MONTANA
Ground-Water Quality

About 54 percent of Montana's 786,000 population (fig. 1) uses ground water for domestic purposes. However, the quantity of ground water withdrawn for domestic use is less than 0.5 percent of total statewide surface- and ground-water withdrawals (Montana Department of Natural Resources and Conservation, 1986). Remaining ground-water withdrawals for irrigation, livestock, and industry are about 1.5 percent of total water withdrawals (Solley and others, 1983). Although ground-water quality in Montana is not thought to be threatened by contamination (Montana Department of Health and Environmental Sciences, 1984) and the overall quality is suitable for many uses, ground-water supplies at several locations in the State have been degraded.

Concentrations of dissolved solids in ground water commonly exceed the national secondary drinking-water standards of the U.S. Environmental Protection Agency (1986b), particularly in principal aquifer groups of eastern Montana (fig. 2). A statistical analysis of computer-accessible ground-water-quality data in Montana indicates that the median dissolved-solids concentration for aquifer groups in the eastern part of the State ranged from about 400 to 5,000 mg/L (milligrams per liter) (Davis and Rogers, 1984). For aquifer groups in the western part, the median dissolved-solids concentration ranged from about 100 to 200 mg/L. Concentrations of trace constituents generally do not exceed the national primary drinking-water standards of the U.S. Environmental Protection Agency (1986a). Few computer-accessible data are available for organic constituents in ground water.

Several areas of ground-water contamination in Montana have inhibited the intended use of wells and required alternative supplies of water (fig. 3*A*, 3*B*). Sources of ground-water contamination as a result of human activity include saline seeps, mining, accidental spills, septic tanks and drain fields, oil and gas exploration, solid-waste-disposal landfills, municipal and industrial wastewater disposal, and leaking petroleum-storage tanks and delivery systems (Montana Department of Health and Environmental Sciences, 1984). A comprehensive ground-water-quality monitoring network has not been developed and ground-water-quality data generally have been collected in response to specific problems. Consequently, statewide ground-water-quality conditions and trends have not been well established.

Montana has seven sites (fig. 3*A*) on the National Priorities List for evaluation of hazardous waste under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

