenne. Water-level measurements provide information on the status of the ground-water supply and facilitate prediction of trends in water levels, which indicate change in ground-water storage. During 1974, about 1,500 measurements were made. Net water-level changes were computed using about 235 measurements made during the first 4 months of 1974 and 1975. Tables of well history, highest and lowest water levels, net changes, and hydrographs for most wells are included in this report.

Ground-Water Levels in Wyoming, 1975
Ballance, Wilbur C., and Freudenthal, Pamela B.

Ground-water levels are measured periodically in a network of about 260 observation wells in Wyoming to record changes in ground-water storage. The areas of water-level observation are mostly where ground water is used in large quantities for irrigation or municipal purposes. This report contains maps showing location of observation wells and water-level changes from 1975 to 1976. Well history, highest and lowest water levels, and hydrographs for most wells are also included in this report.
Ground-water levels in Wyoming, 1976

Ground-water levels are measured periodically in a network of about 280 observation wells in Wyoming to record changes in ground-water storage. The areas of water-level observation are mostly where ground water is used in large quantities for irrigation or municipal purposes. This report contains maps showing location of observation wells and water-level changes from 1976 to 1977. Well history, highest and lowest water levels, and hydrographs for most wells are also included in this report.

Geology and ground-water resources of the Rawlins area, Carbon County, Wyoming

Reconnaissance of the geology and ground-water resources of the Cokeville area, Lincoln County, Wyoming

Geologic map and coal sections of the Pats Bottom quadrangle, Carbon County, Wyoming

WATER-QUALITY DATA FOR THE FLAMING GORGE RESERVOIR AREA, UTAH AND WYOMING, 1969-72
Holker, E. L.; Waddell, K. M., GEOLOGICAL SURVEY, SALT LAKE CITY, UT

GEOLoICAL SURVEY OPEN-FILE REPORT (DUPICATED AS UTAH BASIC-DATA RELEASE NO 24), 1972, 50 P., 1 FIG., 6 TABS, 7 REF., Journal Announcement: SWRU609

SAMPLES FOR CHEMICAL QUALITY ANALYSIS WERE COLLECTED FROM FLAMING GORGE RESERVOIR IN UTAH AND WYOMING BETWEEN OCTOBER 1970 AND SEPTEMBER 1972 AT 17 SITES. CHEMICAL AND PHYSICAL DATA WERE MEASURED IN SITU AT 34 SITES. THE CHEMICAL-QUALITY DATA FOR THE 1969-71 WATER YEARS FOR STREAMS FLOWING INTO AND OUT OF THE RESERVOIR ALSO ARE TABULATED. THE SAMPLING STATIONS FOR THESE STREAMS ARE GREEN RIVER NEAR GREEN RIVER, WYO., BLACKS FORK NEAR LEADVILLE, WYOMING, AND AMERICAN DELL, UTAH.

GEOLoICAL SURVEY STATION IDENTIFICATION NUMBER, EACH STREAM SITE HAS BEEN ASSIGNED A LETTER TO IDENTIFY ITS POSITION ON A MAP. (WOODARD-USGS)

Geohydrologic reconnaissance and measurement of perennial streams crossing outcrops of the Madison Limestone, northeastern Wyoming, 1974

Preliminary digital model of the Arikaree aquifer in the Sweetwater River basin, central Wyoming

Geology and ground-water resources of the Upper Niobrara River Basin, Nebraska, and Wyoming with a section on Chemical quality of the ground water by F. H. Rainwater Bradley, Edward, 1956 U.S. Geological Survey Water-Supply Paper 1368.


Hydrogeologic features of the alluvial deposits in the Niobrara River drainage area, Bighorn Basin, Wyoming

Hydrologic features of the alluvial deposits in the Owl Creek valley, Bighorn Basin, Wyoming
Analysis of Runoff from Small Drainage Basins in Wyoming
Craig, Gordon S., Jr., and Rankle, James G.


A rainfall-runoff model was used to synthesize long-term records of runoff volume and peak discharge from long-term records (73 years) of rainfall and evaporation. The long-term data was transferred from a base station, Cheyenne, Wyoming, to 13 other weather stations in Wyoming. Volume and peak discharge frequencies were developed for the intermontane areas on 22 drainage basins smaller than 11 square miles relative to rainfall at the nearest weather station. Runoff volumes and peak discharges were related to basin parameters with a high degree of correlation. Flood volumes were related to drainage area, maximum relief, basin slope, and channel slope. Flood peak discharge was related to drainage area, maximum relief, basin slope, and channel slope. Recurrence intervals considered were 2, 5, 10, 25, 50, and 100 years.

A dimensionless hydrograph was developed to define the characteristic shape of flood hydrographs to be expected from small drainage basins in Wyoming. The method requires a peak discharge in cubic feet per second and a volume in acre-feet to produce a synthetic hydrograph. Some selectivity was used in the development to avoid multipeak events or unusually shaped hydrographs.

A study of storage behind a highway embankment with a culvert to allow outflow has shown that the single fast-rising peak is most important in culvert design. Single peaks cause higher water pressures behind embankments than do multipeak events of the same magnitude and volume. The study was limited to simple box culverts with inlet control.

GROUND-WATER RESOURCES OF NATRONA COUNTY, WYOMING
Crist, M. A.; Lowry, W. E.

GEOLOGICAL SURVEY, WASHINGTON, D.C. GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1897, 1972, 92 P., 21 FIG., 3 PLATE, 4 TAB., 44 REF.

Journal Announcement: SWAOS17

THE GENERAL OCCURRENCE, CHEMICAL QUALITY, AND AVAILABILITY OF GROUNDWATER IN NATRONA COUNTY, WYOMING, ARE DESCRIBED. SPECIAL ATTENTION IS GIVEN TO IDENTIFYING THE CHEMICAL SUITABILITY OF GROUNDWATER FOR DOMESTIC, LIVESTOCK, INDUSTRIAL, MUNICIPAL, AND IRRIGATION USE. MORE THAN 30 GEOLOGIC FORMATIONS ARE EXPOSED IN THE COUNTY, 26 OF WHICH ARE KNOWN TO YIELD WATER TO WELLS AND SPRINGS. THE MADISON LIMESTONE OF MISSISSIPPIAN AGE AND THE TENSLEEP SANDSTONE AND THE CASPER FORMATION OF PENNSYLVANIAN AND PERMIAN AGE SUPPLY. THE LARGEST YIELDS TO WELLS AND SPRINGS, IN THE NORTHEASTERN PART OF THE COUNTY, FLOW FROM EACH OF THREE WELLS IN THE MADISON IS MORE THAN 4,000 GPM, EACH OF THREE WELLS IN THE TENSLEEP IN THE SAME AREA FLOWS MORE THAN 400 GPM.

YIELDS OF SPRINGS IN THE CASPER FORMATION NEAR CASPER MOUNTAIN RANGE FROM ABOUT 4 TO 10 FEET. THE WATER FROM NEAR THE OUTCROP OF ALL THESE FORMATIONS USUALLY CONTAINS LESS THAN 100 SEVERAL TYPES OF WATER WERE FOUND IN THIS UNIT INCLUDING SODIUM SULFATE, CALCIUM SODIUM SULFATE, CALCIUM SULFATE, SODIUM CALCIUM SULFATE, SODIUM CHLORIDE, AND CALCIUM BICARBONATE.

Hydrology of Stock-water Reservoirs in Upper Cheyenne River Basin
Guller, R. C.

Geological Survey, Cheyenne, Wyo. Water-Supply Paper 1531

The objective of this investigation was to determine the effect on runoff of the many stock reservoirs in the Cheyenne River basin above Angostura Dam. As a first step it was necessary to determine the long-term runoff relations based on all reservoirs in the basin: the storage capacity, the drainage area, and the water loss from each. A sampling method was adopted because the size of the basin, 9,100 square miles, prohibited a complete examination of all reservoirs within the drainage area. Forty-nine sample areas of 9 square miles each were selected as a 5-percent sample of the 95 complete quarter townships within the basin above Angostura Dam. All reservoirs located within the sample quarter townships were surveyed.

The 49 sample areas contain 466 operating reservoirs with an aggregate storage capacity of 4,418 acre-feet and an aggregate drainage area of 222 square miles. Applying the findings of the sampling to the area as a whole, it was estimated that the basin contained 49 sample reservoirs with an aggregate storage capacity of 32,360 acre-feet and an aggregate drainage area of 4,440 square miles. In addition there are 16 reservoirs in the basin having capacities in excess of 230 acre-feet. The aggregate total capacity of these reservoirs is 8,035 acre-feet.

A network of observation reservoirs was operated during the four runoff seasons from 1951 to 1954. The number of reservoirs observed ranged from 48 to 57 and produced a total of 212 station-years of record. A complete record for each observation reservoir is included in this report.

An analysis of the observation-reservoir records permitted the computation of volume of annual inflow to reservoirs in all parts of the basin, volume of inflow retained by reservoirs, and volume of retained inflow depleted by evaporation and seepage. Complete computations were made on each of the two types of runoff producing storms typical of the Cheyenne River basin. Water retained by reservoirs is subjected to two major types of depletion: evaporation and seepage. Evaporation from the water surface constitutes a complete loss chargeable against the reservoirs; but, because seepage may contribute in some degree to ground-water recharge, reservoir loss from this source may in part be recovered. The collected data permitted a fairly comprehensive analysis of the variations of runoff and storage within the basin. Based on this analysis, estimates of losses...
Predicting effects of coal development on surface-water salinity: Green River Basin, Wyoming
Delong, L. L., 1978
Abstract, Annual Meeting AGU, San Francisco December 4-8, 1978

An Analysis of Salinity in Streams of the Green River Basin, Wyoming
Delong, L. L.
Available from the National Technical Information Service, Springfield, VA 22161; as PB-275 72S, Price code: A03 in paper copy; A01 in microfiche. Water-Resources Investigations 77-103, September 1977. 32 p. 1 fig. 4 tab. 6 ref.
Journal Announcement: SWA1112

Dissolved-solids concentrations and loads can be estimated for streamflow records using a regression model derived from chemical analyses of monthly samples. The model takes seasonal effects into account by the inclusion of simple-harmonic time functions. Monthly mean dissolved-solids loads simulated for a 6-year period at U.S. Geological Survey water-quality stations in the Green River basin of Wyoming agree closely with corresponding loads estimated from daily specific-conductance records. In a demonstration of uses of the model, an average gain of 110,000 tons of dissolved solids per year was estimated for a 6-year period in a 70-mile reach of the Green River from Fontenelle Reservoir to the town of Green River, including the lower 30-mile reach of the Big Sandy River. (Woodard-USGS)

Verification of Step-backwater Computations on Ephemeral Streams in Northeastern Wyoming.
Druse, Stanley A.
Step-backwater computations were verified by subsequent discharge measurements at three ephemeral streamflow stations in northeastern Wyoming. The standard step-backwater method for gradually varied subcritical flow was used in computing the water-surface profiles and stage-discharge ratings. Step-backwater computations were made at selected intervals from 1 through 1,000 cubic feet per second on Lodgepole Creek, through 150 cubic feet per second on Raven Creek, and through 600 cubic feet per second on Sand Creek. Stage-discharge rating curves and discharge measurements are illustrated for the three sites, with...
lines of 15-percent departure from the rating curves drawn to measure accuracy of the results. All discharge measurements showed departures of less than 15 percent at the high end of the rating curves.