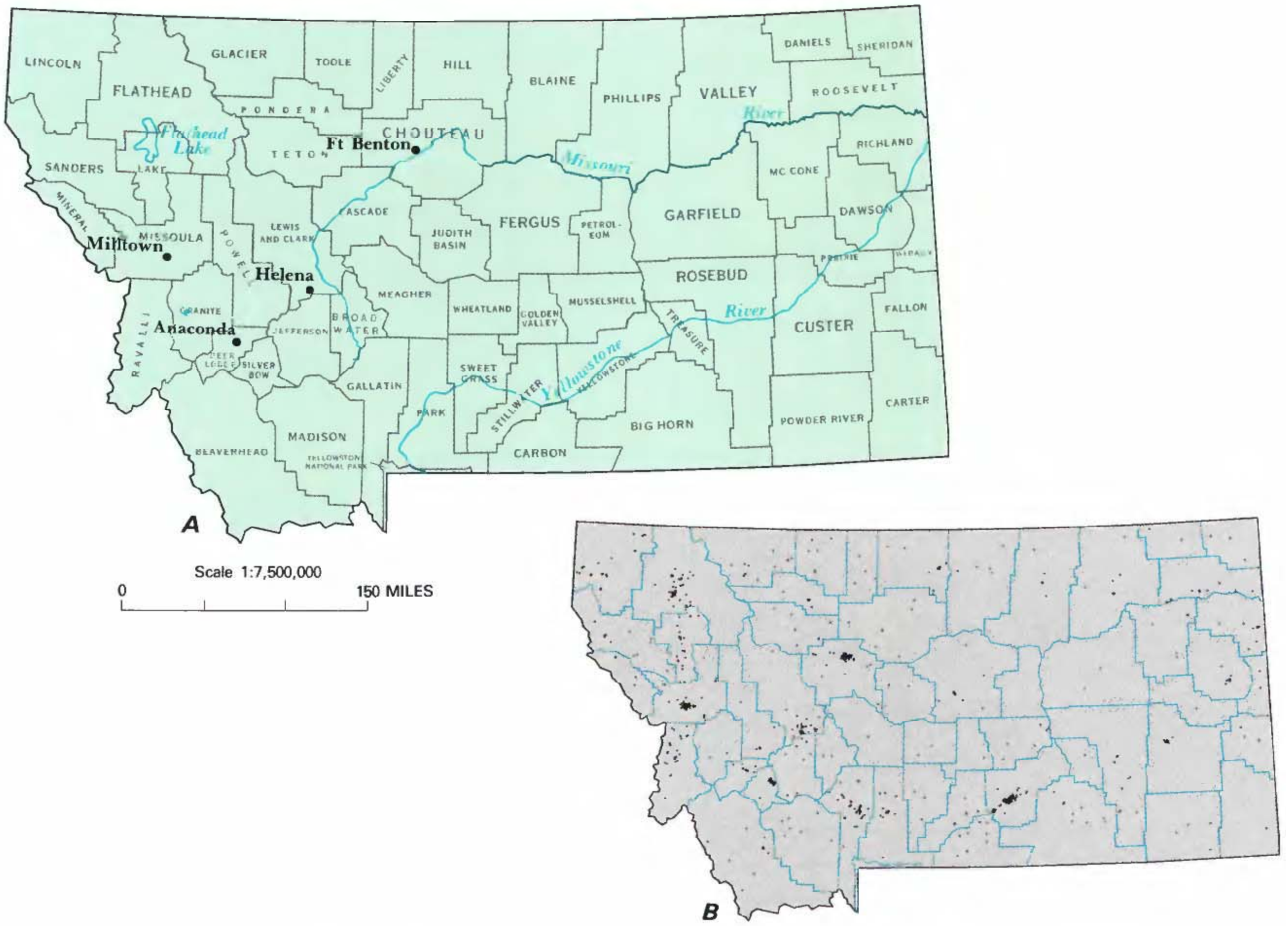

Figure 1. Selected geographic features and 1985 population distribution in Montana. *A*, Counties, selected cities, and major drainages. *B*, Population distribution, 1985; each dot on the map represents 1,000 people. (Source: *B*, Data from U.S. Bureau of the Census 1980 decennial census files, adjusted to the 1985 U.S. Bureau of the Census data for county populations.)

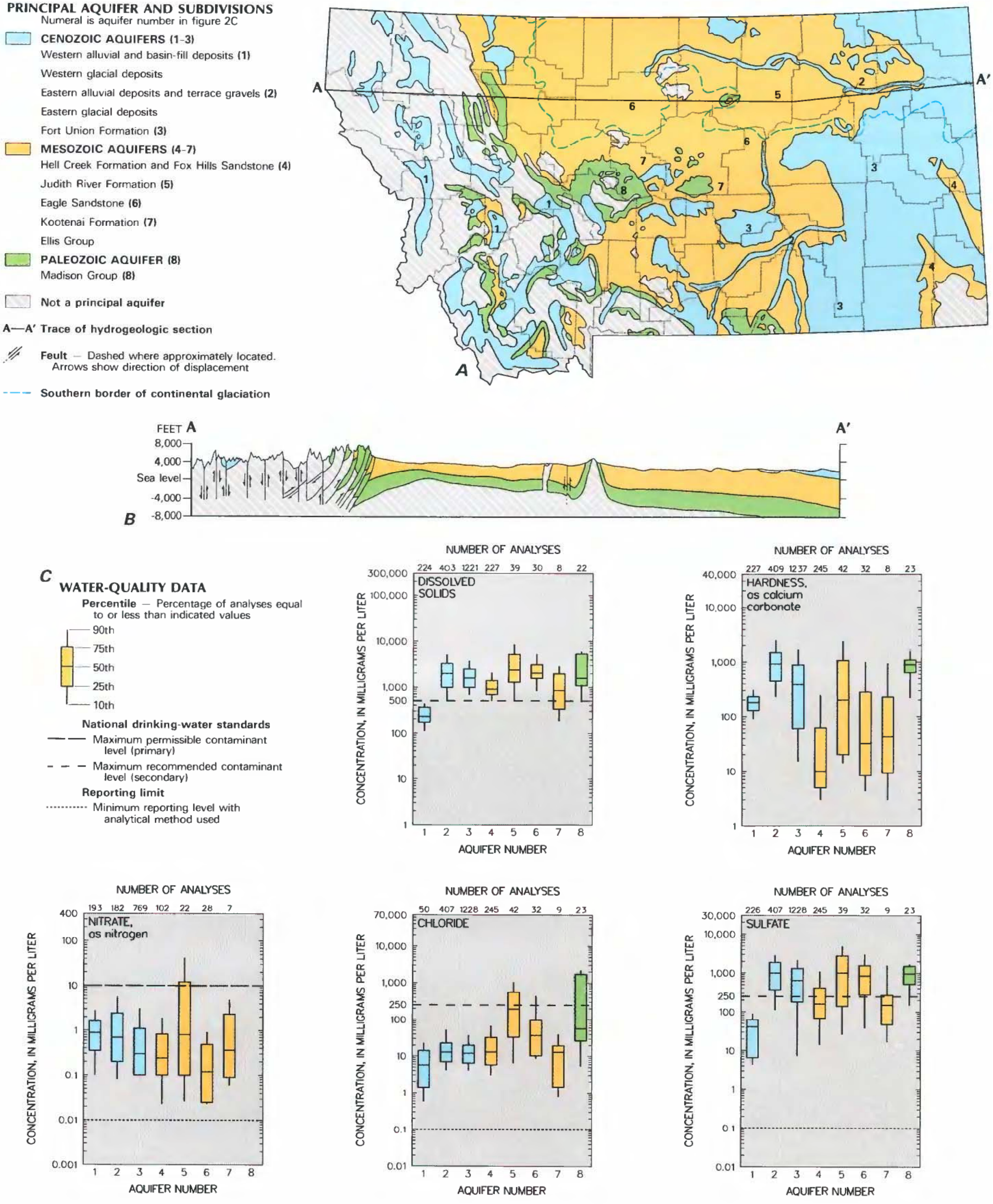

Figure 2. Principal aquifers and related water-quality data in Montana. *A*, Principal aquifers. *B*, Generalized hydrogeologic section. *C*, Selected water-quality constituents and properties, as of 1965-85. (Sources: *A*, Ross and others, 1955. *B*, American Association of Petroleum Geologists, 1972. *C*, Analyses compiled from U.S. Geological Survey files; national drinking-water standards from U.S.Environmental Protection Agency, 1986a,b.)

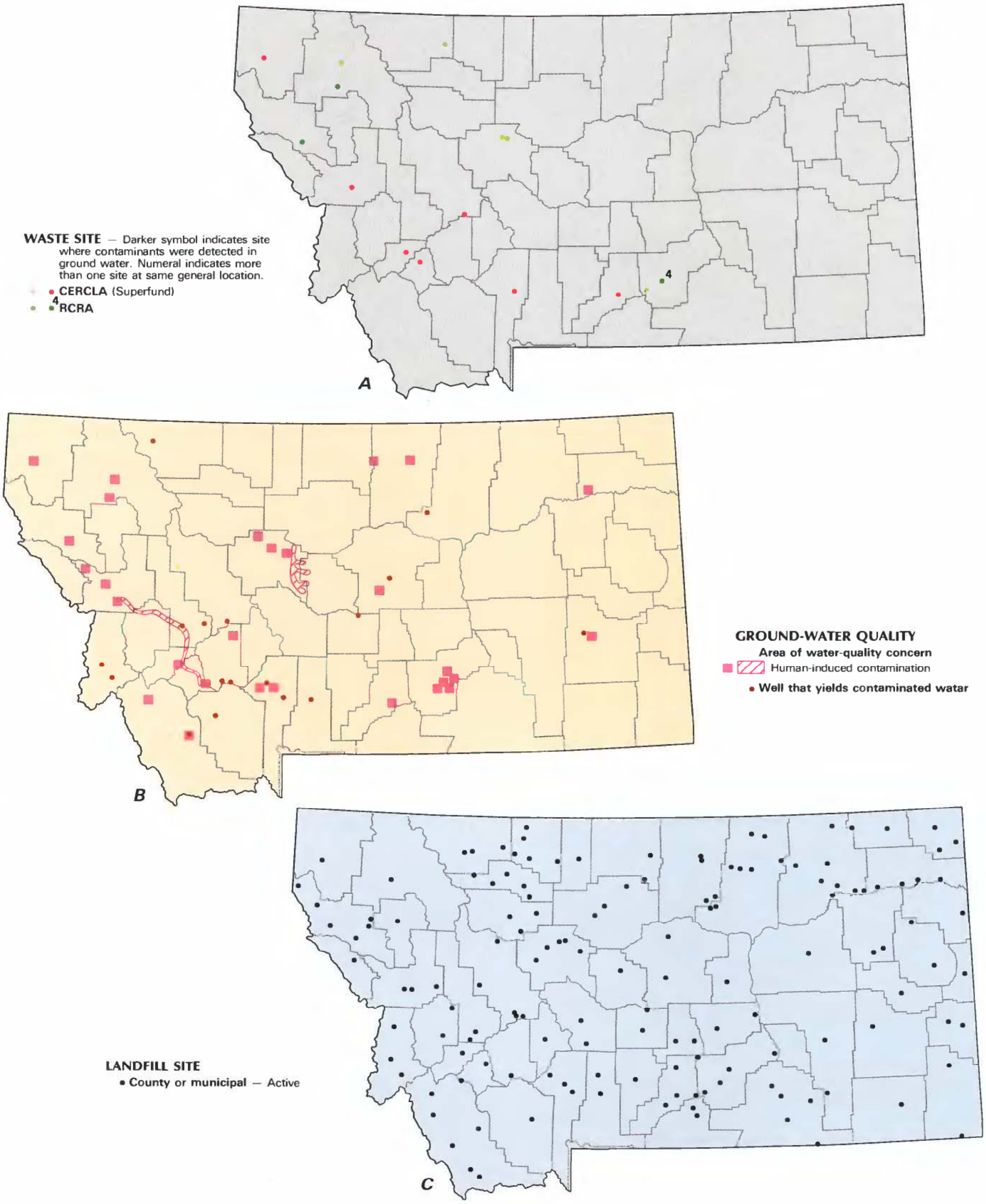

Figure 3. **Selected waste sites and ground-water-quality information in Montana.** *A*, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites and Resource Conservation and Recovery Act (RCRA) sites, as of 1986. ***B***, Areas of human-induced contamination and distribution of wells that yield contaminated water, as of 1986. ***C***, County and municipal landfills, as of 1986. (Sources: *A*, R.C. Thorvilson, Montana Department of Health and Environmental Sciences, written commun., 1986; U.S. Environmental Protection Agency, 1986c. *B*, J.L. Arrigo, Montana Department of Health and Environmental Sciences, written commun., 1986; modified from Montana Department of Health and Environmental Sciences, 1986. *C*, J.E. Leiter, Montana Department of Health and Environmental Sciences, written commun., 1986.)

of 1980. An additional site, proposed to be included as a CERCLA site, is included with 11 sites that require monitoring of ground-water quality under the Federal Resource Conservation and Recovery Act (RCRA) of 1976 (fig. 3*A*). Several additional sites are being investigated (1986) for potential ground-water contamination and possible inclusion in the CERCLA program. Some of these sites include landfills (fig. 3*C*) and other areas of human-induced contamination (fig. 3*B*).

WATER QUALITY IN PRINCIPAL AQUIFERS

Montana has two distinct hydrogeologic regimes that generally coincide with the western and south-central parts of the State and the eastern and north-central parts of the State (fig. 2*A*). Rocks in western and south-central Montana are severely faulted (fig. 2*B*); principal aquifer groups consist of Cenozoic alluvial and basin-fill deposits and glacial deposits. Principal aquifer groups in the eastern and north-central parts consist of Cenozoic alluvial deposits and terrace gravels, glacial deposits, and the Fort Union Formation; the Mesozoic Hell Creek Formation and Fox Hills Sandstone, Judith River Formation, Eagle Sandstone, Kootenai Formation, and Ellis Group; and the Paleozoic Madison Group. The Cenozoic aquifers primarily are unconsolidated to semiconsolidated gravel, sand, silt, and clay. Water in these aquifers generally is unconfined. The Mesozoic aquifers primarily are sandstone, siltstone, shale, and limestone. The Paleozoic aquifer primarily is limestone with some dolomite, anhydrite, and halite. Water in the Mesozoic and Paleozoic aquifers generally is confined except in outcrop areas.