Base flow discharge and chemical-quality measurements were made at 233 selected sites on streams during October-November 1977, August-September 1978, and October 1978 to provide data on the interaction between surface-water and ground-water systems in the northern Great Plains area of Montana and Wyoming. The tabulated data provide an areally broad data base of con-current base-flow conditions.

Streamflow gains or losses were computed for stream reaches not significantly affected by irrigation. On October 17, 1978, the change in flow of the upper Powder River between Susses and Arvada, Wyoming, was a loss of 14 cubic feet per second. On the same date, the change in flow of the Lower Powder River between Arvada, Wyoming, and Moorhead, Montana, was a gain of 6 cubic feet per second. Except for August-September 1978, major subbasins showed little significant differences in water discharge, chemical character, or dissolved-solids concentrations.

Effects of Coal Mine Subsidence in the Sheridan, Wyoming, Area, Dunrud, C. Richard, and Osterwald, Frank W.

An analysis of the surface effects of past underground coal mining in the Sheridan, Wyoming, area suggest that underground mining of strippable coal deposits may damage the environment more over long periods of time than would modern surface mining, provided proper restoration procedures are followed after surface mining. Subsidence depressions and pits are a continuing hazard to the environment and to man’s activities in the Sheridan, Wyo., area above abandoned underground mines in weak overburden less than about 60 m thick and where the overburden is less than about 10-15 times the thickness of coal mined. In addition, fires commonly start by spontaneous ignition when water and air enter the abandoned mine workings via subsidence cracks and pits. The fires can then spread to unmined coal as they create more cavities, more subsidence, and more cracks and pits through which air can circulate. In modern surface mining operations the total land surface underlain by minable coal is removed to expose the coal. The coal is removed, the overburden and topsoil are relatively light, and the land is regraded and revegetated. The land, although disturbed, can be restored by removing the coal, removing the overburden, and revegetating the area.

Underlain by abandoned underground mining in areas where the overburden is less than about 60 m thick or less than about 10-15 times the thickness of coal mined. The resource recovery of modern surface mining is much greater than that of underground mining procedures. Although present-day underground mining technology is advanced as compared to that of 25-60 years ago, subsidence resulting from underground mining of thick coal beds beneath overburden less than about 60 m thick can still cause greater damage to surface drainage, ground water, and vegetation than can properly designed surface mining operations.

This report discusses (1) the geology and surface and underground effects of former large-scale underground coal mining in a 50-square kilometers area 5-20 km north of Sheridan, Wyo., (2) a ground and aerial reconnaissance study of a 5-square kilometers coal mining area 8-10 km west of Sheridan, and (3) some environmental consequences and problems caused by coal mining.

The Biology of Salt Wells Creek and Its Tributaries, Southwestern Wyoming, Engelke, M. J., Jr.


A description of aquatic organisms and biological communities is presented for Salt Wells Creek, a plains stream in the Green River basin. The description includes seasonal population fluctuations of benthic organisms and algae, the food pyramids, and nutrient relations between various types of plants and animals. The algae and stream invertebrates were studied to determine baseline data and biological indicators of water quality, (Woodard-USGS).


Restored stratigraphic cross sections and coal correlations in the Tongue River Member of the Fort Union Formation, Powder River area, Wyoming.

2 sheets.

Water-Quality Data for the Hanna and Carbon Basins, Wyoming

Fruehenthal, P. D.


Available from: OFSS, USGS Box 25425, Fed. Ctr., Denver, CO.

80225, paper copy $6.00, microfiche $3.50. Geological Survey open-file report 79-1277, August 1979. 41 p. 4 figs. 7 tab. 10 Refs.

Journal Announcement: SWRA1314

Water-quality data for the Hanna and Carbon Basins, south-central Wyoming, are presented in tables, with no interpretation. Common-constituent, trace-element, and radiochemical data for ground and surface water and sediment concentrations for surface water are included. Ground water at 53 sites and surface water at 3 gaging stations were sampled. (Kosco-USGS)


U.S. Geological Survey WRI 81-75.

Permit applications made to the Office of Surface Mining for mining of near-surface coal deposits contain both mining and reclamation plans. These plans must be evaluated by regulatory authorities for compliance with the permanent regulations of the Surface Mining Control and Reclamation Act of 1977. Methodologies are presented for assessing the effects of mining and reclamation on the hydrologic system of a potential permit area and the adjacent area, together comprising about 1.6 square kilometers of the drainage basin of Separation Creek, Carbon and Sweetwater Counties, Wyoming. The study area is representative of the hydrologic problems that exist in a semiarid environment of the high plains in Wyoming.

The prevailing hydrology and geology of the study area are described primarily as a basis for evaluation of potential changes that may occur. Data for soil-moisture relations in seven soil-vegetation types show that differences in void space and particle-surface area available for water storage are important factors in planning reclamation. Estimates are also made of runoff volumes and peak discharges for flow magnitudes of specified recurrence intervals using a regression model developed for the State of Wyoming. A shallow aquifer and its hydraulic characteristics are described in the study area. Methods for estimating erosion and sediment yield in the study area by means of the Universal Soil Loss Equation (USLE) and reservoir sedimentation surveys are described.

Selected Hydrologic Data, Yampa River Basin and Parts of the White River Basin, Northwestern Colorado and South-Central Wyoming.

Wyoming

Wyoming.
Hydrologic Effects of Water Spreading in Box Creek Basin, Wyoming

Hadley, R. F., McQueen, J. S., and others,

A study was made during the summer seasons of 1956 and 1957 to determine the use of water by a water-spreading system in Box Creek basin, Converse County, Wyo., which was designed to reduce sediment yield and fluvial erosion. The water-spreading system on Box Creek consists of 27 small dams that divert the flow directly over the flood plains where it is used to irrigate a hay meadow of 360 acres.

Two gaging stations were established; one above the water-spreading system and one below to measure inflow, outflow, and suspended sediment. Also, a network of precipitation gages, ground-water observation wells, and observations on soil-moisture were an integral part of the hydrologic investigation.

There were six runoff events during the 1956 and 1957 seasons for which inflow and outflow through the water-spreading system could be determined. The total inflow for the six runoff periods was 2,026 acre-feet; the outflow was 1,330 acre-feet, which represents a loss of 34 percent of surface flow entering the water spreader.

Total reduction in suspended-sediment load for the six runoff periods was not determined because of the many engaged tributaries between gaging stations. However, two of the storms originated above the upper gaging station, and the suspended-sediment load in the inflow was 4,513 tons and the outflow was 1,119 tons, which represents a decrease of 75 percent between stations. During the 2 years of observation, the total sediment deposition on the water-spreading system was 17.8 acre-feet or 0.049 acre-foot per acre. Most of this sediment was derived from slopes adjacent to water spreaders, and therefore induced some uncertainties in evaluating the sediment-retention efficiency of this type of land treatment.

Data from ground-water observation wells show that some of the surface flow entering the water-spreading system at the upper end may penetrate to a perched water table.

Preliminary applications of Landsat images and aerial photography for determining land-use, geologic, and hydrologic characteristics—Tampa River basin, Colorado and Wyoming.

I-84B), scale 1:24,000, 1 sheet.

This map report describes some of the potential effects on ground-water levels and indicates that the extent of land disturbance that may occur as a result of surface mine development. The data that was collected is based on was collected in the Gillette, Wyoming area underlain by the Wyodak-Anderson coal bed.

Loggers of wells in Campbell County, Wyoming.

Hodson, Warren G.


The report contains approximately 1,200 logs of water wells in Campbell County, Wyoming. The logs are unedited and are given in the style and wording of the driller. Depth to water, yield and drawdown and use of water are given, if known.

Records of water wells...Test Holes, and Chemical Analyses of water for the Madison Limestone...Powder River Basin...Wyoming. Hodson, Warren G.


The report contains data on the Madison Limestone (or equivalent rocks) for the Powder River Basin and adjacent areas in northeastern Wyoming. Records of 56 water wells and springs developed in the Madison, 222 water wells and oil and gas test holes that reached the Madison, and 71 chemical analyses of Madison waters are tabulated in three tables. Location sites for data collected are shown on a map of the area.

CHEMICAL ANALYSES OF GROUND WATER IN THE POWDER RIVER BASIN AND ADJACENT AREAS, NORTHEASTERN WYOMING

HODSON, W. G.

GEOLOGICAL SURVEY, CHEYENNE, WYO. WATER RESOURCES DIV.

WYOMING DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

BASIC DATA REPORT, 1971. 20 P., 1 FIG, 2 TAB, 9 REF.,

Journal Announcement: SWADSOB.

Wyoming

RECOMMENDED MAXIMUM CONCENTRATIONS FOR DOMESTIC AND MUNICIPAL USE ARE GIVEN. THE DISSOLVED SOLIDS RANGED FROM 58 TO 30,000.

WATER RESOURCES OF THE POWDER RIVER BASIN AND ADJACENT AREAS, NORTHEASTERN WYOMING, J. P. HODSON, W. G. PEARL, R. H. DRUSE, S. A.

GEOLoGY Survey, Washington, D.C.

HYDROLOGIC INVESTIGATIONS ATLAS HA-665, 1973, 4 SHEETS, 9 FIG., 11 TAB., 4 MAPS, 70 REF.

Journal Announcement: SWRA 723

GENERAL INFORMATION IS GIVEN CONCERNING THE AVAILABILITY AND QUALITY OF GROUNDWATER RESOURCES OF THE POWDER RIVER BASIN, WYOMING, IN A 4-SHEET HYDROLOGICAL ATLAS. THE POWDER RIVER BASIN IS A STRUCTURAL AND TOPOGRAPHIC BASIN BOUNDED ON THE WEST BY THE BIGHORN MOUNTAINS, ON THE SOUTHWEST BY THE CASPER ARCH, ON THE EAST BY THE BLACK HILLS, AND ON THE SOUTH BY THE LARAMIE RANGE AND MARTVILLE UPLIFT. MEAN ANNUAL PRECIPITATION DECREASES BASINWARDS FROM 16.32 INCHES AT SUNDANCE AND 15.91 INCHES AT SHERIDAN TO 14.00 INCHES AT GILLETTE AND 11.80 INCHES AT CASPER. POTENTIAL EVAPORATION IS HIGH ESPECIALLY IN THE POWDER RIVER BASIN, AND IS SEVERAL TIMES THE PRECIPITATION. CONSEQUENTLY, MUCH SNOW, SURFACE WATER, AND SOIL MOISTURE EVAPORATE TO THE ATMOSPHERE. ALLUVIUM ALONG IRRIGATED VALLEYS IS RECHARGED IN PART FROM IRRIGATION WATER. SOME MOVEMENT OF WATER BETWEEN FORMATIONS PROBABLY OCCURS IN THE SUBSURFACE. DISCHARGE IS MAINLY BY EVAPORATION, SEEPAGE TO SPRINGS AND LAKES, TRANSPARATION BY PLANTS, AND PUMPAGE FROM WELLS. MOST GROUNDWATER DEVELOPMENT HAS BEEN FOR STOCK AND WILDLIFE PURPOSES.