Recharge to the ground-water systems mainly is from infiltration of precipitation in outcrop areas, although recharge also occurs by infiltration of streamflow in some areas and by leakage between aquifers. The annual rate of recharge is estimated to range from less than 1 inch in parts of the eastern plains to several inches in the western mountains.

Discharge from ground-water systems is variable. Generally, shallow ground water flows from topographically high areas toward local surface drainages, and deeper ground water flows toward major surface drainages.

Most ground-water withdrawals in Montana are from the near-surface Cenozoic aquifers, although water from all aquifers is used to some extent. A more complete description of aquifers and withdrawals is contained in a report by the U.S. Geological Survey (1985, p. 285–290).

BACKGROUND WATER QUALITY

A graphic summary of selected water-quality variables compiled from the U.S. Geological Survey's National Water Data Storage and Retrieval System (WATSTORE) is presented in figure 2*C*. The summary is based on dissolved solids, hardness, nitrate (as nitrogen), chloride, and sulfate analyses of water samples collected from 1965 through 1985 from principal aquifers in Montana. Percentiles of these variables are compared to national primary and secondary drinking-water standards of the U.S. Environmental Protection Agency (1986a,b) that specify the maximum concentration or level of a contaminant in a drinking-water supply. The primary maximum contaminant level standards are health related and are legally enforceable. The secondary maximum contaminant level standards apply to esthetic qualities and are recommended guidelines. The primary standards include a maximum concentration of 10 mg/L for nitrate (as nitrogen), and the secondary drinking-water standards include maximum concentrations of 500 mg/L for dissolved solids, 250 mg/L for chloride, and 250 mg/L for sulfate.

Water from the principal aquifers generally can be classified as calcium bicarbonate in the western and south-central parts of Montana and as sodium bicarbonate or sodium sulfate in the eastern and north-central parts. The summary shows considerable ranges in values. Most dissolved-solids concentrations exceed the standard, and figure 2*C* indicates that hardness varies considerably; many areas yield water that is hard or very hard (Durfor and Becker, 1964). Dissolved nitrate and chloride seldom occur in concentrations that exceed the drinking-water standards. However, sulfate concentrations commonly exceed the drinking-water standard in most aquifers except in the western alluvial and basin-fill deposits, the Hell Creek Formation and Fox Hills Sandstone, and the Kootenai Formation. Following are detailed descriptions of water quality in each of the principal aquifer groups of Montana.

Cenozoic Aquifers

WESTERN ALLUVIAL AND BASIN-FILL DEPOSITS

Generally, the western alluvial and basin-fill deposits are located along streams, and adequate water supplies for stock, rural-domestic, and some irrigation uses can be obtained within several hundred feet of land surface. Water in the deposits generally is unconfined, although clay lenses may result in locally confined conditions.

The alluvial deposits are one of the most widely used sources of ground water because of favorable water-yielding characteristics. In most areas, the quality of water from the deposits is suitable for many uses. On the basis of median values of major dissolved constituents, calcium and bicarbonate ions are predominant (Davis and Rogers, 1984).

Fifty percent of the water samples collected from these deposits from 1965 through 1985 had dissolved-solids concentrations less than 230 mg/L, the smallest median dissolved-solids concentration among the principal aquifers in Montana (fig. 2*C*). The median hardness value was 180 mg/L, which classifies about one-half of the ground-water samples as being very hard. The median concentrations for nitrate (0.89 mg/L), chloride (5.7 mg/L), and sulfate (41 mg/L) did not exceed the drinking-water standards.

WESTERN GLACIAL DEPOSITS

The western glacial deposits consist of two units: glacial till and glaciolacustrine deposits. The deposits generally are less than several hundred feet thick and can transmit substantial quantities of water. Water in the deposits generally is unconfined, although locally may be confined.

Water from the western glacial deposits probably is suitable for most uses, although few data are available in WATSTORE for this aquifer. On the basis of median values of major dissolved constituents, calcium and bicarbonate ions are predominant (Davis and Rogers, 1984). Ground-water-quality data in WATSTORE for 1965 through 1985 were insufficient to determine median values of dissolved solids, hardness, nitrate, chloride, and sulfate.

EASTERN ALLUVIAL DEPOSITS AND TERRACE GRAVELS

Water in the eastern alluvial deposits and terrace gravels generally is unconfined, although clay lenses locally may cause confinement. The alluvial deposits and terrace gravels produce the most substantial quantities of ground water in eastern Montana. However, use may be limited in localized areas because of the quality.

Water from the eastern alluvial deposits and terrace gravels is used for many purposes, even though the dissolved-solids concentration commonly exceeds the drinking-water standard. On the basis of median values, sodium, magnesium, and sulfate ions are predominant (Davis and Rogers, 1984).