THE BLUE RIVER BASIN IS THE LARGEST, CONTAINING MORE THAN 97 PERCENT OF THE COUNTY IN THE UNITED STATES. THE PRINCIPAL DEPOSIT IS THE WYOMING-ANDERSON COAL BED. THE BED IS 50-100 FEET (15-30 METERS) THICK OVER LARGE AREAS, LIES LESS THAN 200 FEET (60 METERS) DEEP IN MANY AREAS, AND EXTENDS SOUTHWARD TO A DISTANCE OF 167 KILOMETERS. LONG AND 2-3 MILES (3-5 KILOMETERS) WIDE, AND CONTAINS AN ESTIMATED 15 BILLION TONS (13.6 BILLION METRIC TONS) OF SUBMINERALIZED LOW-SULFUR COAL THAT IS NOT CONSIDERED TO BE ACCESSIBLE TO SURFACE MINING. EXTENSIVE MINING OF THIS DEPOSIT HAS THE POTENTIAL FOR CAUSING A VARIETY OF ENVIRONMENTAL IMPACTS AND HAS BEEN A MATTER OF MUCH PUBLIC CONCERN AND DEBATE IN RECENT YEARS.

An integrated program of geologic, hydrologic, geochronologic, and related studies by the U.S. Geological Survey in central Campbell County, along the eastern margin of the Powder River Basin, in northeastern Wyoming, contains more coal than any other county in the United States. The principal deposit is the Wyoming-Anderson coal bed. The bed is 50-100 feet (15-30 meters) thick over large areas, lies less than 200 feet (60 meters) deep in many areas, and extends southward to a distance of 167 kilometers. Long and 2-3 miles (3-5 kilometers) wide, and contains an estimated 15 billion tons (13.6 billion metric tons) of submineralized low-sulfur coal that is not considered to be accessible to surface mining. Extensive mining of this deposit has the potential for causing a variety of environmental impacts and has been a matter of much public concern and debate in recent years.


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Sediment Transport and Source Areas of Sediment and Runoff, Big Sandy River Basin, Wyoming.

Kircher, James E.
A study was conducted for the resolution of sediment source areas in the Big Sandy River Basin, southwestern Wyoming. Suspended-sediment and bedload data were collected in order to determine total sediment transport at several locations within the basin. The bedload data were compared to the Einstein bedload function and total load data were compared to the Colby method. The bedload comparison showed a higher estimation of transport rates with Colby-Smith sampler measurements than with the Einstein bedload function. The Colby method yielded higher transport rates at high flows and lower transport rates at low flows than the measured total transport rates.

Water Resources of Upper Separation Creek Basin, South-Central Wyoming

Larson, L. R.; Zimmerman, L. A.

Journal Announcement: SWA1420

Expected development of coal in the 85-square-mile upper Separation Creek basin of south-central Wyoming will greatly increase the demands on water resources. Flows in Separation Creek are seasonal and highly variable. Streamflow is primarily caused by snowmelt. Very light snowpack in the spring of 1977 resulted in annual runoff being only 10 percent of that for the previous year. Surface-water quality is variable in both time and space. Dissolved-solids concentrations ranged from less than 150 to more than 1,300 milligrams per liter. Flushing of accumulated salts occurs during a rising stage. Ground water is obtained from the Reser de Formation, the Lance and Fort Union Formations, and from alluvium. Yields from wells and springs are usually less than 10 gallons per minute, though some springs flow as much as 35 gallons per minute. Ground-water quality varies with the formation. Stream biota are governed by the intermittent nature of the stream and by habitat. Daily mean sediment concentrations ranged from 34 to 1,1900 milligrams per liter.

WATER RESOURCES OF THE THRUST BELT OF WESTERN WYOMING LINES. G. C. GLASE, W. R.
GEOL OGICAL SURVEY, CHEYENNE, WYO.
FOR SALE BY USGS, RESTON, VA. 22092; PRICE $2.00 PER SET.
HYDROLOGIC INVESTIGATIONS ATLAS WA-539. 1975. 3 SHEETS, 38 REF.
JOURNAL Announcement: SWA0913

This ATLAS REPORT DESCRIBES THE RESULTS OF ONE OF A SERIES OF WATER-RESOURCES RECONNAISSANCE STUDIES OF LARGE AREAS IN WYOMING. IN THE U.S. GEOLOGICAL SURVEY INVESTIGATION WITH THE WYOMING STATE ENGINEER, THE PURPOSES OF THE STUDY ARE TO OBTAIN A GENERAL KNOWLEDGE OF THE OCCURRENCE, AVAILABILITY, AND QUALITY OF GROUNDWATER AND TO SUMMARIZE FLOW CHARACTERISTICS AND CHEMICAL QUALITY OF WATER IN MAJOR STREAMS IN THE THRUST BELT OF WESTERN WYOMING. THE THRUST BELT IS AN ELONGATE, NEARLY RECTANGULAR AREA OF ABOUT 5,300 SQ. MI IN THE MIDDLE ROCKY MOUNTAIN PHYSIOGRAPHIC PROVINCE. THE LARGEST USE OF WATER IN THE AREA IS FOR IRRIGATION OF ALFALFA, GRASS HAY, AND PASTURE TO COMPLEMENT LIVESTOCK GRAZING IN THE MIDDLE LARGER AREAS OF FOREST AND RANGE LAND. IN THE PART OF THE BEAR RIVER BASIN THAT IS IN WYOMING AN ESTIMATED 58,700 ACRES WERE IRRIGATED IN 1970 (HUNTER AND OTHERS, 1971) ONLY ABOUT 2,000 ACRES OF THIS TOTAL WAS IRRIGATED WITH WATER FROM WELLS. INDUSTRIAL WATER USE IN 1970 IS ESTIMATED AT 6 MGD WITH ABOUT 80 PERCENT OF THE WATER DERIVED FROM SURFACE-WATER SOURCES. APPROXIMATELY TWO-THIRDS OF THE ESTIMATED 18,000 PEOPLE THAT LIVED IN THE STUDY AREA IN 1970 WERE SERVED BY MUNICIPAL WATER SUPPLIES IN AFTON, COKEVILLE, EVANSTON, KEMMERER, JACKSON, AND THAYNE. ESTIMATED USE IN 1970 BY THESE MUNICIPAL SUPPLIES WAS 3.4 MG. THREE AREAS OF THERMAL-WATER DISCHARGE ARE KNOWN IN THE AREA. (WODDARD-USGS)
Reconnaissance of the geology and ground-water hydrology of the Laramie Basin, Wyoming.

Littleton, R. T., 1950


Preliminary potentiometric-surface map showing freshwater heads for the Lower Cretaceous rocks in the Northern Great Plains of Montana, North Dakota, South Dakota, and Wyoming.

Lobmeyer, D. N., 1980


Lowham, H. W.; De Long, L. L.; Peter, K. D.; Al, E. T.

Geological Survey, Cheyenne, Wyo.


Journal Announcement: SWAD924-Development of extensive coal, oil, gas, trona, and oil-shale resources as well as other developments in the Green River and Great Divide Basins in Wyoming will require a projected increase in water consumption of 400,000 acre-ft per year by 2020. Developments of energy resources in other parts of Wyoming will also require large amounts of water; transbasin diversion of Green River water to other areas could total an additional 270,000 acre-ft per year. In anticipation of this increased demand, water planners and managers need much more information about available ground and surface waters, present quality of the waters, and hydrologic effects that would be caused by development of energy resources. The U.S. Geological Survey is conducting an extensive hydrologic study of the basins, this report summarizes the study plan and discusses the methods of approach that would be utilized in the study. Regarding water quality, particular attention is being given to trace metals, biological characteristics, and trend analysis. Salinity, channel-geometry, and hydraulic characteristics, detailed statistical analyses, and mathematical models are being applied to surface-water studies. An updated well inventory, aquifer tests, and borehole geophysical surveys are being used in ground-water studies.

(WODAR-USGS)


Lowham, H. W., 1978


This report presents a method for estimating temperatures of streams in the Green River Basin, Wyoming. The procedure utilizes a regional model for estimating mean daily temperatures of streams at unmeasured sites. The regional model was developed by describing annual temperature patterns at 43 measured sites in the basin and by applying the harmonic function T = M + A sin (0.0272 t + C) where: T is mean daily temperature; M, A, and C are harmonic coefficients calculated from data for each stream temperature station; and t is the day of the water year. Application of the above equation for estimating temperatures at unmeasured sites requires regionalized estimates of M, A, and C. Regional estimates were developed with the aid of multiple-regression techniques; whereas the calculated harmonic coefficients were regressed against physical and climatic characteristics of the stream-temperature stations. Stream elevation was found to be a significant factor affecting water temperature.

Analysis of areal and temporal variations in temperature showed that springs, irrigation return flows, and reservoir storage were affecting reaches of several major streams.


Lowham, H. W.


Width, depth, cross-sectional area, and velocity of streamflow were depicted for 51 gaged sites by summarizing data obtained from current-meter discharge measurements. Using these at-a-station relations as a base, regional relations were then developed that characterize hydraulic features of streams throughout the study area.

Channel size is an indication of flow magnitude. High flows influence channel formation and the annual peak-flow array is a representation of these flows. The geometric mean of this array is used as a statistical index of channel-forming flows because it represents the relative magnitude of high flows at a site. Bankfull discharge is a physical index of flows dominating channel formation. The magnitude of the geometric mean equates closely to bankfull discharge, on the average. Relations depicting hydraulic characteristics to a discharge equal to the geometric mean of annual peak flows may therefore be considered to be generally representative of channel conditions existing during bankfull discharge. The relations have application for predicting channel response to developments that would alter streamflow.

Hydrology of Salt Wells Creek--A Plains Stream in Southwestern Wyoming.


Available from the National Technical Information Service, Springfield, VA 22151 as PHS2-201211. Price codes: A04 in paper copy; A01 in microfiche. Geological Survey Water Resources...