The median dissolved-solids concentration of 2,000 mg/L indicates that most samples collected from 1965 through 1985 had concentrations that exceeded the drinking-water standard. In addition, 50 percent of the samples had hardness values larger than 920 mg/L, indicating that the water is very hard. The median concentrations of nitrate (0.70 mg/L) and chloride (13 mg/L) did not exceed the drinking-water standards. The median concentration for sulfate was 1,000 mg/L, which considerably exceeded the drinking-water standard.

EASTERN GLACIAL DEPOSITS

The eastern glacial deposits include several units. Water in the deposits generally is unconfined, although locally it may be confined. In some areas, the deposits can transmit significant quantities of water.

On the basis of median values of major dissolved constituents, calcium, magnesium, sodium, and sulfate ions are predominant (Davis and Rogers, 1984). Ground-water-quality data for 1965 through 1985 were insufficient to determine median values of dissolved solids, hardness, nitrate, chloride, and sulfate.

FORT UNION FORMATION

The Fort Union Formation is composed of several members. Water in the formation can be unconfined or confined, with flow toward local or major surface drainages. Water from the formation is used for domestic and livestock purposes, even though the dissolved-solids concentration commonly exceeds the drinking-water standard. Chemical characteristics of water in the formation tend to change with depth. For well depths of 200 feet or less, median concentrations of common ions indicate that sodium and sulfate ions are predominant. For well depths of more than 200 feet, sodium and bicarbonate ions predominate (Davis and Rogers, 1984).

Fifty percent of the ground-water samples collected from 1965 through 1985 had dissolved-solids concentrations larger than 1,600 mg/L. The median hardness concentration was 390 mg/L, which indicates that the water generally is very hard. The median concentrations for nitrate (0.30 mg/L) and chloride (12 mg/L) did not exceed the drinking-water standards. The median concentration for sulfate was 640 mg/L, which exceeded the drinking-water standard.

Mesozoic Aquifers

HELL CREEK FORMATION AND FOX HILLS SANDSTONE

Water in the basal sandstone of the Hell Creek Formation and the underlying Fox Hills Sandstone is either unconfined or confined. Wells completed in the aquifer can yield as much as 200 gal/min (gallons per minute), although most yields are about 20 gal/min or less. Water from wells completed in this aquifer is used mainly for livestock, rural-domestic, and public supply, even though the dissolved-solids concentration commonly exceeds the drinking-water standard. Chemical characteristics of water in the aquifer tend to change with depth. On the basis of median concentrations for well depths of 200 feet or less, sodium, bicarbonate, and sulfate ions are predominant. For well depths more than 200 feet deep, sodium and bicarbonate ions predominate (Davis and Rogers, 1984).

Fifty percent of the ground-water samples collected from 1965 through 1985 had dissolved-solids concentrations larger than 910 mg/L. The median concentration for hardness was 10 mg/L, which indicates that the water generally is soft. The median concentrations for nitrate (0.24 mg/L), chloride (13 mg/L), and sulfate (160 mg/L) did not exceed the drinking-water standards.

JUDITH RIVER FORMATION

Water in the Judith River Formation is both unconfined and confined. Yields of wells completed in the formation range from 1 to 100 gal/min and average about 10 gal/min.

The water is used for many purposes, even though the dissolved-solids concentration commonly exceeds the drinking-water standard. Chemical characterisics of water in the aquifer tend to change with depth. On the basis of median concentrations of common ions for well depths of 200 feet or less, sodium and sulfate ions are predominant. For well depths more than 200 feet, sodium, bicarbonate, and sulfate ions predominate (Davis and Rogers, 1984).

Fifty percent of the ground-water samples collected from 1965 through 1985 had dissolved-solids concentrations more than 2,400 mg/L, the largest median dissolved-solids concentration among the principal aquifers. The median hardness concentration was 200 mg/L, which indicates that much of the water is very hard. The median concentration for nitrate was 0.81 mg/L, but more than 25 percent of the samples exceeded the drinking-water standard. The median concentration for chloride was 195 mg/L, which did not exceed the drinking-water standard. The median concentration for sulfate was 1,000 mg/L, which substantially exceeded the drinking-water standard.

EAGLE SANDSTONE

Water is both unconfined and confined in the Eagle Sandstone. Yields of wells completed in the Eagle range from 0.5 to 200 gal/min and average about 20 gal/min.

Water from the Eagle Sandstone is used for many purposes, although the dissolved-solids concentration commonly exceeds the drinking-water standard. Chemical characteristics of water in the aquifer change with depth. On the basis of median concentrations for well depths of 200 feet or less, sodium and sulfate ions are predominant. For well depths more than 200 feet, sodium and bicarbonate ions predominate (Davis and Rogers, 1984).

Fifty percent of the ground-water samples collected from 1965 through 1985 had dissolved-solids concentrations larger than 2,050 mg/L. The median concentration for hardness was 32 mg/L, which indicates that the water generally is soft. The median concentrations for nitrate (0.12 mg/L) and chloride (37 mg/L) did not exceed the drinking-water standards. The median concentration for sulfate was 835 mg/L, which substantially exceeded the drinking-water standard.

KOOTENAI FORMATION

Water is both unconfined and confined in the Kootenai Formation, although confined conditions predominate. Yields from wells completed in the Kootenai Formation range from 1 to about 90 gal/min and average about 30 gal/min.

Water from the Kootenai Formation is used for many purposes, although dissolved-solids concentrations commonly exceed the drinking-water standard. Chemical characteristics of water in the aquifer tend to change with depth. On the basis of median concentrations for well depths of 200 feet or less, calcium, magnesium, and bicarbonate ions are predominant. For well depths more than 200 feet, calcium, sodium, and bicarbonate ions predominate (Davis and Rogers, 1984).

Fifty percent of the ground-water samples collected from 1965 through 1985 had dissolved-solids concentrations larger than 850 mg/L. The median hardness concentration was 43 mg/L, which indicates that the water generally is soft. The median concentrations of nitrate (0.36 mg/L), chloride (13 mg/L), and sulfate (150 mg/L) did not exceed the drinking-water standards.

ELLIS GROUP

The Ellis Group includes several formations. Water in the aquifer is both unconfined and confined.

Water from the Ellis Group is used for many purposes. On the basis of median concentrations, calcium and bicarbonate ions are predominant (Davis and Rogers, 1984). Ground-water-quality data from 1965 through 1985 were insufficient to determine median concentrations of dissolved solids, hardness, nitrate, chloride, and sulfate.

Paleozoic Aquifer

MADISON GROUP

The Madison Group includes several formations. Water in this aquifer is both unconfined and confined.

Water from the Madison Group is not used extensively because of the deep drilling generally required. The water is fresh near outcrops but increases in salinity with distance from outcrops (Feltis, 1980). On the basis of median concentrations, calcium and sulfate ions are predominant (Davis and Rogers, 1984).

Fifty percent of the ground-water samples collected from 1965 through 1985 had dissolved-solids concentrations larger than 1,600 mg/L. The median hardness concentration was 890 mg/L, which indicates that the water is very hard. The median concentration for nitrate was not determined because only two water samples were available. The median concentration for chloride was 57 mg/L, which did not exceed the drinking-water standard. The median concentration for sulfate was 960 mg/L, which substantially exceeded the drinking-water standard.

EFFECTS OF LAND USE ON WATER-QUALITY

Ground-water-quality problems in Montana are varied. Ground-water quality is affected by agricultural practices, leachates from mine spoils and tailings, and disposal or spills of wastes and petroleum products. Major contaminants that have entered some of Montana's ground-water-flow systems include hydrocarbons, trace metals, salts, pesticides, and fertilizers. Sites where ground-water quality has been affected, or has the potential to be affected, by human activity are shown in figures *3A*, *3B*, and *3C*.

Contamination of ground water has caused the closure of some private and public wells in Montana. Estimates by the Montana Department of Health and Environmental Sciences indicate that 57 private wells and 5 public wells have been contaminated since 1975. On the basis of those estimates, about 172 people that obtain water from private wells and 263 people that obtain water from public wells have been using contaminated well water (J.L. Arrigo, Montana Department of Health and Environmental Sciences, written commun., 1986).

Agricultural Practices

Agricultural practices in the dryland crop areas of the central and eastern Montana plains have resulted in the widespread and rapidly expanding problem of saline seeps. Saline seeps are characterized by wet salty areas that are discharge zones for shallow water-table aquifers. The crop and fallow system used for much of the plains area promotes recharge from precipitation, which in turn causes the water tables to rise and to discharge saline water at the land surface. In 1969, 28 counties in Montana contained saline seeps that affected about 51,200 acres. In 1983, the affected area had increased to about 280,000 acres (Montana Department of Health and Environmental Sciences, 1984). The development of saline seeps near Fort Benton during 1941, 1951, 1956, 1966, and 1971 is shown in figure 4. Water from saline seeps generally is characterized as a sodium-magnesium sulfate type having dissolved-solids concentrations of 4,000 to 60,000 mg/L (Miller and others, 1980). Saline seeps have affected the quality of water in some domestic and livestock wells.

Degradation of ground water by pesticides and other chemicals has been studied by the Montana Department of Agriculture. Although no widespread contamination of ground water by application of fertilizers and pesticides has been documented, localized problems are known to exist. Some of these problems were caused by improper disposal of contaminated wash from spray equipment and spillage from aerial pesticide applicators.

Mining and Related Activities

Surface mining of coal from the Fort Union Formation in the eastern part of Montana has removed areas of coal and sandstone aquifers and replaced them with mine spoils. Where mine spoils have become saturated, they contain water generally having a dissolved-solids concentration larger than that of water from nearby stock and domestic wells (Van Voast and others, 1978). Water from the mine spoils has a large range of dissolved-solids concentrations, and some of the spoils water is unsuitable for use by livestock. Water-quality changes at the mines have affected few people or wells because of the sparse population of the area, the slow rate of ground-water movement from the mine spoils, and the availability of alternative water supplies.

Mine tailings, mine operations, and smelting have caused local contamination of ground water in several areas. In a mining area about 20 miles south of Helena, cadmium concentrations in water from domestic water wells exceed the drinking-water standard (Montana Department of Health and Environmental Sciences, 1984). Mine tailings in sediments at a reservoir near Milltown caused arsenic contamination of ground water in nearby downgradient areas. As a result, some wells of a public-supply well system that supplied water to 33 residences in Milltown were abandoned and replaced. Smelting operations in East Helena (5 miles east of Helena) and Anaconda are sources of trace-metal contaminants. At East Helena, arsenic and sulfate contamination was found in shallow ground water (Montana Department of Health and Environmental Sciences, 1986); however, drinking-water supplies for nearby residences have not been affected.

Waste Disposal and Spillage

Hazardous waste is treated, stored, or disposed at 11 RCRA sites that constitute a known or potential hazard to the quality of ground water (fig. *3A*). The Montana Department of Health and Environmental Sciences has determined that contamination of shallow ground water has occurred at four of these sites. At the other seven sites, either no contamination has been detected or monitoring data have not been evaluated. Known or potential contaminants at the sites include sludges from petroleum refining wastewater at six sites, creosote sludge at two sites, solvents and related chemicals at two sites, and pesticide-formulating wastes at one site.