Development of energy minerals in plains areas of Wyoming is expanding rapidly. Such development may affect water resources and hydrologic relations of the plains; however, little information exists concerning hydrologic processes for these areas. This report summarizes results of a hydrologic study made during 1975-78 of Salt Wells Creek, a drainage area of about 500 square miles located southeast of Rock Springs, Wyoming. The area is typical of arid and semiarid plains areas in southwestern Wyoming where mineral development is occurring. Salt Wells Creek is predominately an intermittent stream. Numerous springs in the headwaters cause small perennial flows in some upstream tributaries; evaporation, freezeup, and seepage deplete these flows so that the middle and lower reaches of the main channel have only intermittent flows. The water quality is highly variable. The nature of streamflow affects water quality. It was observed that a flushing of dissolved solids and suspended sediment occurs during the first flows of a runoff event. A striking feature of the stream is its deeply incised channel. The downcutting is attributed to the cumulative effects of: (1) a change in the relative climate, amounts of annual precipitation occurring as rain and snow, (2) change in base level due to downstream channelization, and (3) changes in land use. Because of the incision, erosion is now expanding to include intervening tributaries. (USGS)

CHEMICAL ANALYSES OF GROUNDWATER IN THE BIGHORN BASIN, NORTHWESTERN WYOMING

LOWRY, M. E.; LINES, G. C.

GEOLoGICAL SURVEY, CHEYENNE, WYO. WATER RESOURCES DIV.

WYOMING DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT

BASIC DATA REPORT. 1972. 24 P., 1 Fig., 2 Tabs. 9 Ref. Journal Announcement: SWRA053


Hydrology of the uppermost Cretaceous and lowermost Paleocene rocks in the Niobrara oil field, Campbell County, Wyoming

LOWRY, M. E., 1973


Ground-water resources of Sheridan County, Wyoming


Sheridan County is in the north-central part of Wyoming and is an area of about 2,500 square miles. The western part of the county is in the Bighorn Mountains, and the eastern part is in the Powder River structural basin. Principal streams are the Powder and Tongue Rivers, which are part of the Yellowstone River system. The climate is semiarid, and the mean annual precipitation at Sheridan is about 16 inches.

Rocks of Precambrian age are exposed in the central part of the Bighorn Mountains, and successively younger rocks are exposed eastward, so that the Tertiary age rocks are exposed throughout a large part of the Powder River structural basin. Deposits of Quaternary age underlie the flood plains and terraces along the larger streams particularly in the western part of the basin.

Aquifers of pre-Tertiary age are exposed in the western part of the county but they dip steeply and are deeply buried just a few miles east of their outcrop. Aquifers that might yield large supplies of water include the Bighorn Dolomite, Madison Limestone, Amsden Formation, and Tensleep Sandstone. The Flathead Sandstone, Sundance Formation, Morrison Formation, Cloverly Formation, Newcastle Sandstone, Frontier Formation, Parkman Sandstone, Bearpaw Shale, and Lance formation may yield small or, under favorable conditions, moderate supplies of water. Few wells tap aquifers of pre-Tertiary age and these are restricted to the outcrop area. The meager data available indicate that the water from the Lance Formation, Bearpaw Shale, Parkman Sandstone, Tensleep Sandstone and Amsden Formation, the Flathead Sandstone is of suitable quality for domestic or stock purposes, and that water from the Tensleep Sandstone and Amsden Formation, and the Flathead Sandstone is of good quality for irrigation. Samples could not be obtained from other aquifers of pre-Tertiary age; so the quality of water in these aquifers could not be determined.

Adequate supplies of ground water for stock or domestic use can be developed throughout much of the report area from the Fort Union and Wasatch Formations of Tertiary age; larger supplies might be obtained from the coarse-grained sands of the Wasatch formation near Moncier Ridge. Four aquifer tests were made at wells tapping formations of Tertiary age, and the coefficients of permeability determined ranged from 2.5 to 7.9 gallons per day per square foot. The depths to which wells must be drilled to penetrate an aquifer differ within relatively short distances because of the lenticularity of the aquifers. Water in aquifers of Tertiary age may occur under water-table, artesian, or a combination of artesian and gas-lift conditions.

Water from the Fort Union is usable for domestic purposes, but
the iron and dissolved-solids content impair the quality at some locations. Water from the Fort Union Formation is not recommended for irrigation because of sodium and bicarbonate content. The water is regarded as good to fair for stock use. Water from the Wasatch Formation generally contains dissolved solids in excess of the suggested domestic standards. But this water is usable in the absence of other supplies. The development of irrigation supplies from the Wasatch Formation may be possible in some areas, but the water quality should be carefully checked. Water of good to very poor quality for stock supplies is obtained depending upon the location. Hydrogen sulfide, commonly present in water of the Fort Union and Wasatch Formations, becomes an objectionable characteristic when the water is used for human consumption.

Deposits of Quaternary age generally yield small to moderate supplies to the wells. Two pumping tests were conducted, and the coefficients of permeability of the aquifers tested were 380 and 1100 gallons per day per square foot. Usable supplies of graviatile water can be developed from the deposits. The thickest known deposit, the alluvium, is in the valley of Dutch Creek, which heads in the Powder River structural basin. Water from the alluvium is usable as a stock supply but has objectionable characteristics for domestic and irrigation use. Recharge to ground-water reservoirs is from precipitation and seepage from streams and irrigation. Recharge conditions are generally better in the western part of the basin where precipitation is adequate, and where there is some perennial and streams and irrigated lands. Discharge from the ground-water reservoirs is by seepage to streams, evaporation, transpiration, and by wells and springs.

**Water Resources of the Bighorn Basin, Northwestern Wyoming**


The water-bearing properties of the geologic units are summarized. The hydrogeologic map illustrates the distribution of wells in the different units and gives basic data on the yields of wells, depth to water, and dissolved solids and conductance of the water. Aquifers capable of yielding more than 1,000 gpm (gallons per minute) underlie the area everywhere except in the mountains on the periphery of the basin. In 1970, approximately 29,500 of the 40,475 people living in the Bighorn Basin were served by municipal water supplies. The municipal water supply for about 6,300 of these people was from ground water. The natural flows of streams in the Bighorn Basin differ greatly due to a wide variety of climatic, topographic, and geologic conditions of the basin. The station locations and the average discharge per square mile are shown on the map and give an indication of the geographic variation of basin yields. The maximum instantaneous discharge that has occurred at each station during its period of record is shown. Most of the runoff in the basin is from snowmelt in the mountains.

(Woodard-USGS)

**WATER RESOURCES OF THE LARAMIE, SHIRLEY, HANNA BASINS AND ADJACENT AREAS, SOUTHEASTERN WYOMING**


The availability and quality of ground water and flow characteristics and quantity of water in the major streams were studied in the Laramie basin, the Shirley basin, and the Hanna basin, all in southeastern Wyoming. Tremendous quantities of water are present in rocks underlying the area. Permeability there would be in excess of 60 acre-feet of water stored in a sandstone 1 foot thick and 1 mile square. Groundwater suitable in quantity and quantity for stock use is generally available at depths of 500 feet or less. Most wells for which data are available are used for stock or domestic supplies. Flow-duration curves show the distribution of daily discharges for the period for which the data were compiled. There is in most places a free exchange of water between streams and floodplain deposits to the extent that any significant change in the quantity of water in one will be reflected in the other. No areas were identified during this study where perennial streams lose water to bedrock formations. The most prevalent condition is typified by that in the Laramie basin. There, the areal relations of water in bedrock to water in the Little Laramie and Laramie rivers indicate that bedrock underlying the flood plain of these rivers is not sufficiently pervious to measurably affect the flow of the Laramie River by either increasing or decreasing discharge. (Knapp-USGS)

**An Evaluation of Surface-Mine Spoils area restoration in Wyoming using Rainfall Simulation**

CHEMICAL QUALITY OF SURFACE WATER IN THE FLAMING GORGE RESERVOIR AREA, WYOMING AND UTAH

MADISON, M. J.; WADDELL, K. M.

GEOLOGICAL SURVEY, WASHINGTON, D.C.
GEOLOGICAL SURVEY WATER-SUPPLY PAPER 2009-C, 1973, 18 P., 8 FIG., 1 PLATE, 3 TAB., 6 REF.

THE MAJOR INFLOW TO THE FLAMING GORGE RESERVOIR, WYOMING AND UTAH, IS FROM THE GREEN RIVER, WHICH CONTRIBUTES AN AVERAGE OF 81% OF THE WATER AND 59% OF THE INFLOW LOAD OF DISSOLVED SOLIDS. TOGETHER, BLACKS FORK AND HENRY'S FORK CONTRIBUTE ABOUT 16% OF THE INFLOW LOAD, AND ABOUT 23% OF THE DISSOLVED-SOLIDS LOAD. WHEREAS MINOR TRIBUTARIES CONTRIBUTE APPROXIMATELY 3% OF THE TOTAL INFLOW WATER TO THE RESERVOIR, BUT ABOUT 18% OF THE TOTAL INCOMING LOAD OF DISSOLVED SOLIDS. THE CONCENTRATION OF DISSOLVED SOLIDS IN CONCENTRATION IS DUE MOSTLY TO LEACHING OF MINERALS FROM THE RESERVOIR BOTTOM. THE MAJOR DIFFERENCE BETWEEN THE CHEMICAL COMPOSITION OF THE INFLOW DURING 1962-66 AND THAT OF THE RESERVOIR IN 1966 IS AN INCREASE IN SULFATE AND A DECREASE IN DICARBONATE. IMPOUNDMENT CAUSED THE CONCENTRATION OF DISSOLVED SOLIDS IN THE RIVER SYSTEM TO INCREASE BY ABOUT 32%.

E. L. Ward

COELESEY, M. R.

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 2009-C, 1973, 18 P., 8 FIG., 1 PLATE, 3 TAB., 6 REF.

Journal Announcement: SWAG 615

Washington, D.C.


E. L. Ward

COELESEY, M. R.

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 2009-C, 1973, 18 P., 8 FIG., 1 PLATE, 3 TAB., 6 REF.

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GEOLOGICAL SURVEY WATER-SUPPLY PAPER 2009-C, 1973, 18 P., 8 FIG., 1 PLATE, 3 TAB., 6 REF.

Journal Announcement: SWAG 615

Washington, D.C.

either runoff or nonrunoff. A power-decay-type curve is visually fitted to the two types of rainfall events. This separation curve is an incident-ponding curve and its equation describes infiltration parameters for a soil. For the soils more than one soil complex, only the incident-ponding curve for the soil complex with the lowest infiltration rate can be defined using the separation technique. Incident-ponding curves for soils with infiltration rates greater than the lowest curve are defined by ranking the soils according to their relative permeabilities and optimizing the curve position. A comparison of results for six basins produced computed total runoff for all events used ranging from 16.6 percent less to 2.3 percent more than measured total runoff.