The seven sites in Montana listed by the U.S. Environmental Protection Agency as CERCLA (Superfund) sites are shown in figure *3A*. Contaminants have been detected in shallow ground water at each of these sites. At five of these sites, metals (arsenic, cadmium, copper, iron, lead, and zinc) from ore processing or smelting are the source of contamination. At the other two sites, pentachlorophenol and other petroleum derivatives from wood-treating operations have entered the ground water.

Contamination of ground water by petroleum products from spills or leaking storage tanks is a significant problem. Petroleum-contamination problems have varied from a few gallons of gasoline leaking into a developed spring to hundreds of thousands of gallons of diesel fuel spread by ground-water flow beneath major railroad centers. From April 1982 to May 1986, 81 instances that relate to petroleum contamination were reported to the Water Quality Bureau of the Montana Department of Health and Environmental Sciences. Petroleum leaks and spills have degraded the quality of water in springs and rural-domestic and public water-supply wells and have caused gasoline vapors to enter storm drains, sewers, and buildings. Currently (1986), 15 locations of reported fuel leaks are being investigated by the Montana Department of Health and Environmental Sciences.

POTENTIAL FOR WATER-QUALITY CHANGES

The potential for contamination of ground-water supplies in Montana is difficult to assess. Although the estimated number of ground-water analyses for Montana exceeds 25,000, the data base is not sufficiently complete, centralized, or organized to allow analysis, identification, and quantification of contamination prob-

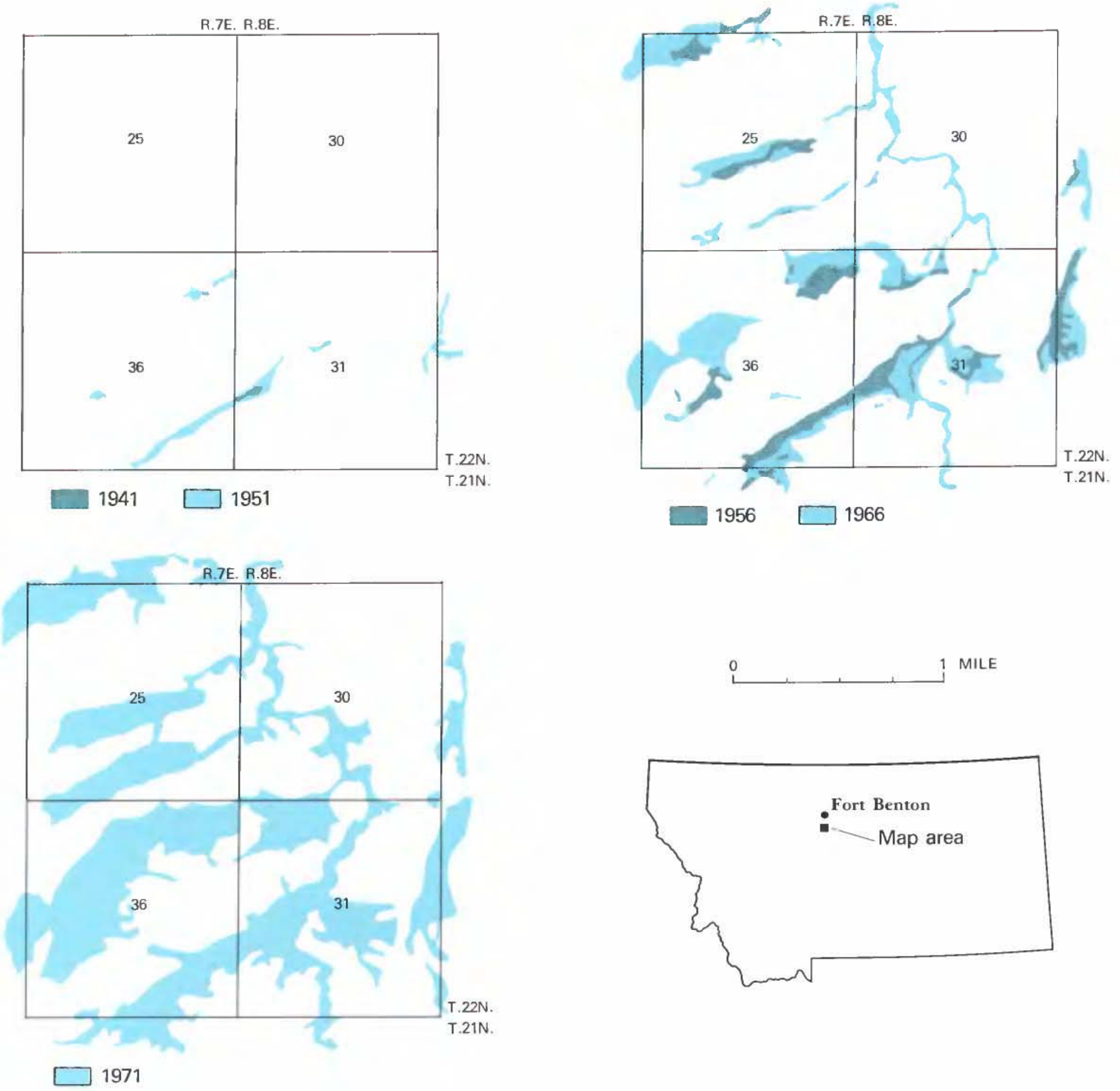

Figure 4. Saline-seep development in a 4-square-mile area near Fort Benton, Montana, 1941, 1951, 1956, 1966, and 1971. (Source: Miller and others, 1980.)

lems and trends (Davis and Rogers, 1984; Montana Department of Health and Environmental Sciences, 1984). A trend of increasing ground-water contamination in Montana is implied by the increasing number of reports of sites where hazardous materials have affected or have the potential to affect ground water. However, the increasing number of reports of sites could reflect the increased vigilance of governmental agencies and concerned citizens.