Rainfall and Runoff Data from Small Basins in Wyoming

Rainfall and runoff occurrences in Wyoming are tabulated for years 1965 to 1973. Small ephemeral streams having drainage areas of less than 11 square miles. Precipitation and discharge data in 5-minute increments are given for 392 flow events in 22 small-drainage basins. The data were collected for use in design of drainage structures for highways crossing ephemeral streams with small drainage areas (Woodard-USGS).

Ground-Water Levels in Wyoming 1940-1971

Ringen, Bruce H.

Publication of the Wyoming State Engineer and Wyoming Department of Economic Planning and Development Prepared by the U.S. Geological Survey. 479 p., 25 Illus., 1 Table, 1 Ref.

Report contains water-level measurements made in observation wells in Wyoming by the U.S. Geological Survey and cooperative state and Federal agencies during the period 1940-71. The data are listed by counties. Maps showing locations of the observation wells are included. Aquifers tapped by the observation wells are identified.

Records of Ground-Water Levels in Wyoming, 1972-73

Ringen, Bruce H.

Publication of the Wyoming State Engineer and Wyoming Department of Economic Planning and Development Prepared by the U.S. Geological Survey. 165 p., 21 Illus., 1 Table, 2 Ref.

This report contains tables of water-level measurements made in observation wells in Wyoming by the U.S. Geological Survey in cooperation with State and Federal agencies during the period 1972-73. The data are listed by counties. Maps showing locations of the observation wells are included. Aquifers tapped by the observation wells are identified.

Effect on Sediment Yield and Water Quality of a Nonrehabilitated Surface Mine in Northern Central Wyoming

Ringen, Bruce H., Shown, L. M., Hadley, R. F., and Hinkley, T. K.


Journal Announcement: SWA1303

Sediment and chemical quality of water data were collected from two adjacent drainage basins in northern Wyoming to compare hydrologic differences between an undisturbed basin and a surface-mined, virtually unrehabilitated basin. Rate of sediment accumulation in a pond in the basin that was surface mined for coal and left unrehabilitated was over 11 times greater than in a pond in the adjacent undisturbed basin. The additional sediment came primarily from barren highwalls and roughed out spoil banks. No sediment was yielded by ungraded spoil rows that drained to closed depressions. Most sediment yielded from the two basins was trapped in the two ponds. The chemical composition of materials from slopes, channels, and pond bottoms of the two basins were similar; however, concentrations of dissolved and suspended matter in water of the two ponds were different. Low concentrations of dissolved chemical constituents in the pond water below the undisturbed basin suggest surface runoff as the source. Higher concentrations of dissolved chemical constituents, notably calcium, magnesium, and sulfate, in pond water below the mined area suggest ground-water discharge as the source. Sediment yield was a better indicator of the effects of disturbance on mined areas than chemical quality of water (Woodard-USGS).

Coal of Laramie Basin, Wyoming

Siebenthal, C. E., 1907

U.S. Geological Survey Bulletin 50-9, p. 9 Fig, 7 Tabs, 23 Ref.

Permit requirements for development of energy and other selected natural resources for the State of Wyoming. Smith, J. F., 1981


Wyoming Water Resources Association 1976, 16 p., 1 Fig., 1 Tab, 17 Ref, 77-04994.

An overview of River-Phase assessment techniques in an energy-impacted region—Yampa River Basin, Colorado and Wyoming.

STEELY, T. B., 1979

Vol. 3 No. 3 P. 151-171, 1979, 10 Fig, 2 Tab, 29 Ref., 80-01952.

AN ENVIRONMENTAL ASSESSMENT OF IMPACTS OF COAL DEVELOPMENT ON THE WATER SOURCES OF THE YAMPA RIVER BASIN, COLORADO AND WYOMING—PHASE-1 WORK PLAN (Duplicated see Colorado).

STEELY, T. B.; BAUER, D. P.; WENTZ, R. A.; WARNER, J. W.

GEOLOGICAL SURVEY DENVER, COLD. Basin, resulting from coal-resource development were assessed. Basin population may increase by as much as threefold between 1975 and 1990. Volumes of wastes requiring treatment will increase accordingly. Potential problems associated with ammonia-nitrogen concentrations in the Yampa River downstream from Steamboat Springs were evaluated using a waste-land assimilative-capacity model. Changes in sediment loads carried by streams due to increased coal mining and construction of roads and buildings may be apparent only locally; projected increases in sediment loads relative to 1940 values in the basin are estimated to be 2-3 fold.

Solid-waste residuals generated by coal-conversion processes and disposed of into old mine pits may cause widely dispersed ground-water contamination based on simulation results. Projected increases in year-round water use will probably result in the construction of several proposed reservoirs. Current seasonal patterns of streamflow and of dissolved-solids concentrations in streamflows will be altered by these reservoirs. Decreases in time-weighted mean-annual dissolved-solids concentrations of as much as 34 percent are anticipated, based upon model simulations of several configurations of proposed reservoirs.

Detailed statistical analyses of water-quality conditions in the Yampa River basin were made. Regionalized maximum water-quality conditions were estimated for comparison with future conditions. Using Landsat imagery and aerial photography, potential remote-sensing applications were evaluated to monitor land-use changes and to assess both snow cover and turbidity levels in streams. The technical information provided by the several studies of the Yampa River basin assessment should be useful to regional planners and resource managers in evaluating the possible impacts of development on the basin's water resources.

Depending on the magnitude of mining and use of coal resources in the basin, an estimated 0.7 to 2.7 million tons (0.6 to 2.4 million metric tons) of waste residuals may be discharged annually into the environment by coal-resource development and associated economic activities. If the assumed development of coal resources in the basin occurs, annual consumptive use of water, which was approximately 142,000 acre-feet (175 million cubic meters) during 1975, may almost double by 1990. In a related analysis of alternative cooling systems for coal-conversion facilities, four to five times as much water may be used consumptively in a wet-tower, cooling-pond recycling system as in once-through cooling. An equivalent amount of coal transported by slurry pipeline would require about one-third the water used consumptively by once-through cooling for in-basin conversion.

Stevens, Marvin D.

Ground-water levels are measured periodically in a network of observation wells in Wyoming, principally in areas where ground water is used for irrigation or municipal purposes. In areas of heavy ground-water pumping, measurements of water levels are made usually in January, February, or March. However, sometimes weather conditions prevent reaching some wells until April.

The time selected for measuring is when recovery of water levels from pumping effects of the previous irrigation season is virtually complete. These water-level measurements indicate changes in ground-water storage when compared with previous measurements. Water levels measured in about 240 wells during the first 4 months of 1978 were compared with measurements made during the same period in 1977 to give the net change in water levels for this period. These net changes along with depth to water in 1978 are shown in tables and on maps.

Water levels were measured periodically in about 290 wells for a total of about 1,150 measurements in 1977. Twenty-three wells were used as water-stage recorders in 1977. Hydrographs of most wells in the observation-well network were made using periodic measurements or the highest water levels recorded for the first and fifteenth day of each month for those wells equipped with water-stage recorders.

Five previous reports of ground-water levels in Wyoming were compiled by the U.S. Geological Survey (Ringen, 1973; Ringen, 1974; Ballance and Freudenthal, 1975; Ballance and Freudenthal, 1976; and Ballance and Freudenthal, 1977).


Swenson, F. A.
U.S. Geological Survey Miscellaneous Investigations Map 1-848-B.


Plan of study of the hydrology of the Madison Limestone and associated rocks in parts of Montana, Nebraska, North Dakota, South Dakota, and Wyoming.

U.S. Geological Survey, 1975

Coal Fields of east-central Carbon County, Wyoming.

Weathea, A. C., 1907

Reconnaissance of the geology and ground-water resources of the Pass Creek Flats area, Carbon County, Wyoming.

Visher, F. N., 1952
Wyoming


Physical, Chemical, and Biological Relations of Four Ponds in the Hidden Water Creek Strip-Mine Area, Powder River Basin, Wyoming

Wangsness, D. J.


The Hidden Water Creek area in Wyoming was mined from 1944 to 1955 and abandoned. The open pits filled with water and pond-type ecosystems developed. Light was transmitted to greater depths within two control ponds located outside the mine area. The lower light transmittance in the ponds within the mined area probably was due, in part, to the greater number of phytoplankton cells. Also, unconsolidated soil material within the mine area was observed to slough off the pond banks, which could add to the concentration of suspended sediments. Dissolved oxygen concentrations were lower in the ponds within the mined area. Most of the major ions (calcium, magnesium, sulfate, and sodium) were present in greater concentrations in the pools within the mined area. Higher concentrations of bicarbonate and total hardness were in the water within the mined area. Biological communities were less diverse and chemical concentrations fluctuated more in the mined area than in the ponds outside the mined area. (Woodard-USGS)

Physical, chemical, and biological relations in a potential coal surface-mine area, Clear Creek Drainage, Powder River Basin, Wyoming

Wangsness, D. J.


Biological reconnaissance of the Powder River structural basin, Wyoming

Wangsness, D. J.


Geology and ground-water resources of the Kaycee area, Wyoming

Warner, D. A., 1967


Ground-water resources and Geology of Niobrara County, Wyoming.
Whitcomb, Harold A.,


Niobrara County occupies an area of about 2,600 square miles in eastern Wyoming. The region lies in the eastern part of the High Plains and is characterized by rolling grasslands, isolated low mountains, and local badlands. The climate is typical of the northern Great Plains, a region of low precipitation, high rate of evaporation, and a wide range in temperature. The economy of Niobrara County is based principally on ranching and farming.

The rocks exposed in Niobrara County are mostly sedimentary deposits that range in age from Cambrian to Recent. Igneous and metamorphic rocks of Precambrian age crop out in the core of the Hartville uplift in the southcentral part of the county. Throughout most of the area older rocks are overlain by deposits of Late Cretaceous and Tertiary age. Aquifers of pre-Cretaceous age generally lie too deep to be considered potential sources of ground water in the area.

The 150 to 300 feet of interbedded sandstone and shale that composes the basal unit of the Cretaceous System in Niobrara County is designated as the Inyan Kara Group in the northern part of the report area and the Cloverly Formation in the southwestern part. Although the correlation between these formations has not been established, they are believed by some authors to be lithostratigraphic equivalents. In this report, the Inyan Kara Group and Cloverly Formation yield small quantities of water to domestic and stock wells drilled in or near areas of outcrop and moderate quantities to wells supplying the Lance Creek oil field. The water is generally under artesian pressure and is drawn from the Lance Creek wells flowing at a rate of about 4,000 gpm. The Inyan Kara Group is overlain by as much as 4,500 feet of principally shale and claystone of Cretaceous age. These deposits are considered to be water-bearing beds in some areas of the outcrop that might be obtained from the Newcastle Sandstone where it crops out on the eastern flank of the Old Woman anticline.

The Fox Hills Sandstone of Late Cretaceous age yields small quantities of water to stock and domestic wells in the northeastern part of Niobrara County. The water is under artesian pressure, and wells drilled along the margins of the outcrop might flow. The generally steep dip of the beds causes the formation to lie at progressively increasing depths west of an Inyan Kara-Cloverly contact. The formation is as much as 1,200 feet thick in the southern part of the outcrop and apparently thins northward.

The Lance Formation of Late Cretaceous age and the Fort Union Formation of Eocene age are the principal sources of stock and domestic water in the northwestern part of Niobrara County. In most areas the yield to wells may be expected to increase with depth and the number of water-bearing beds penetrated. The thickness of the formations increases from a thin eroded edge along the east margins of their outcrops to an estimated combined thickness of about 4,000 feet at the county line between Niobrara and Converse Counties.

The White River Group of Oligocene age, which unconformably overlies older rocks ranging in age from Early Cretaceous to Paleozoic, yields to small quantities of water in stock wells in the central part of the report area. Larger quantities might be obtained from coarse channel deposits that occur at some places in the formation. The thickness of the White River Group ranges from a thin edge overlapping older rocks to about 550 feet in the eastern part of the outcrop area.

The Arkaree Formation of Miocene age is the only known source of large quantities of ground water in Niobrara County. It yields water to many stock and domestic wells, 16 irrigation wells, and the wells supplying the communities of Lusk and Havre. The Arkaree is characterized by small quantities of water as much as 500 gpm (gallons per minute) and several wells would probably produce 1,000 gpm with suitable pumping equipment. Even larger yields may be expected from wells penetrating arenaceous sandstones of similar thicknesses of the aquifer. The Arkaree is thin where it wedges out against the Hartville uplift but is estimated to be about 600 to 700 feet thick in the vicinity of the Nebraska State Line. The alluvial deposits of Quaternary age in the valleys of the Cheyenne River and Lance Creek yield water to a few stock and domestic wells and to several irrigation wells. These deposits are the principal potential source of moderate to large quantities of ground water in the northern part of Niobrara County. Reported yields of irrigation wells range from 170 to 300 gpm, and larger yields of larger capacity probably can be developed in some areas. The thickness of the alluvium ranges from a few feet in the upper reaches of Lance Creek to a reported 100 feet near the confluence with the Cheyenne River. Water utilized in Niobrara County is obtained from drilled wells because surface-water supplies are ephemeral and unpredictable. Some water is pumped for irrigation from Lance Creek and the Cheyenne River. Ground water utilized during periods of low stream flow and perennial flow in the Niobrara River provides water for irrigation along the lower reaches in Niobrara County. In most areas larger pumpages of ground water could be increased without noticeably affecting water levels or seriously decreasing the quantity of water in storage.

Recharge to the ground-water reservoir is principally from precipitation, percolation of about 15 inches annually in Niobrara County. Recharge to the Arkaree Formation has been estimated to be only about 0.35 inches per year; probably, a somewhat smaller amount reaches the ground-water reservoir in the finer grained rocks underlying most of the northern part of the county.

Ground-water discharge in Niobrara County is principally by underground flow. Smaller quantities are discharged by springs and seeps, evapotranspiration, and discharge from wells. Approximately 5 to 8 million gallons of...
water per day moves as underflow through the Arikaree Formation eastward across the Nebraska State line. Appreciably larger quantities of ground water probably move westward through the Fox Hills Sandstone and the Lance and Fort Union Formations into the Powder River Basin. A study of the use of ground water by cottonwood trees along Lance Creek indicates that at least 4 million gallons of ground water is withdrawn daily from alluvial deposits.

Ground-Water Resources and Geology of Northern and Central Johnson County, Wyoming.

Whitcomb, Harold A., Cummings, T., Ray, Jr., and McCullough, Richard A.


Northern and central Johnson County, Wyoming, is an area of about 2,600 square miles that lies principally in the western part of the Powder River drainage basin but also includes the east flank of the Bighorn Mountains. Sedimentary rocks exposed range in age from Cambrian to Recent and have an average total thickness of about 16,000 feet. Igneous and metamorphic rocks of Precambrian age crop out in the Bighorn Mountains. Rocks of pre-Tertiary age exposed on the flanks and in the foothills of the Bighorns dip steeply eastward and lie at great depth in the Powder River basin. The rest of the project area is underlain by a thick sequence of interbedded sandstone, siltstone, and shale of Paleocene and Eocene age. Owing to the Regional structure, most aquifers in Johnson County contain water under artesian pressure.

The Madison Limestone had not been tapped for water in Johnson County at the time of the present investigation (1963), but several wells in eastern big Horn and Washakie Counties, on the west flank of the Bighorn Mountains, reportedly have flows ranging from 1,100 to 2,600 gallons per minute. Comparable yields can probably be obtained from the Madison in those areas where the limestone is fractured or cavernous. The Tensleep Sandstone reportedly yields 600 gallons per minute to a pumped irrigation well near its outcrop in the southwestern part of the project area. Several flowing wells tap the formation on the west flank of the Bighorn Mountains. The Madison Limestone and the Tensleep Sandstone have limited potential as sources of water because they can be developed economically only in a narrow band paralleling the Bighorn Mountain front in the southwestern part of the project area.

Overlying the Tensleep Sandstone is about 10,000 feet of shale, siltstone, and fine-grained sandstone that, with a few exceptions, normally yields only small quantities of water to wells. The Cloverly Formation and the Newcastle Sandstone may yield moderate quantities of water to wells; but, in some areas, properly constructed wells tapping both formations might yield larger quantities of water. The Shoshone Sandstone Member of the Cody Shale will probably yield only small quantities of water to wells, but it is the best potential source of ground water in the
meet suggested domestic standards with respect to dissolved solids, iron, manganese, and sulfate. Hydrogen sulfide is an objectionable constituent of water from some wells. The water is generally unsuitable for irrigation, either because of its high sodium and high bicarbonate content or because of its high salinity hazard. It ranges from good to poor quality for stock use.

GROUND-WATER RESOURCES AND GEOLOGY OF THE WIND RIVER BASIN AREA, CENTRAL WYOMING

WHITCOMB, HAROLD A.; LOWRY, MARLIN E.
US GEOLOGICAL SURVEY.

U. S. GEOLOGICAL SURVEY, HYDROL INVEST ATLAS HA-270, 13 P, 1968, 1 MAP, 1 CHART, 29 REF.,

Journal Announcement: SWRA0801

The Wind River Basin is a 12,000-sq.-mi area in Central Wyoming where climate ranges from humid to arid. The basin, a structural depression uplifted and faulted along the margins, contains several thousand ft of tertiary rocks. Mountains around the basin are formed by rocks, Precambrian to Cretaceous, which dip beneath the basin. Groundwater occurs under both water-table and artesian conditions. Principal water-bearing units are alluvial deposits and tertiary sandstones (Carikaree and Wind River formations), which have the potential to yield large quantities of water at places. The tertiary Fort Union formation and several of the pre-tertiary formations also yield water locally. Quality of the groundwater varies from low in mineral content and suitable for domestic use to unusable for stock supplies. Groundwater locally contains undersirable amounts of dissolved solids, fluoride, chloride, sodium, or hydrogen sulfide. Water in alluvial deposits underlying the Riverton Irrigation Project area is highly mineralized due to interaction with river and stream flow. Analyses of water are given in a table, and the lithologic and hydrologic characteristics of geologic formations are given in a chart. Maps at 1:250,000 show geology, piezometric contours, well data, and specific conductance of water.

Water Resources Data for Wyoming, Published annually since 1975.

Available from the National Technical Information Service, Springfield, VA 22161.

Water Resources data for Wyoming consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. This data represents that part of the national water data system operated by the U.S. Geological Survey and cooperating State and Federal agencies in Wyoming. (USGS)

WATER RESOURCES INVESTIGATIONS IN WYOMING, 1968

GEOLOGICAL SURVEY, WASHINGTON, D.C.

GEOLICAL SURVEY REPORT OF INVESTIGATIONS FOLDER, 1 SHEET, 1969, 6 Fig, 1 MAP.

Journal Announcement: SWRA0521

The Water Resources Studies and Investigations of the U. S. Geological Survey in Wyoming are summarized, a selected bibliography of material concerning the state is included, a list is given of State and federal agencies, and cities who cooperate in different parts of the program. The Hydrologic Data Network consists of 216 primary, secondary, and water management streamflow stations; 238 groundwater observation wells; and 91 water quality observation surveys. Small State Maps show principal sources of groundwater, mean annual precipitation, average annual runoff, sediment concentration of rivers, discharge of the principal rivers, and the dissolved solids in major streams. A map scale 1:42 mi to the inch, shows by symbols, numbers, and colored outline the Hydrologic data network and investigations in Wyoming in December 1968. (Woods-USGS)

WATER RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN THE NORTHERN GREAT PLAINS COAL REGION OF WYOMING, MONTANA, AND NORTH DAKOTA, 1975

GEOLOGICAL SURVEY, DENVER, COLO. WATER RESOURCES Div.
OPEN-FILE REPORT, MAY 1975, 110 P, 27 FIG, 27 REF.

Journal Announcement: SWRA0824

The Geological Survey’s water resources division has for many years maintained a program of Water Resources Investigations that includes the coal regions of Wyoming, Montana, and North Dakota. The recent interest in coal has added new dimensions and greater intensity to the investigations. The work has expanded to include monitoring the environmental effects of coal mining and processing and to determine the availability of additional water supplies for coal-conversion plants and related demands. This report describes the water-resources investigations program that is currently in operation. Locations of gaging stations and water-quality measuring sites, frequencies and parameters, and areas of groundwater studies are included. Brief descriptions of coal-related studies by investigators who are headquartered outside the Northern Great Plains coal regions are also included. Such studies are research in topics related to coal extraction, water supply, and post-mining reclamation. (Woods-USGS)

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This document analyzes the impacts of approval of a mining and reclamation plan to recover 80 million tons of 84 million tons of federally leased surface-minable coal in the Powder River Basin, in northeastern Wyoming, over 20 years. The site, proposed Buckskin Mine, consists of 600 acres 10 miles north of Gillette in Campbell County. Most of the site is a gentle south slope, dissected by intermittent Rawhide Creek (69 square mile upstream drainage area, average flow 0.8 cubic feet per second) and ephemeral Spring Draw (drainage area 2.13 square miles). Maximum relief near Rawhide Creek is about 150 feet. Annual precipitation of 15 to 16 inches results in 14 gallons per minute runoff. The coal occurs in two seams at the top of the Fort Union Formation: the Anderson seam, about 40 feet thick, separated by 3 feet of shale from the underlying Canyon seam, about 64 feet thick. The coal is overlain by 0 to 215 feet of the Wasatch Formation. The beds dip less than two degrees southwest into the Basin. Small quantities of water are in the coals and discontinuous sandstones in the Wasatch Formation. The site contains 6 shallow wells, 5 reservoirs, irrigation ditches and spreader dams. Both surface and ground water is too highly mineralized (4,000 to 6,000 ppm) for irrigation.
milligrams per liter dissolved solids) for human consumption. Surface mining would require de-watering 400 gallons per minute during years 3 to 4, reducing to 260 gallons per minute during the 16th year. About 30 gallons per minute would be used. The remainder would be discharged to Rawhide Creek after treatment. De-watering of the sandstone would extend 1,000 to 1,500 feet. The coal de-watering would extend about 3 miles from the site. About 456 acres of shallow aquifers would be modified, resulting in a deterioration of water quality.