Saline seeps are considered by some to be most threatening to ground-water quality in the State (Montana Department of Health and Environmental Sciences, 1982). With present cropping practices, the areas affected by saline seeps could continue to expand at a rate of 10 percent per year (Miller and others, 1980).

Mined areas account for additional sources of ground-water contamination. Mining increases dissolved-solids and trace-metals concentrations locally. Because ground-water movement is slow in most areas, the effects of mining on ground-water quality are considered to be long term.

Petroleum contamination is becoming a major problem in near-surface ground water throughout Montana and even deeper ground water in some areas (Montana Department of Health and Environmental Sciences, 1984). As storage and transmission systems related to the petroleum industry become older, the potential for leaks increases. Because several years may elapse before detection of petroleum leaks, ground water under a large number of acres possibly is being contaminated each year.

GROUND-WATER-QUALITY MANAGEMENT

State ground-water regulations, termed the Montana Ground Water Pollution Control System, were promulgated by the Montana Department of Health and Environmental Sciences on October 29, 1982. The regulations include a ground-water classification system, ground-water-quality regulations, a nondegradation policy, and a permit system. The regulations also provide the Water Quality Bureau of the Department of Health and Environmental Sciences with emergency powers to protect the quality of existing and future beneficial uses of ground water.

The Montana Ground Water Pollution Control System primarily addresses the protection of ground water from potential pollution sources such as surface impoundments, waste piles, landfills, disposal systems, and releases from spills or unanticipated discharges. Operators of any of these potential pollution sources (except spills) are required to obtain a ground-water pollution-control permit as outlined under the system. Most of the approximately 30 existing permit sites under the system are gold-leach operations and industrial nonhazardous-waste storage and disposal facilities. A permit is not required for operations that were in existence before October 29, 1982. However, ground-water-quality regulatory objectives still must be maintained at these sites.

Montana Ground Water Pollution Control System rules do not require additional permitting for potential sources of ground-water pollution that are reviewed and approved or permitted under other regulations. They simply require compliance with the State's ground-water-quality regulations as outlined under the system. This situation results in joint review by the Water Quality Bureau and other State agencies on many projects that are excluded from the system's permitting requirements. Compliance with the regulations then is addressed within the approval or permit from the other agencies. Examples of these joint reviews are Major Facility Siting Act projects under the Department of Natural Resources and Conservation, permitting of mining and milling operations under the Department of State Lands, approval of subdivision and other public or private waste-treatment systems by the Water Quality Bureau, and review of CERCLA activities by the Department of Health and Environmental Sciences.

The management of regulated wastes in Montana is overseen by the Solid and Hazardous Waste Bureau of the Department of Health and Environmental Sciences. Because all waste-management sites have the potential to contaminate ground water, hazardous-waste treatment, storage, and disposal facilities are regulated under the Montana Hazardous Waste Act and are subject to regulations that generally are more stringent than those of the Montana Ground Water Pollution Control System. Permits for hazardous-waste treatment, storage, or disposal facilities are issued almost entirely by the staff of the Solid and Hazardous Waste Bureau. The Water Quality Bureau participates in the review and oversight of all CERCLA activities administered by Solid and Hazardous Waste Bureau or the U.S. Environmental Protection Agency. The Water Quality Bureau also is involved in locating, investigating, and evaluating sites where hazardous materials have been improperly managed or disposed or where they threaten ground-water quality.

The Montana Department of Agriculture has surveyed ground-water quality at several locations where mismanagement of pesticides is documented or suspected. If beneficial uses of ground water have been affected by the improper handling of pesticides, the Water Quality Bureau assists the Montana Department of Agriculture in formulating appropriate remedial actions. Corrective actions or compliance plans to maintain ground-water quality usually are administered by the Water Quality Bureau in situations involving pesticides that contaminate ground water.

The Montana Bureau of Mines and Geology is the primary ground-water research organization for the State of Montana. It is a source of ground-water information and data, including results of studies of specific ground-water problem areas; it also participates in the review of some CERCLA sites. Coordination between the Water Quality Bureau and the Montana Bureau of Mines and Geology is expected to increase in response to the Montana Ground-Water Information Center, which currently (1986) is being developed by the Montana Bureau of Mines and Geology.

The Water Quality Bureau also coordinates with Federal agencies involved in ground-water protection. Federal agencies such as the U.S. Geological Survey are a source of ground-water data and other information that result from data-collection activities and ground-water studies. The U.S. Geological Survey also participates in the review of CERCLA studies in cooperation with the Montana Department of Health and Environmental Sciences and the U.S. Environmental Protection Agency. Water Quality Bureau personnel commonly conduct joint inspections and review of ore-processing and storage facilities on Federal lands in cooperation with personnel from the U.S. Forest Service, the U.S. Bureau of Land Management, or the U.S. Bureau of Indian Affairs.

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