Proposed Coal Leasing in the Carbon Basin Area, Wyoming
ELM, Cheyenne, Wyoming
PES, 1979

This statement analyzes impacts of leasing 6,146 acres of Federal coal in the Carbon Basin, interspersed among private coal, in order to create logical mining units. The surface of the basin is characterized by a northeast-trending ridge, maximum relief 400 feet, dissected by ephemeral Second and Third Sand Creeks and Chapann Draw draining eastward to the Medicine Bow River, and by First Sand Creek, also ephemeral, a closed basin. These creeks are estimated to flow only 10 to 15 days per year. Annual precipitation is 10 inches and lake evaporation ranges from 36 to 42 inches per year. The coal, in the Paleocene-Eocene Hanna Formation, crops out on the southern end of the Basin. The main coal, the Johnson Bed, ranges from 8 to 22 feet thick. Two other coals, the Finch Group, more than 13 feet thick locally, and the Blue Group, more than 13 feet thick locally, overlie the Johnson Bed. About 10 million tons could be surface-mined to a depth of 150 feet and 95 to 98 percent of less than 400 million tons could be recovered underground by continuous and longwall mining. The coal beds and overlying sandstones are poorly productive aquifers, confined toward the basin center. Aquifers in the deeper Mesa Verde Formation are isolated from the Hanna Formation by the intervening Lewis Shale. Surface mining would remove one shallow well, seven stock ponds and two surface diversions. A maximum mine inflow of 40,000 gallons per day would have to be handled. Water in four test holes ranged from 672 to 8,084 milligrams per liter total dissolved solids.

Cherokee Proposed Project
ELM, Cheyenne, Wyoming
IN: Development of Coal Resources in Southcentral Wyoming, PES, 1978

The proposed Cherokee surface mine of 10,671 acres 30 miles west-southwest of Rawlins in Carbon and Sweetwater Counties, is near the Continental Divide, the saddle between the Great Divide and Washakie Basins. The relatively level landscape is underlain by nearly horizontal beds of the Fort Union/Wasatch Formation which contains two main coal seams, 12 and 14 feet thick. Annual precipitation of 10 inches produces probably poor quality ephemeral runoff of less than 0.17 inches to closed basins. Small amounts of poor quality, dissolved solids 2,000 to 3,760 milligrams per liter occur in the coals and lenticular sandstone above. Potentially 500 gallons per minute of water containing less than 1,000 milligrams per liter of dissolved solids could be obtained from a well in the Fort Union basal sandstone at a depth of about 3,500 feet. Mining would destroy two or three stock reservoirs and moist coal washing wastes conceivably could contaminate heavily mineralized ground water in Cow Butte Basin, a small playa, less than one square mile.

Eastern Powder River Coal
ELM, Cheyenne, Wyoming
DSS, 1978

This statement updates the Final Environmental Impact Statement, Eastern Powder River Coal Basin of Wyoming (PES 74-55). It evaluates impacts of surface coal mining and related activities by the year 1990 at three levels, 1) low—169 million tons per year from 14 surface mines presently operating or pending approval, 2) probable—173 million tons per year, one additional mine, and 3) high—13 existing or pending mines and 23 new mines producing 329 million tons per year, and one gasification plant. It also evaluates site-specific impacts of the one mine responsible for the probable level. The study area is the eastern flank of the Powder River Basin in Wyoming, comprising about 5 million acres, bound on the east by the coal outcrop, on the south by the North Platte River, on the west by the Powder River, and on the north by the Montana-Wyoming state line. The northern part of the area is characterized by rolling hills, having relief of 500 to 1,000 feet. The southern part is plains and table land with relief of 300 to 500 feet. The Powder and Little Powder Rivers drain the north, Donkey Creek and Belle Fourche River drain the middle, and South Fork, Cheyenne River, Lance Creek and North Platte River drain the southern. Streams drain the southern part ephemeral but some have isolated intermittent reaches. Annual precipitation increases from less than 12 inches in the south to 17 inches in the northwest. More than 73 billion tons of mineable (less than 300 feet deep) coal occurs in 9 coal fields in the Eocene Wasatch Formation and the Paleocene Fort Union Formation. The alluvium in larger streams has produced several hundred gallons per minute of usable quality water. The Wasatch and Fort Union Formations and underlying Lance Formation and Fox Hills Sandstone contain sandstonal layers that produce about 25 gallons per minute of hard water at shallow depths (less than 1,000 feet) near outcrop areas, and industrial size supplies of softer water usually containing 500 to 1,500 milligrams per liter of dissolved solids at depths of 3,000 to 5,000 feet where the water is confined. In deep (below 5,000 feet) parts of the basin, where the Madison Limestone is fractured and cavernous, flows of as much as 7,000 gallons per
minute at 179 pounds per square inch flowing pressure have been obtained. Recharge to the Madison Limestone may be as much as 75,250 acre-feet per year from the Big Horn Mountains, the Laramie Range, the Black Hills, and possibly the Hartville uplift, all bounding the basin. The only Madison water analysis showed a total dissolved solids content of 3,726 milligrams per liter. Low level surface mining would modify shallow aquifers and lower shallow water tables in about 18,729 acres (except in the southwest where overburden and coal are above the water table), destroy some wells, reduce spring and nearby streamflow and degrade water quality. High level surface mining of an additional 19,279 acres would have expanded equivalent impacts.

ETSI Coal Slurry Pipeline, eastern Wyoming to Louisiana
BLM, Denver, Colorado
FEIS, 1980

Energy Transportation Systems, Inc., (ETSI) proposed to transport 37.4 million tons of coal per year for fifty years from the Powder River Basin near Gillette, Wyoming, by slurry pipeline to various power plants in Oklahoma, Missouri, Arkansas, and Louisiana. Slurry would require 20,000 acre-feet of water per year to be pumped from the Madison Formation in Niobrara County. A numerical model predicted drawdowns of more than 100 feet would occur in a 3,400-square-mile area around the well field, extending into southwestern South Dakota, affecting some existing Madison water users, including the City of Edgemont, South Dakota. Surface waters would also be affected, including base flow reductions of 1 to 4 cubic feet per second in the Cheyenne River, and Cascade and Hot Springs. Drawdowns of more than 100 feet in the Inyan Kara aquifer would extend over 1,600 square miles. Six water supply alternatives were analyzed. One alternative would purchase part of the required water from the City of Gillette well field, reducing drawdowns around the Niobrara County well field by 30 percent, but extending drawdowns over much of Crook County. Another alternative to develop a well field in Crook County would extend drawdowns of more than 23 feet over 23,600 square miles including adjacent parts of Montana and South Dakota, and 7,800 square miles of the Inyan Kara aquifer. Using Gillette and Crook County well fields would reduce the overall affected area but it would extend further south than if the Crook County well field was used alone. Obtaining the required water half from the Crook County well field and half from the Niobrara County well field would reduce the extent of 100-foot drawdown in the Madison to 3,700 square miles and 330 square miles in the Inyan Kara. Obtaining water from the Oahe Reservoir in South Dakota would not impact ground or surface waters. Using treated wastewater from South Dakota would not impact ground water but would reduce four South Dakota streams' flow by 1.3 to 12.4 cubic feet per second. Document is supported by Well Field Hydrology, Surface Water Quality, and Ruptures and Spills Technical Reports.

Green River/Hams Fork Regional Coal, Colorado and Wyoming
BLM, Craig, Colorado
FEIS, 1980

This statement analyzes the impacts of leasing as many as 16 tracts of Federal coal beneath 30.2 square miles in a 37,000 square-mile area in northwestern Colorado and south-central Wyoming. The Colorado tracts are in the Yampa and Damsforth Hills Coal Fields. The Wyoming tracts are along the east side of the Washakie and Great Divide Basins and in the Hanna Basin. In both states, the tracts are in mountain-bound areas of relatively low relief, consisting of low, rolling hills, broad plains and river valleys, and cuestas, in many places characterized by dip slopes and subdued escarpments. In Colorado, the coal is in the Illies and Williams Fork Formations of the Meadeville Group, and the Lance Formation, all Upper Cretaceous, and in the Paleocene Fort Union Formation. The Wyoming coals are in upper Cretaceous formations and the Paleocene Fort Union Formation. The region is semiarid, annual precipitation ranging from about 9 inches in Wyoming to as much as 13 inches in parts of the Colorado region. The tracts are drained by ephemeral streams in small water-sheds of tributaries to the North Platte River in Wyoming, and the Yampa River in Colorado. Annual runoff from the tracts is about 0.7 inches in Colorado and 0.2 inches in Wyoming. Runoff contains half of the sediment, and two to three times the dissolved solids of nearby mountain streams. In some places, small amounts, less than 10 gallons a minute to wells, of shallow ground water is perched above unsaturated coal layers. In Colorado, the water is of marginal quality for domestic use, and in Wyoming it contains 2,000 to 4,500 milligrams per liter of dissolved solids. Shallow ground water issues in a few springs in Colorado. Impacts to both surface and ground water would be local, relatively minor and generally short lived. Mining following maximum leasing would disturb no more than 0.23 percent in Colorado, and less than 0.05 percent in Wyoming, of the shallow aquifers in their respective watersheds. Alternate water would have to be furnished for 14 shallow wells and 9 springs in Colorado, and 47 small reservoirs, each less than 3 acre-feet, and rapidly filling with sediment.

Hanna Basin Study Site Coal Resource and Surface Mining Potential
Reclamation Evaluation in the Hanna Coal Field, south-central Wyoming
BLM, Denver, Colorado
EMRIA Report No. 2-75

The coal resource of the Hanna Basin study site consists of about 25 percent of the 41.2 thousand tons of identified coal beneath less than 200 feet of overburden in the Hanna Basin. The coal is in the upper Ferris Formation of Paleocene age. The site is drained by ephemeral streams tributary to the
Medicine Bow River to the east. Small amounts of water occur in thin sandstone layers above the coal, and slightly larger amounts are found in fractures in the coal beds. Depth to water ranges from 12 to more than 100 feet depending on topography. Flow is westwardly to the North Platte arm of the Seminoe Reservoir. Total dissolved solids in ground water ranges between 1,000 and 4,000 milligrams per liter, many toxic constituents exceeding EPA recommended standards. Surface mining will necessitate draining the coal below the reservoir level. Reversal of the gradient will increase flow into the mine, increasing the amount of water to be handled. No existing wells will be affected. Proper restoration practices will eliminate increased stream sedimentation.

Hanna South Proposed Project
BLM, Cheyenne, Wyoming

The proposed Hanna South surface mine of 4,127 acres just south of Hanna, Wyoming, includes 640 acres of Federally owned coal and surface. Mining would disturb 90 public acres and 642 private acres containing four coal beds averaging 41.2 feet in total thickness beneath less than 150 feet of overburden. The coal beds dip 25 to 40 degrees northwesterly into the Hanna Basin. The terrain is gently sloping at the head of northwesterly draining ephemeral draws. Small amounts of confined water occur near the mine, at depths ranging from 26 to 115 feet. Total dissolved solids ranged from 470 milligrams per liter in a shallow, 130-foot-deep well, to 9,160 milligrams per liter in a well 240 feet deep. Annual precipitation of 10 inches produces runoff of 0.3 inch in ephemeral draws. Runoff is high in dissolved solids and sediment. Mining would lower water level in an unused nearby well and destroy one stock reservoir. Water levels would recover by about 1996.

Powder River Regional Coal, Montana and Wyoming
BLM, Casper, Wyoming

Leasing of 14 tracts within the Powder River region of Montana and Wyoming is proposed to all for development of 1.5 billion tons of associated coal reserves. Development of the leases would affect Big Horn, Powder River, and Rosebud Counties in Montana, and Campbell, Converse, Crook, Johnson, Natrona, Sheridan, and Weston Counties in Wyoming. Maintenance tracts to be leased would include the Colstrip A and B, Colstrip C, Colstrip D, Cook Mountain, Coal Creek, Northeast Otter Creek, Timber Creek, Duck Nest Creek, Kintz Creek, and Keeline Tracts. All mined land would be reclaimed. Mining processes would consume 8,310 acre-feet of water, and associated municipal uses would consume 33,400 acre-feet of water in 1990. Approximately 310 wells and 35 springs would be destroyed. Approximately 247,000 acres of shallow aquifers would be removed to depths of 100 to 400 feet, although they would eventually be replaced by spoil aquifers. Surface outflow from the region would be reduced by approximately 350 acre-feet per year during mining. Between 20 and 33 point-watering sources would be destroyed.

Red Rim Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in the Green River Coal Region, south-central Wyoming
BLM, Denver, Colorado

The Red Rim study site is above the northwestward dipping sediments of the southern (Red Desert) part of the Great Divide closed Basin. The coal is in the lower part of the Tertiary Fort Union Formation, and overlies a thick sandstone whose outcrop forms the Basin's Red Rim to the southeast. Nearly 40 thousand tons of the estimated coal resource are in beds more than 2.5 feet thick covered by less than 200 feet of overburden. Most of the site is composed of remnants of hogbacks, severely eroded into rolling to rugged high plains. Climate is semiarid. Snowfall provides 40 percent of the annual precipitation of 10.4 inches. The site are drained by intermittent Separation Creek and tributaries. Little runoff originates on the site. Little water occurs above and in the coal. Only one of 10 test holes encountered water. Moderate (several hundred gallons per minute) quantities of good quality water may be available from a thick (500-600 feet) sandstone below the coal downdip from the site. Mining should encounter little water. Protective measures and restoration practices could eliminate degradation of water quality.

Sand Butte Preference Right Lease Application, southwestern Wyoming
BLM, Rock Springs, Wyoming

This document assesses the impacts of an extension of the Black Butte mine in Sweetwater County, about 28 miles east-southeast of Rock Springs, southwestern Wyoming. The 5,078-acre area is a semiarid (annual precipitation 8.8 inches) high plateau, consisting of a series of northeast trending escarpments and 4- to 6-degree dip slopes. About 33 million tons of coal occur in several beds averaging 3.7 to 9.3 feet thick, in the Fort Union and Lance Formations under less than 200 feet of overburden. The area is drained by ephemeral Patrick Draw, tributary to Bitter Creek, several miles northeast. About 60 percent of the surface is bare ground. Small quantities of poor quality water occur in and above the coal beneath drainage ways. No wells exist nearby. It is doubtful that mining would significantly change occurrence of ground water.
this statement assesses the impacts of approval of five mine and reclamation plans, 4 surface and one underground, issuance of associated rights-of-way, and cumulative impacts of potential coal development in the region. The five mines would produce 15.2 million tons per year, in addition to the 1990 annual production of 16 million tons of existing and projected mines. Three of the mines are in the Overthrust Belt on the west of the region and two are in the Rock Springs uplift on the east. The main resources are on the flanks of the Green River Basin and are drained by ephemeral Green River tributaries. Surface water quality is generally good, ranging from less than 100 to more than 2,000 milligrams per liter dissolved solids, depending on flow. Wells generally yield 10 to 100 gallons per minute of water ranging from 500 to 3,300 milligrams per liter of dissolved solids. Water use of 5,040 acre-feet per year due to the proposed action is about 0.035 percent of expected total water use by 1990. Mining would temporarily increase recharge and salinity of ground water near the river, but regional impact would be insignificant. Lower infiltration rates of reclaimed overburden would increase streamflow and sediment load locally.
The gently rolling uplands and isolated knobs and buttes of the 3.6-square-mile White Tail Butte study area cover an elongate drainage divide between intermittent Elk and White Tail Creeks. Maximum relief is 350 feet. Precipitation is about 16.3 inches. Three Tongue River Member (Fort Union Formation) coal beds crop out or are covered by less than 200 feet of overburden: the Anderson, averaging 34.3 feet thick; the Dietz, 18 to 28 feet thick; and the Canyon, averaging 21.6 feet thick. Small amounts of water containing about 2,000 milligrams per liter dissolved solids occur in shallow layers above, in and between the coals. Small amounts of less mineralized water occur below the Lebo shale member which lies below the lowest, the Canyon, coal bed. Surface mining will alter shallow aquifers, displace springs, and destroy several stock ponds. Aquifers below the Lebo Shale Member (bottom of the Fort Union Formation) would not be affected.
Control and Reclamation Act of 1977 is the understanding of the actual and proposed surface mining areas. Surface water data for small specific-sites and for larger areas such as adjacent and general areas are needed also to satisfy the hydrologic requirements of the Act. The Act specifies that surface-water modeling techniques may be used to generate the data and information. The purpose of this report is to describe how this can be achieved for smaller watersheds. This report also characterizes 12 'state-of-the-art' strip-mining assessment models that are to be tested with data from two data-intensive studies involving small watersheds in water resources in specific-site data. Extending surface-water modeling techniques to larger watersheds remains relatively untested, and to date the upper limits for application have not yet been established. The U.S. Geological Survey is currently collecting regional hydrologic data in the major coal provinces of the United States and this data will be used to help satisfy the "general-area" data requirements of the Act. This program is reviewed and described in this report (USGS) Chemical quality of public water supplies of the United States and Puerto Rico, 1962 Durfor, C. N., and Becker, Edith, 1964 U.S. Geological Survey Hydrologic Investigations Atlas H-2001 1 sheet.


The most abundant and available federal coal reserves in Eastern United States are in and near the National forests. The National forest areas offering the greatest potential for coal development are in or near the Daniel Boone in Kentucky and Tennessee, Hoosier in Indiana, Jefferson in Virginia, Monongahela in West Virginia, Shawnee in Illinois, and Wayne in Ohio. An evaluation of the available data and published information on coal mining and the water resources of these areas identifies informational needs. Three such needs common to all six National forest areas are for (1) numerical characterization of streamflow water-quality, and sedimentation characteristics; (2) information about ground-water availability, movement, and quality before, during and after mining; and (3) a hydrologic reconnaissance of all major lakes and impoundments within the prospective Federal coal-lease area. Investigations by the U.S. Geological Survey over a 6-year period. The applications of sophisticated analytical and interpretive techniques in these studies must be preceded by the collection and preparation of adequate hydrologic data.


In the past decade hydrologists have emphasized the development of computer-based mathematical models to aid in the understanding of flow, the transport of heat, and deformation in the groundwater system. These models have been used to provide information and predictions for water managers. Too frequently, ground-water was neglected in water-resource planning because managers believed that it could not be adequately evaluated in terms of availability, quality, and effect of development on surface water supplies. Now, however, with newly developed digital groundwater models, effects of development can be predicted. Such models have been used to predict hydrologic and quality changes under different stresses. These models have grown in complexity over the last 10 years from simple one-layer flow models to three-dimensional simulations of groundwater flow which may include a variety of transient, transport, effects of land subsidence, and encroachment of salt water. This paper illustrates, through case histories, how predictive groundwater models have provided the information needed for the sound planning and management of water resources in the United States.
General References

National coal resource investigations of the United States Geological Survey
Wood, G. H. Jr., (compiler), 1977
(Coal Project, see especially pp. 24-25).

Summary appraisals of Nation’s ground-water resources—upper
Colorado Region
Price, Don, and Arnow, Ted, 1974

Guidelines for sample collecting and analytical methods used in
the U.S. Geological Survey for determining the chemical
composition of coal
Swanson, V. E., and Hufner, Claude, Jr., 1976

Coal Field of the United States: Sheet 1
Trumbull, J. V., Jr., 1960
U.S. Geological Survey 1 sheet, scale 1:500,000

National coal resource investigations of the United States
Geological Survey
Wood, G. H. Jr., (compiler), 1977
(Coal Project, see especially pp. 24-25).

Index to water-data activities in coal provinces of the United
States, Vol. II, Interior Province
U.S. Geological Survey, 1979
U.S. Geological Survey, Office of Water Data Coordination

U.S. Geological Survey, Office of Water Data Coordination

U.S. Geological Survey, Office of Water Data Coordination

U.S. Geological Survey, Office of Water Data Coordination

General References

Coal resource classification system of the U.S. Bureau of Mines
and U.S. Geological Survey

Index to water-data activities in coal provinces of the United
States, Vol. II, Interior Province
U.S. Geological Survey, 1979
U.S. Geological Survey, Office of Water Data Coordination

Catalog of selected offices of the Office of Surface Mining,
Bureau of Land Management, and Geological Survey relating to
coal, 1981
U.S. Geological Survey, 1980b

Hydrologic modeling of coal lands
Van Haveren, R. P., and Levesley, G. H., 1979
A cooperative effort of the Bureau of Land Management and Water
Resources Division of the U.S. Geological Survey, Administrative
Reports, 13 p.

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